You Can't Save Alone: Commitment in Rotating Savings and Credit Associations in Kenya

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I. Introduction

This article examines reasons why individuals develop and maintain local-level financial savings organizations known as rotating savings and credit organizations, or Roscas. Roscas are locally organized groups that meet at regular intervals; at each meeting members contribute funds that are given in turn to one or more of the members. Once every participant has received funds, the Rosca can disband or begin another round. In joining a Rosca, an individual agrees to a schedule of periodic payments in return for which she receives a lump-sum payment at a future date. Roscas often pay no interest, and participants may have little or no control over when they receive the funds. Participants also bear the risk that other participants may not fulfill their obligations.

Rotating savings and credit associations are among the oldest and most prevalent savings institutions found in the world and play an important role in savings mobilization in many developing economies. Rosca participation is particularly high in Africa. Estimates suggest that Rosca participation ranges from 50% to 95% in many rural areas in Liberia, Ivory Coast, Togo, and Nigeria (Bouman 1995). Surveys in central Kenya estimate Rosca participation at 45%–50% (Kimuyu 1999). While Roscas are often found in African economies where formal credit markets are thin or nonexistent, they are also found in more developed areas where individuals have access to formal banking institutions. Roscas have been reported among employees of the International Monetary Fund (IMF; Ardener 1995) and among bank employees in Bolivia

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(Adams and Canavesi 1992) and Ghana (Bortei-Doku and Aryeetey 1995). In a sample in urban Zimbabwe, 76% of urban market traders participate in a Rosca, even though 77% of these traders have a bank account (Chamlee-Wright 2002). In countries such as Taiwan, with relatively well-functioning credit markets, as many as 80% of adults are estimated to belong to Roscas (Levenson and Besley 1996). Rosca-style banking mechanisms remain popular in modern Japan (Dekle and Hamada 2000) and Argentina (Schreiner 2000).

Given the riskiness and inflexibility of Roscas, why would anyone join a Rosca instead of saving alone, especially in the presence of other saving technologies? The economics literature on Roscas provides several rationales for Rosca formation. Besley, Coate, and Loury (1993) suggest that individuals join Roscas to finance the purchase of an indivisible durable good, taking advantage of the gains from intertemporal trade between individuals so that individuals expect to enjoy the benefits of savings sooner than if they had saved on their own. Klonner (2003) shows that Roscas with funds allocated by bidding allow participants to insure themselves against idiosyncratic risks. Calomiris and Rajaraman (1998) show that some bidding Roscas in India contain insurance components. More recently, the literature has examined the commitment properties of Roscas. Ambec and Treich (forthcoming) present a model of Roscas in which the design of Roscas helps individuals to cope with self-control problems. Anderson and Baland (2002) argue that women's Rosca membership in urban Roscas in Kenya is a forced-savings mechanism that is the result of asymmetric preferences for indivisible household goods between husbands and wives.

This article contributes to the literature on Roscas and commitment by providing evidence on Rosca participation and design from a sample of 70 Roscas and 1,066 Rosca participants in rural Kenya. The data are consistent with the idea that commitment forms an important rationale for Rosca participation and that key features of Rosca design can best be explained as a savings commitment technology. Although it is impossible to fully rule out all competing explanations for Rosca participation and design, the evidence makes a plausible case that commitment should be taken seriously in future research on Roscas.

Ethnographic and anthropological literature has often mentioned the commitment feature of Roscas (Ardener 1964; Bouman 1995; Chamlee-Wright 2002), and recent surveys of savings behavior have indicated the importance of and use of savings commitment technologies in many economies (Rutherford et al. 1999; Wright 1999), but until recently little systematic empirical data have been collected on this aspect of Roscas. If commitment features are a key feature of these Roscas' design and a key motivation for participation, this has

important implications for the design of savings products both in developing and developed economies, suggesting that commitment technologies will be valued by savers. It also suggests the need to diversify how we study Roscas. Roscas may not be one type of organization; instead, there may be multiple kinds of Roscas that should be considered as separate phenomena. Studying how Rosca organization, participation, and design varies across settings is thus an interesting question for future research.

The article proceeds as follows. Section II reviews the literature on time discounting and commitment and presents a simple framework to illustrate why individuals with time-inconsistent preferences might want to join a Rosca that provides a commitment technology. Section III reviews the data used in the article, and Section IV discusses the evidence from Rosca design. Section V analyzes Rosca participation, elaborates the commitment features of these Roscas, and discusses alternative hypotheses. The final section concludes.

II. Roscas, Savings, and Commitment

A. Savings and Self-Commitment

The psychological evidence on preference formation suggests that self-control problems are widespread (Ainslie 1992) and finds that individuals often exhibit discount rates that decline over time (Frederick, Loewenstein, and O'Donoghue 2003). Recent survey evidence from Vietnam and the Philippines, for example, suggests that individuals exhibit present-biased preferences (Anderson, Dietz et al. 2004) and are willing to pay to have their choices constrained (Ashraf, Karlan, and Yin 2006). Individuals with time-varying discount rates face an interpersonal commitment problem, because they are unable to credibly commit themselves to future behavior without some kind of commitment mechanism. Such mechanisms might be intrapersonal or extrapersonal. Intrapersonal bargains are obviously difficult to observe. The empirical emphasis has therefore been on identifying and modeling visible precommitment mechanisms, or what O'Donoghue and Rabin (1999) call "smoking guns." This article follows this approach, viewing the structure of Roscas as one such smoking gun.

B. A Simple Framework of Time-Inconsistent Behavior

A common approach in the literature on time-inconsistent behavior is to model the choice between present and future decisions as a bargaining game among sequential selves in which current selves control current behavior and future selves control future behavior (Phelps and Pollack 1968; Loewenstein and Prelec 1992; Laibson 1997; O'Donoghue and Rabin 1999). In order to constrain future behavior, therefore, a person must be sophisticated, that is, they must be aware of their self-control problem (O'Donoghue and Rabin 1999). A

sophisticated but time-inconsistent individual who desires to save then faces the task of constructing a mechanism to constrain her current self from consuming instead of saving. This mechanism could be individual, as in the case of an illiquid asset, or joint, as in the case of joining a Rosca. The standard exponential model of individual behavior is characterized by a simple maximization problem:

$$U^t(u_t, u_{t+1}, \ldots, u_T) = \sum_{\tau=t}^{T} \delta^\tau u_\tau. \tag{1}$$

Utility is the sum of utility in all periods up to T, discounted by δ, which lies between zero and one and represents the time-consistent exponential discount factor. A typical model of time-inconsistent preferences uses what Laibson (1997) calls "quasi-hyperbolic" utility. In the model originally developed by Phelps and Pollack (1968) and used by Laibson (1997) and O'Donoghue and Rabin (1999), the utility maximization problem with quasi-hyperbolic utility can be given by

$$U^t = \delta^t u_t + \beta \sum_{\tau=t+1}^{T} \delta^\tau u_\tau. \tag{2}$$

In this case, δ represents standard exponential utility, while β represents the time-inconsistent discount factor. When $\beta < 1$, a person gives more weight to period τ when it arrives than in any previous period. If we assume $\delta = 1$ to abstract away from time-consistent discounting, utility is simplified to

$$U^t = u_t + \beta \sum_{\tau=t+1}^{T} u_\tau. \tag{3}$$

A simple example shows why time-inconsistent individuals might have difficulty saving. Assume individuals live in a 4-period world. In periods 2 and 3 (the "harvest periods") each individual receives one unit of surplus income that they can either save or consume in exchange for one unit of utility. If both units of surplus are saved, they may be traded in period 4 for an indivisible good with consumption benefit c or consumed directly. With standard utility assuming $\delta = 1$ and $\beta = 1$, individuals will save and purchase the indivisible good as long as the benefit of the indivisible good is greater than the benefits of consumption or as long as $\beta c > 2\beta$ or $c > 2$. When $\beta < 1$, the decision to save changes over time. At period 1, individuals will save if $c > 2$, as in the time-consistent case. At period 2, however, individuals will save only if $c > (1 + \beta)/\beta$, which is greater than two for all $\beta < 1$. The lower the discount parameter β (i.e., the greater the time inconsistency), the greater the benefit

needed to induce savings, with the result that benefits that would induce savings in the time-consistent case will be insufficient to induce savings here.

Time-inconsistent individuals need a commitment mechanism that causes their "period 2 selves" to adhere to their period 1 preferences. Individuals who are sophisticated about their preferences might therefore have a rationale to form a Rosca to credibly commit them to savings. The difficulty, of course, is that the first individual to receive funds has an incentive to default and refuse to pay the other in the next round. To succeed as a commitment technology, Roscas must therefore ensure that neither participant reneges on her commitments.[1] Since Roscas are informal arrangements, there is no external enforcement mechanism. But the ethnographic literature on group lending and Roscas has long stressed the important role of social relations in screening and monitoring peer group members (Stiglitz 1990; Varian 1990), as well as the effective power of the threat of sanctions in preventing default by threatening an individual's reputation (Ardener 1964; Ardener and Burman 1995). Besley et al. (1993) note that Roscas tend to avoid large-scale default in practice through use of preexisting social connections between individuals. The disciplining power of social sanctions is particularly compelling in rural African communities where kinship relations regulate access to many resources (Berry 1993; Platteau 2000; Miguel and Gugerty 2005). Thus, the social setting of many Roscas provides an enforcement mechanism that may allow individuals with time-inconsistent preferences to credibly commit themselves to savings.

III. Rosca Data

The Roscas in the sample are located in Busia and Teso districts in western Kenya, near the border with Uganda. The two districts are primarily rural with a local economy based on small-scale farming for subsistence and local market trade. Both districts are relatively poor for Kenya; the Busia district office estimated per capita income in the district in 2002 at $170 (Bishop-Sambrook 2003), while World Bank estimated average per capita income for the country in 2003 was $390.

The Roscas in the sample are run by local women's self-help groups. In addition to running Roscas and income-generation projects, these self-help groups may also provide emergency assistance to members. Roscas are run separately from the other activities of the group, and not all self-help-group members participate in the Rosca. This pattern of Roscas, embedded in mutual

[1] One could also argue that a hyperbolic consumer will suffer self-control problems upon receiving funds from the Rosca. But the consumption decisions available when the individual receives Rosca funds are different than those along the savings path (assuming no access to credit) because consumption possibilities are now expanded.

assistance groups, is quite common in sub-Saharan Africa (Siebel and Marx 1987; Shipton 1992; Bortei-Doku and Aryeetey 1995; Nelson 1995; Wright 1999; Anderson and Baland 2002). A survey of informal savings organizations in Kenya finds a similar pattern throughout Kenya (Mugwanga 1999), and Anderson and Baland (2002) find many Roscas run by women's groups in urban Kenya. Bouman (1994) notes how tontines in Cameroon are actually "multi-functional self-help institutions" that run Roscas, provide collective insurance, and develop business and investment opportunities for members. Although the self-help groups studied here are women's groups, 20% of members are men, typical of many women's groups in Kenya (Srujana 1996). Men are typically prohibited from holding key positions in the women's group; 98% of executive officials of the women's groups in this sample are women, and 73% of male participants are the wives of group members.

The original sampling unit in the data is the women's self-help group. These women's groups were originally identified to participate in a development project funded by a Dutch nongovernmental organization (NGO) working in the area. The NGO surveyed the existing women's groups in the subdistricts in which they worked and identified 100 operational women's groups. Eighty rural groups were selected from these 100 groups to participate in an NGO agricultural assistance program during the period examined here. These 80 groups appear to be a fairly complete enumeration of all of the nonurban women's groups operated in these subdistricts.[2] The NGO program provided the groups with agricultural training and implements but did not directly affect the operations of any Rosca run by the groups.[3]

Of the 80 women's groups in the sample, 77 operated Roscas. Analysis is restricted to the 70 Roscas that had complete records and had completed at least one full cycle of payments. A trained enumerator visited each of the active Rosca groups twice. At each meeting, the group leader, treasurer, secretary, and group members were jointly interviewed, and the groups' written

[2] The included survey areas consisted of the subdistricts that acted as catchment areas for the primary schools in which the NGO ran child sponsorship programs and development projects. A criterion for inclusion in the NGO project was that the groups undertake agricultural activity. The excluded 20 groups were largely town-based groups that were not composed of poorer individuals. Enumeration of these groups did not produce a large number of women's groups beyond those included in the project. While there may be even more informal Roscas operating in the area that were not captured by the enumeration, all the available field evidence for rural Kenya suggests that Roscas are almost always run through a semiformal women's or community group.

[3] Gugerty and Kremer (2006) evaluate the impact of the NGO agricultural funding on group activities using a prospective, randomized evaluation and find no effect of funding on any aspect of Rosca activity and very little evidence of impact on any area of women's group activity. The Rosca sample is evenly distributed between funded and unfunded groups.

Rosca records reviewed to gather detailed information on the functioning of the Rosca. Data were gathered on Rosca structure, size, and meeting frequency, and written Rosca records were used to gather data on the complete cycle of Rosca payments and disbursements for the last completed cycle of the Rosca, including the timing and amounts of all payments made by Rosca participants for the cycle. Basic socioeconomic data were gathered from the women's groups on all group members. In addition, individual interviews were conducted with the three executive officials of each group and three additional randomly selected members. These interviews collected more detailed data on the members' households and on their Rosca participation. Additional data from ethnographic and nonrandom interviews with participants were also collected.

Because the original sampling unit was women's groups rather than randomly selected individuals, Rosca participants are likely to differ systematically from both nonparticipating women's group members as well as from individuals in the area more generally. The data suggest that women's group members are better-off than the average resident of the area, but Rosca participants have lower socioeconomic status than nonparticipants from the same women's group. Table 1 compares the characteristics of women's group members to the characteristics of mothers of primary school children in the same subdistricts.[4] Women's group members tend to be somewhat better-off than the mothers of primary students in the area, having higher levels of postprimary education and latrine ownership. Women's groups are slightly more ethnically homogeneous than the primary school population.[5] Table 1 also compares Rosca participants to women's groups members as a whole. Columns 3 and 4 indicate that Rosca participants are more likely to be female and are significantly less likely to have formal sector income. Given that women's group members differ from the population of the area as a whole, generalization of the results on Rosca participation presented should be undertaken with caution. As will be argued below, however, the design and operation of these Roscas is quite typical of Roscas in Africa.

Table 2 provides additional data on Rosca characteristics. The average Rosca in the sample has been running for 6.5 years and has completed five cycles.

[4] The mothers of children who are enrolled in primary schools in western Kenya may of course differ systematically from women in the population at large, being better-off than average. Enrollment rates for children in primary school in Kenya in this period were fairly high, around 85% according to UNICEF's 1999 State of the World's Children report. Rates in densely settled areas like western Kenya may be even higher.

[5] Ethnicity used for female participants is that of her spouse. Patrilocal residence and patrilineal inheritance in this area mean that the husband's ethnic group determines a women's access to kin-based resources.

TABLE 1

WOMEN'S GROUP, ROSCA, AND RESIDENT CHARACTERISTICS IN BUSIA AND TESO DISTRICTS

Mean per Group (SD)	All Female Women's Group Members (1)	Mothers of Primary School Students in Nearest School Zone (2)	All Women's Groups Members (3)	Rosca Participants from Women's Groups (4)
Proportion from same ethnic group[a]	.84	.79***		
	(.19)	(.18)		
Proportion with a latrine at home	.90	.84***	.90	.88
	(.15)	(.08)	(.15)	(.16)
Proportion with postprimary education	.22	.18***	.29	.29
	(.19)	(.06)	(.21)	(.22)
Proportion with formal sector income			.16	.12***
			(.16)	(.13)
Years of education			5.66	5.53
			(2.94)	(2.33)
Proportion female			.81	.90***
			(.17)	(.12)
Years in the women's group			6.5	6.62*
			(3.56)	(3.67)
Proportion married			.98	.99
			(.04)	(.04)
Average age			40.5	40.0*
			(5.01)	(5.83)
Proportion whose spouse lives at same residence			.69	.69
			(.20)	(.23)

Note. Number of observations = 70; SD = standard deviation. The comparisons of female women's group members (col. 1) and mothers of primary children (col. 2) and of women's group members (col. 3) and Rosca participants (col. 4) are two sample *t*-tests of the hypothesis of equal means. Significant differences are noted with asterisks in cols. 2 and 4. Data on mothers in surrounding school zones are taken from Miguel and Gugerty (2005).

[a] The ethnicity used here is that of the husband's (or father's) ethnic group, since residence in this area is patrilocal; women join a husband's clan upon marriage, and male clan lineage is what is used to determine kinship resources. The main ethnic group in the area is the Luhya. The Luhyas were not considered one "tribe" until just before independence, when the various subgroups all speaking related languages became more unified politically under the name Luhya. Here each Luhya subtribe is considered a separate ethnicity.

* Means are significantly different at 90%.

*** Means are significantly different at 99%.

TABLE 2
ROSCA CHARACTERISTICS

	Mean (SD)
Rosca structure:	
Number of years operated	6.74 (4.84)
Total number of rounds completed	5.35 (4.4)
Number of participants	15.24 (6.16)
Average individual contribution (US$)	3.12 (4.96)
Duration of rosca in months	11.4 (5.62)
Largest indivisible expense as a percentage of total	.77 (.14)
Proportion of women's group members participating in the rosca	.70 (.22)
Proportion of roscas that use a fixed order	.34
Proportion of roscas that use a random order	.42
Proportion of roscas that use a negotiated order	.21
Rosca geographic characteristics:	
Km from paved road	9.47 (11.8)
Km from post office	4.18 (3.83)
Km from bank	15.4 (16.0)
Number of roscas	70

Note. SD = standard deviation.

In this article, a "round" refers to one complete cycle of the Rosca, in which all members have received funds. A "meeting" refers to one individual period in the Rosca in which members contribute funds and distribute the Rosca pot to one individual. The average Rosca recipient receives a pot of about $25, or just over one-third of the national average of monthly household expenditures.[6] The longest running Rosca in the sample has been in place for 19 years; 22 of the Roscas have been operating for 10 or more years. Participation in the Roscas in this sample is relatively stable. This is characteristic of many Roscas, particularly in eastern and southern Africa (Shipton 1992; Ardener and Burman 1995; Bouman 1995; Niger-Thomas 1995; Wright 1999; Rutherford 2000). Members may leave the Rosca at the end of a round, and new members can be admitted at that point. In total, 6% of all participants in the sample left the Rosca at the end of the last round.

IV. Rosca Design and Rationale

Every Rosca must make a number of decisions regarding organizational design, including how to make payments; allocate the pot to participants; and balance the size of the contribution, the number of participants, and the frequency of contributions. Funds can be allocated in a number of ways: by randomized draws; by bidding; or by some other criterion such as need, seniority, or residential patterns. The method for allocating Rosca funds is typically related

[6] Average rural monthly expenditures for the country were estimated at $70 in 1998 (Republic of Kenya 2003).

to the rationale of the Rosca. In insurance-based Roscas, for example, the pot is generally allocated by bidding. The three main mechanisms of allocating funds in this sample are random draws at the start of a round (42% of Roscas), an order negotiated among members at the start of each round (21%), or a repeated order of allocation for each round (34%). In all but one of the Roscas in this sample, participants know the order of allocation of funds before the Rosca round begins, thus, at the start of the Rosca cycle, there is no uncertainty to resolve. This suggests that individuals are not joining Roscas for insurance, since they are unable to access funds when needed through a bidding or auction mechanism. Indeed, the use of such auction mechanisms in African Roscas appears quite limited (Shipton 1992; Ardener and Burman 1995; Platteau 1997; Anderson and Baland 2002). No Rosca in the sample pays interest, and again this seems typical of Roscas in Africa and in Kenya (Aryeetey 1996; Mugwana 1999).

The predetermined order of allocation used in these Roscas also suggests that financing indivisible durable goods and expediting the receipt of funds may not explain participation and design in these Roscas. In the indivisible good model, Roscas are one-shot games, and funds are allocated through one of two mechanisms: bidding or randomized allocation at each meeting. All individuals except the last improve their welfare by joining a Rosca, as each receives the indivisible durable good sooner than by saving alone, but their position in the Rosca is not known ex ante. In the Roscas examined here, if the motivation for Roscas were purely saving for an indivisible good, then the last person could do just as well by saving alone and would not join. In this case the second-to-last person becomes the last, and no longer wants to join, and so on, causing the Rosca to unravel.[7] This use of a predetermined order is consistent with what other researchers have found. In a sample of 374 Roscas from an urban area in Kenya, for example, Anderson, Baland, and Moene (2004) find that all the Roscas in their sample are repeated with largely the same membership and fix the order of allocation at the start of the round, either by random draws (29%) or by a preexisting repeated order (71%).

[7] However, individuals might join the Rosca and discover after joining that they are last in the order. They may desire to drop out, but the sanctions or social disapproval that might follow this action force them to remain in the Rosca. This explanation seems unlikely, both because 37% of the Roscas are repeated with the same order of allocation and because there is no evidence that individuals who leave the Rosca before receiving the payout face strong sanctions (Gugerty 2006). One might argue that an individual joins a Rosca with an inflexible order to finance the purchase of a durable good and then waits patiently for someone to drop out of the Rosca, hoping she will move up in the order of allocation. In some future round, then, she may receive the good sooner than by saving alone. She would undoubtedly be better-off, however, by joining a Rosca that allocates the pot randomly at each meeting.

The data available on individuals' use of Rosca funds also suggest that participants are not using funds solely to purchase indivisible goods, although saving for such purchases may be a complementary motive for participation. Individual data on Rosca use was collected from an average of four Rosca participants from each Rosca in individual interviews at their home. Over half of these participants report that they used their most recent Rosca payout for more than one purpose, and one-fifth used their winnings for more than two purposes. On average, 76% of the funds received are spent on one type of expenditure, but many of these (such as household items, school fees, and food) are often divisible, since school fees may be paid in installments and food purchased in small quantities (though often at a higher cost).[8] Table 7 provides additional data on the breakdown of reported Rosca expenditures, which is discussed further in Section V.

If a key benefit to Rosca participation is to have earlier access to savings than by saving alone, then participant preferences should reflect a desire to receive funds as early as possible in the Rosca. But Rosca participants in this sample do not always prefer to receive money sooner rather than later. First, in a repeated Rosca with a repeated order of allocation (37% of the sample here; 71% of the Anderson, Baland et al. [2004] Kenya sample), each individual is essentially joining an organization in which she saves a fixed amount each month and receives this money back after x periods, where x equals the number of Rosca participants. Moreover, Rosca participants report that they prefer to receive funds at particular times of the year rather than always preferring to receive earlier in the cycle. This is consistent with data from west Africa that Rosca participants have at the start of a round a preferred date to receive funds (Bortei-Dorku and Aryeetey 1995). The largest proportion of participants surveyed (40%) report they prefer to receive Rosca funds in the period just after the harvest when ongoing household demands are lowest.

In general, the method of allocating funds, participants' use of funds, and the ethnographic data on participant preferences does not point to insurance or the expedited financing of indivisible goods as the primary factor in design or participation in this sample of Roscas, although saving for the purchase of a lumpy durable good may form part of the motivation for participation.

[8] Since money is fungible, it is possible that individuals would have spent funds this way in the absence of a Rosca; moreover, Rosca participation may mean that consumption was merely reallocated and consumption in other areas increased. Note that while Rosca expenditures are not used exclusively to purchase indivisible durable goods, Rosca expenditures are "lumpier" than typical household expenditures, suggesting that saving for an indivisible durable good provides a complementary motive for participation in these Roscas. This is discussed further in Sec. V.C.

The evidence for commitment as rationale for Rosca participation and design is presented in Section V.

V. Roscas and Commitment

This section first examines whether household conflict provides a key rationale for participation in these Roscas, then presents the evidence available on commitment, and concludes with a discussion of alternative participation rationales. A key feature of all Roscas is that they render savings illiquid. Individuals may want to hold illiquid savings for several reasons: to render savings less vulnerable to theft or loss, to protect savings from the demands of households or kin, or to protect savings from personal consumption splurges on the part of oneself or one's family. Indeed, one reason that Roscas remain so popular may be that they simultaneously accomplish all of these goals. Separating and testing these motives is difficult in the absence of detailed individual savings, credit, and consumption data that are not available for this sample. I argue, however, that there is evidence to suggest that self-commitment is a valuable feature of these Roscas that has been underemphasized in the literature on Roscas and informal finance.

A. Rosca Participation and Household Conflict

In some countries, Rosca participation appears higher among women than among men, and some researchers have argued that household conflict could explain these participation rates. For example, Anderson and Baland (2002) observe higher Rosca participation among women in Kenyan urban slums and argue that Roscas are a commitment mechanism married women use because of intrahousehold conflict resulting from different preferences for indivisible goods between wives and husbands. Women join Roscas to bind themselves to a particular savings pattern that is different from their husbands' preferences. With such asymmetric preferences, Roscas can act as a household commitment mechanism because once a woman has joined a Rosca, the threat of social sanctions prevents the household from reneging on its commitment. Moreover, once the Rosca pot is received, the husband will be willing to buy the good preferred by the wife even if ex ante he was not willing to save at all, so long as her bargaining power is sufficiently high. As Anderson and Baland note, the literature on intrahousehold bargaining suggests a positive relationship between a woman's share of household income and her bargaining power in the household. This implies an inverted U-shaped relationship between female share of household income and Rosca participation. Women will join Roscas to commit the household to savings when they have sufficiently high bargaining power within the household, that is, a sufficiently high share of

household income. At very high levels of income share, women will have sufficient bargaining power so that they do not need the Rosca, and at low shares will not have sufficient bargaining power to persuade their husbands to change their consumption preferences.

Below I examine the roles that household conflict and commitment play in motivating participation in the 70 Roscas in the sample. Several caveats apply. First, because the sample is drawn from the membership of women's self-help groups that are composed largely of women, and because male members may be barred from Rosca participation in some cases, it is difficult to draw conclusions about the relative participation of women and men in these particular Roscas. Second, data on individuals were gathered through the women's self-help group and therefore do not include individuals outside of these women's groups; Rosca members are a subset of women's group members. Finally, the set of women's self-help groups (and therefore of Roscas) available to an individual is likely to be dependent on an individual's characteristics and social relationships, since individuals typically join a preexisting Rosca embedded in a women's group and must be first vetted by current participants. Rosca design may also change over time; design and participation are therefore endogenous. Thus, the analysis presented here does not claim to identify the determinants of participation; the aim is to assess whether the household conflict story is consistent with patterns of participation in this sample.

Table 3 presents the correlates of participation in the Roscas using a probit estimation of the probability that an individual women's group member belongs to a Rosca. Columns 1–5 present the results on participation by women's self-help group members in Roscas run by the women's group. Among group members, participation is associated with being female, the number of years of participation in the women's group, being a member of the largest ethnic group in the Rosca, and holding an officer position in the group. This is consistent with the literature, which emphasizes the importance of social ties, information, and trust in recruitment and sustainability in informal organizations. Since individual income data are not available for this sample, whether an individual has formal sector income is used as a proxy for income.[9] Formal

[9] Individuals were asked about their main sources of income, including salaried work, a regularly operated business, and farming. Individuals with a salaried income or who own and operate a business on a daily basis in a fixed location/area are considered to have formal sector income. Formal sector income appears highly correlated with income. Among a subsample of 508 participants asked to estimate their monthly income, those without formal sector income reported a mean income of $13 a month, while those with a formal sector income report mean monthly income of $74. Years of education is very highly positively correlated with having a formal sector income and is highly negatively correlated with age, and so is excluded from regressions 1–5. Results are robust to the exclusion of the last three variables.

TABLE 3
PARTICIPATION IN ROSCAS

	Probability of Participation by Members of Self-Help Groups in Roscas Run by the Self-Help Group					Probability of Participation by Members of Self-Help Groups in Any Rosca			
	All Women's Group Members	Female Women's Group Members Only			Female with Co-residing Spouse	All Women's Group Members	Female Women's Group Members Only		Female with Co-residing Spouse
Explanatory Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Age	.003	.002*	.002	.003*	.003*	.003*	.003*	.003*	.002
	(.002)	(.001)	(.002)	(.002)	(.002)	(.002)	(.001)	(.001)	(.001)
Female	.40***					.33**			
	(.06)					(.06)			
Have a latrine on the home compound	.07	.09*	.08*	.09*	.07	.13**	.11***	.11***	.12**
	(.05)	(.05)	(.05)	(.05)	(.06)	(.04)	(.04)	(.05)	(.06)
Married	.26	.14	.25	.11		.25			
	(.24)	(.32)	(.27)	(.30)		(.17)			
Participant has formal sector income	−.06		−.04			−.04	−.07		
	(.04)		(.05)			(.06)	(.06)		
Spouse lives on the same compound	.02	.02	.01	.01		.02	.03	.03	
	(.03)	(.03)	(.03)	(.03)		(.03)	(.02)	(.03)	
Either wife or husband has formal sector income		.05		−.05	−.09			−.06	−.02
		(.04)		(.06)	(.08)			(.07)	(.10)

Only wife has formal sector income				.10	.15*			.03	.08
				(.07)	(.07)			(.07)	(.05)
Only husband has formal sector income				.11**	.17***			.03	−.03
				(.05)	(.06)			(.03)	(.08)
Member of the largest ethnic group in the rosca	.08**	.11**	.10**	.11**	.12**				
	(.04)	(.04)	(.04)	(.04)	(.04)				
Years in group	.01*	.005	.005	.006	.005				
	(.005)	(.004)	(.004)	(.004)	(.005)				
Officer in group	.21**	.17**	.16**	.17***	.18*				
	(.03)	(.03)	(.03)	(.03)	(.04)				
Years of education						.008*	.007*	.007*	.004
						(.003)	(.003)	(.003)	(.003)
χ^2	91.89	55.19	54.47	58.63	35.5	66.49	14.69	16.00	10.74
Pseudo R^2	.14	.05	.05	.05	.06	.08	.03	.04	.03
No. observations	1,337	1,101	1,101	1,101	728	829	677	677	450

Note. Probit estimation with robust standard errors clustered at the group level. Coefficients are probit estimates that give the change in the probability for an infinitesimal change in each independent, continuous variable and the discrete change in the probability for dummy variables, evaluated at the mean. In cols. 4–5 and 7–8, households where neither spouse has a formal sector income are the excluded category. Columns 1–5 include all self-help group members and estimate the probability of belonging to the Rosca run by that self-help group. Columns 6–9 include all self-help group members and estimate the probability of participating in any Rosca, whether that Rosca is run by the group or not, for the subset of members for which these data are available.

* Significantly different than zero at 90%.

** Significantly different than zero at 95%.

*** Significantly different than zero at 99%.

sector income is not significantly associated with participation, although the coefficient is negative, suggesting that the highest income members of women's groups do not participate in the Rosca. This may reflect the fact that fewer men participate in these Roscas, and men are more likely to have a formal sector income, although the results are similar when restricted to women. This may also reflect the fact that individuals with formal sector income have alternative savings commitment technologies available to them; this is discussed further in Section V.D.[10] Latrine ownership, another proxy for wealth, is weakly positively associated with Rosca participation.

The household conflict story predicts that participation will be related to the presence of a spouse and to female bargaining power within the household. Although the vast majority of the sample is married, not all couples live together.[11] In western Kenya it is common for men to out-migrate to urban areas for work; in this sample, 35% of married women's husbands do not co-reside with them. The presence of a co-residential spouse, however, is not associated with Rosca participation. The data on formal sector income are used to construct measures of bargaining power. An indicator variable for households in which only the wife has formal sector income is included as a proxy for high levels of female bargaining power; an indicator for husband-only formal sector income serves as a proxy for low levels of female bargaining power. The omitted category is households in which neither the husband or the wife has formal sector income. The results suggest that patterns of participation do not follow an inverted U-shaped pattern with female bargaining power. The presence of household formal sector income and wife-only formal income are not significantly associated with participation among female women's group members, but the coefficient on husband-only formal income is positive and significant (see table 3, col. 4). When the sample is restricted to women with co-residing spouses, the coefficient on wife-only formal sector income is positive and weakly significant while that on husband-only income remains positive

[10] In nonrandom interviews with 100 women's group members, 69% of those with formal sector income reported having a post office savings or bank account, as compared to 30% of those without formal sector income. Anderson and Baland (2002) argue that income should be positively related to Rosca participation under a commitment motive; this analysis finds positive relationship between participation and latrine ownership but no strong relationship with formal sector income. The data on formal sector income, however, only capture the very upper end of the income distribution; latrine ownership probably captures the very bottom of income distribution, since only 10% of women's group members do not have a latrine in their compound.

[11] Because women move to their husband's homestead in this area, unmarried (in this case meaning not yet married) women are often excluded from participation in Roscas because they are considered to be residentially unstable. At any point they may get married and move, whereas married women have already made the move to their husband's family and kinship group.

and significant (see table 3, col. 5). This suggests that the positive relationship between participation and husband formal sector income is not the result of remittances.[12] Participation does not appear associated with very high or very low levels of female bargaining power in this sample. The positive coefficient on male-only formal sector income suggests that Rosca participation may be a household strategy, consistent with the idea that participation may be a household response to problems of self-control rather than the result of household conflict.

The previous data analyzed participation in Roscas run by women's groups. A more complete test would examine the participation of women's group members in all Roscas, not just those run by these groups. Limited data are available for some women's groups on their members' participation in Roscas outside the Rosca run by the women's group.[13] When we examine overall Rosca participation among those individuals (table 3, cols. 6–9), participation is positively associated with latrine ownership, with years of education, and with being female. Having one's spouse on the compound is not associated with Rosca participation. Neither having a formal sector income in the household nor household bargaining variables is significant.

The idea that household conflict cannot fully explain participation in these Roscas and that husbands might support the Rosca participation of their wives is consistent with the ethnographic evidence available. In a subsample of interviews with 102 Rosca participants, 41% of women interviewed report that their husband gave them money for their Rosca contributions; the total amount given over the course of a Rosca cycle averaged $15. Many women (48%) also gave money to their husbands after they had received the pot, on average giving them $14.[14] This is consistent with other evidence from Africa that husbands are often supportive of their wives' membership in Roscas (Ardener and Burman 1995; Dzingirai 2000) and often contribute for payments (Niger-Thomas 1995).

[12] The coefficient on husband formal sector income is positive but not quite significant at the 10% level when the sample is restricted to women whose husbands do not live at home.

[13] Data are missing for 19 groups in one geographic area because these groups were surveyed before this question was included. In addition, data are not available on contributions in non–women's group Roscas, preventing the use of a two-stage selection model to estimate participation.

[14] This relatively high figure contrasts with the relatively low percentage of funds given to relatives reported in table 4. This could be for several reasons. First, these questions were asked about different rounds of the Rosca and of different individuals. Second, funds that were used by members of the immediate household were likely not conceptualized as "given to households." The use of funds in this round did not ask directly about funds given to spouses. The second round asked explicitly about payments to husbands. Third, if husbands sometimes gave wives money for contributions, then women's payments to their husbands may actually be repayment of a loan and reflected under the category of debt repayment.

B. Rosca Design and Self-Reported Rationales for Participation

In Roscas motivated by household conflict concerns, participants are likely to stress secrecy as an important feature of Rosca organization (Ardener and Burman 1995; Anderson and Baland 2002). For example, Anderson and Baland report that Rosca meetings and activities in their urban Kenyan sample are secret, and the punishment for violating confidentiality can be expulsion from the Rosca. In contrast, the Rosca meetings studied here are relatively public events that would be quite difficult to hide from husbands or community members. All the Roscas but one meet at the home of the recipient of funds and are celebratory singing and dancing events, as reflected in the local name for Roscas: "merry-go-rounds." This structure makes Roscas particularly poor devices for hiding money from husbands. Moreover, in five of the Roscas studied here, spouses participate together, and 66% of the men participating in the other 65 Roscas are themselves the spouses of Rosca participants. Roscas are commonly repeated with essentially the same membership but with no penalty for withdrawal at the end of a round; it is hard to understand why husbands would allow their wives to participate in Roscas once they had discovered their membership and, therefore, why secrecy would be necessary over the long run.[15]

In addition, Rosca participants do not stress household conflict as a key motivation for Rosca participation—quite different from the urban Kenya sample. The ethnographic evidence gathered in interviews with Rosca participants suggests that making a public commitment to saving is a key reason for joining a Rosca for many participants. Consider the following responses to the question of why individuals joined a Rosca:

> You can't save alone—it is easy to misuse money.
>
> Saving money at home can make you extravagant in using it.
>
> Sitting with other members helps you to save.
>
> It [a Rosca] makes you look harder for money to save.

Table 4, panel A, presents the responses of a subsample of 308 Rosca members about why they joined a Rosca. The question was first phrased in an open-ended manner: "What is the most important reason you joined this Rosca?" A total of 38% of respondents reported that it was difficult to save at home because money got used up in small household needs. Another 21% reported that it was difficult to save alone, that they "got the strength to save" by sitting with others. Only 11% of individuals reported that they joined a Rosca as a response to household conflict, fear of theft, or demands by kin.

[15] As noted earlier, 6% of Rosca members in this sample left at the end of the round. Anderson and Baland (2002) and Anderson, Baland, and Moene (2004) also find Roscas are repeated with the same members.

TABLE 4
SELF-REPORTED REASONS FOR JOINING A ROSCA

	Number of Respondents	Percentage of Total
A. What is the most important reason why you joined a rosca? (open-ended)		
I can't save at home because money gets used up on household needs	103	38
Get strength to save from sitting with others/can't save alone	57	21
Group wanted to make sure that each member had a certain item	41	15
Can't save at home; my family will use	18	7
Can get a lump sum to buy a big item	16	6
Safe place to save/fear of theft	8	3
Can't save at home, my husband will use	3	1
To visit each other's houses and see how the person is living	3	1
Other	21	8
B. Here are seven reasons why you might belong to a rosca; which is most important to you personally?		
Get strength to save from sitting with others/can't save alone	94	35
Group wanted to make sure that each member had a certain item	70	26
Can't save at home; money gets used on other things	49	18
To visit each other's houses and see how the person is living	35	13
Safe place to save/ fear of theft	9	4
Can't save at home; my family will use	5	1.5
Can't save at home; my husband will use	4	1.5
Other	4	1.5

Note. Observations = 270.

The question was subsequently rephrased to ask the respondent to choose the most important reason from among seven choices. Panel B of table 4 shows the seven choices given and the responses. The most frequently chosen response was that Roscas gave individuals the "strength" to save. Again, only 8% of respondents gave fear of theft or demands of husbands or families as reasons for joining a Rosca. Answers such as "money gets used up on household needs" can be difficult to interpret, since household needs might include the needs of children or husbands. Finding the "strength to save" may include resisting the demands or ignoring the needs of family members. Moreover, individuals may have been uncomfortable talking about household circumstances to enumerators. But surveys implemented in quite similar environments suggest women are more than willing to share such concerns about household conflict with outsiders. For example, Anderson and Baland find women in Roscas repeatedly complained about the difficulties of savings due to disagreements with their husbands (2002, 968–69). It is also possible that the "strength to

save" response reflects commitment problems at the household level if household are making joint savings and consumption decisions; Rosca participation may be household response to self-control problems on the part of the husband, the wife, or both. This would explain the sharing of Rosca contributions and the positive relationship between husband-only formal sector income and participation noted above.

C. Commitment and Rosca Design

This article puts forward the hypothesis that the commitment properties offered by some Roscas may be a key feature motivating participation. The ideal test for a commitment rationale would involve either a measure of individual rates of time preference or data on individual savings and debt that would allow us to identify the consumption and savings behavior predicted by time inconsistency.[16] In the absence of such data, we have relied on more circumstantial evidence. Key to the arguments in this article is the idea that Rosca design in the sample is most consistent with a commitment motive. Below I discuss additional design features of these Roscas that include monitoring and precommitment mechanisms to further restrict individuals' future choices.

All the Roscas in the sample emphasize public information in their design. All Roscas monitor participants' payments through the public process of payment at each meeting. Each participant's name is called out, and he or she comes forward to put money in the pot. Surprisingly, many Roscas also monitor participants' payments to themselves. The selected recipient of funds must also contribute to her own pot in front of her peers on that day. Her name is duly recorded in the register, and her funds are returned to her along with the contributions of the other members. If she does not contribute, she is considered delinquent. Her name is recorded, and Rosca participants follow up with her until she pays this debt to herself at a future meeting. This is an extreme form of self-commitment.

Many Rosca groups use an additional commitment mechanism, in the form of a spending agreement. In these agreements, Rosca participants commit to the use of some or all of their funds before they receive the pot, and members of the Rosca subsequently verify the individual's use of funds: this is done by having the item brought directly to the individual, by accompanying the in-

[16] For example, Ashraf, Karlan, and Yin (2006) ask hypothetical questions about time discounting and find that women who exhibit a lower discount rate for the future relative to current tradeoffs were more likely to open a savings account with commitment properties. Angeletos and others (2001) note that time-inconsistent individuals will have a preference for illiquid forms of saving and will have the bulk of their savings in illiquid form while also borrowing to finance current consumption.

dividual to purchase the item, or by subsequent visits to the home to verify the purchase. Nearly 60% of the Roscas in the sample use some kind of spending agreement.

It seems reasonable to assume that individuals suffering from strong time inconsistency might want to join a spending agreement Rosca if they continue to face self-control problems after receiving funds, and we might therefore expect participants in such Roscas to differ from those in Roscas without these agreements.[17] It is difficult to make a causal argument about Rosca design and participation, however, since individuals do not face a competitive market for Roscas, and individuals typically join a preexisting Rosca, complicating our ability to disentangle Rosca design from the characteristics of Rosca participants. Since data are not available on individual time preferences, the available respondents' answers to the question of why they joined a Rosca are used as a proxy for time inconsistency, assuming that those who responded that Roscas gave them "the strength to save" were more likely to suffer from inconsistency problems.[18]

Table 5 presents the characteristics of spending agreement Roscas and participants in comparison to nonagreement Roscas and tests for significant differences between them. Spending agreement Roscas appear to be composed of wealthier individuals who live in relatively close proximity. Average contribution levels are higher in these Roscas, and they include a higher proportion of participants who have a formal sector income or live in households with at least one formal sector income. The proportion of married females with the

[17] What might prevent all individuals from consumption splurges when they receive Rosca funds? If an individual wants to save for an indivisible good, as in the framework presented in Sec. II, at each point along the savings path she faces the choice between current consumption and savings, which represents some portion of a future indivisible good—the benefit of which is discounted by β, the time-inconsistent discount factor. Once she has saved through a commitment device and received her funds, however, the individual now faces a trade-off between current consumption and the purchase of an indivisible good available for immediate benefit. Thus, we should expect that the marginal rate of substitution between current consumption and purchase of an indivisible durable will be quite different at the point of receiving funds from what it was along the savings path, since the trade-off is between different goods. Empirically, many popular savings commitment devices, such as Christmas clubs, would not be used if individuals were unable to purchase the goods for which they were saving. In addition, because individuals do not face a perfect market for Roscas, participants cannot always join a Rosca with their optimum contribution level. Thus, an individual could find herself with more savings than needed to buy a specific item, allowing for the purchase of indivisible goods as well as other current consumption items. This would explain the expenditure patterns shown in table 7.

[18] The data are limited, however, because they are missing for two groups and were not gathered through a random sampling of members. Rather, all group members who showed up on the day the group was surveyed were asked to answer this question. It seems likely that those in attendance were not a representative sample of group members.

TABLE 5

CHARACTERISTICS OF ROSCAS USING A SPENDING AGREEMENT

	All Roscas	Spending Agreement Roscas	Nonspending Agreement Roscas
Rosca participant characteristics:			
Proportion female	.91	.91	.90
	(.12)	(.12)	(.13)
Years of education	5.51	5.83	5.05
	(2.26)	(2.45)	(1.9)
Average age	40.1	39.4	40.9
	(5.82)	(6.44)	(4.79)
Proportion of women whose husband lives at home	.70	.70	.69
	(.22)	(.23)	(.21)
Proportion from the same village	.72	.76*	.66
	(.24)	(.23)	(.25)
Proportion from same ethnic group[a]	.83	.83	.84
	(.21)	(.24)	(.16)
Proportion of roscas that include both husbands and wives	.43	.39	.48
	(.50)	(.49)	(.51)
Proportion of rosca participants with formal sector income	.12	.15**	.07
	(.13)	(.16)	(.08)
Proportion with at least one formal sector salary in household	.34	.40**	.27
	(.23)	(.26)	(.15)
Proportion of married women with only formal sector income in household	.04	.05***	.01
	(.05)	(.06)	(.03)
Proportion of married women with only formal sector income whose husband lives at home	.04	.03**	.01
	(.05)	(.04)	(.03)

Proportion of married women with only formal sector income whose husband does not live at home	.006	.007	.004
	(.02)	(.02)	(.01)
Proportion of married women whose husband has only formal sector income	.21	.22	.19
	(.16)	(.17)	(.14)
Proportion of rosca participants who report "strength to save" most important reason to join rosca ($n = 68$)	.35	.37	.32
	(.28)	(.26)	(.30)
Rosca structure:			
Total number of founds completed	5.35	5.39	4.96
	(4.4)	(4.74)	(4.19)
Number in rosca	15.24	14.7	15.8
	(6.16)	(4.54)	(7.80)
Average per member contribution (US$)	3.12	4.10**	1.61
	(4.96)	(6.09)	(1.99)
Duration of rosca in months	11.4	11.65	11.16
	(5.62)	(5.03)	(6.09)
Rosca characteristics:			
Km from paved road	9.47	8.6	10.8
	(11.78)	(10.5)	(12.9)
Km from post office	4.18	4.29	4.08
	(3.83)	(4.04)	(3.61)
Number of roscas	70	41	29

Note. Tests were run of the equality of means for variables in spending agreement and nonspending agreement Roscas.

[a] The ethnicity used here is the husband's ethnic group, since residence in this area is patrilocal and women join a husband's clan upon marriage. The main ethnic group in the area is the Luhya. The Luhyas were not considered one "tribe" until just before independence, when the various subgroups, all speaking related languages, became more unified politically under the name Luhya. Here we consider each of the Luhya subtribes as separate ethnicities.

* Means are different at the 90% level.

** Means are different at the 95% level.

*** Means are different at the 99% level.

only formal sector income in the household is significantly higher on average in spending agreement Roscas, as is the proportion of women with formal sector income who reside with their spouse. The proportion of females with the only formal sector income and no co-residing spouse is also higher in spending agreement than in nonagreement Roscas but is not statistically significant, and the proportion is quite low. Although the average proportion of Rosca participants who report that they join to get the strength to save is higher in spending agreement Roscas, the difference is not statistically significant. The fact that spending agreement Roscas are composed of higher-income women's group members is consistent with a commitment story, assuming that the need for commitment is increasing with income. As Anderson and Baland (2002) note in the household context, if an individual faces a fixed probability of theft, and if the demands of relatives are rising in income, an individual with no outside saving options is strictly better-off joining a Rosca at higher levels of income and accumulating excess savings at home rather than just saving at home. However, the risk of theft and demands of family may also be increasing in income, and we are unable to control for the possible endogeneity of income and Rosca participation here.

Table 6 shows the association between the use of spending agreements by Roscas and the characteristics of Rosca participants using a probit estimation of the probability that a Rosca uses a spending agreement.[19] The use of spending agreements is positively associated with the proportion of participants drawn from the same village, with contribution levels, and with having a formal sector income, but not with the proportion of participants who reside with their spouse. Roscas using spending agreements have a higher proportion of women with the only formal sector income in the household (col. 3). This association does not appear to be driven solely by women with co-residing spouses, however, since the disaggregating of the proportion of women with the only formal sector income by the presence of a spouse leads to positive but not statistically significant coefficients on both variables (col. 4).[20] Although identification is not possible here, the patterns of participation and design are consistent with the idea that women join spending agreement Roscas for commitment rather than as a response to household conflict. The positive relationship between the proportion of participants with formal sector income and the use of a spending agreements suggests that the need for commitment mechanisms may be increasing in income, although it is difficult to disentangle

[19] As noted above, participation and Rosca design are endogenous; the analysis here is therefore focused on identifying the patterns of spending agreement use.

[20] When the proportion of participants who report they participate to "get the strength to save" is included, it is not significant.

TABLE 6
USE OF SPENDING AGREEMENTS IN ROSCAS

	Use of Spending Agreement by Roscas			
	(1)	(2)	(3)	(4)
Proportion with latrine	−.24	−.30	−.33	−.38
	(.38)	(.41)	(.37)	(.38)
Proportion from same village	.57**	.48*	.64***	.59**
	(.28)	(.28)	(.30)	(.30)
Distance from post office	.02	.02	.02	.02
	(.02)	(.02)	(.02)	(.02)
Number of years rosca in operation	−.01	−.01	−.01	−.01
	(.01)	(.01)	(.01)	(.01)
Per member contribution	.03**	.03**	.03	.03*
	(.01)	(.01)	(.02)	(.01)
Proportion of participants with formal sector income	1.44**			
	(.50)			
Proportion of participant households with at least one formal sector income		.69**	.88***	.70**
		(.29)	(.41)	(.31)
Proportion of participant households where only wife has formal sector income			4.09***	
			(1.97)	
Proportion of participant households where only husband has formal sector income			−.50	−.82
			(.59)	(.57)
Proportion of participant households where only wife has formal sector income and husband resides at home				3.40
				(2.52)
Proportion of participant households where only husband has formal sector income and resides at home				5.87
				(4.04)
Proportion of female members whose husband resides with them	.06	−.05	−.07	.03
	(.27)	(.29)	(.28)	(.30)
χ^2	18.71	15.28	19.36	23.29
Pseudo R^2	.17	.15	.25	.23
Number of observations	70	70	70	70

Note. Coefficients are probit estimates that give the change in the probability for an infinitesimal change in each independent, continuous variable and the discrete change in the probability for dummy variables, evaluated at the mean. In cols. 3 and 4, the excluded income category is the proportion of participant households where neither wife or husband has formal sector income.
* Significantly different than zero at 90%.
** Significantly different than zero at 95%.
*** Significantly different than zero at 99%.

the need for self-commitment from the need for safe storage and for hiding money from one's kin. Indeed, the household as a unit may face commitment problems and may use Roscas to commit the household to savings or to protect the household from the demands of kin. This would explain the positive coefficients on male formal sector income noted earlier.

Do participants in spending agreement Roscas use their funds differently? Section IV noted that Rosca pots are not used solely to fund indivisible purchases and that the majority of recipients use Rosca funds for more than one purpose. As noted throughout the article, individuals are constrained in choosing their contribution levels by the set of Roscas available to them, so that the savings rate achieved in a Rosca may be higher or lower than an individual's ideal rate. This may explain why reported Rosca expenditures are "lumpier" than overall household expenditures but, as noted in Section IV, are not spent exclusively on indivisible durables.[21] Since Rosca participants using spending agreements choose how to spend their funds, there is no reason to think that funds will be spent differently unless spending agreement Roscas are more successful in preventing consumption splurges or in circumventing the demands of relatives. Table 7 shows how participants in spending agreement Roscas report spending their funds relative to nonagreement Roscas. Expenditure patterns are similar with two exceptions: spending agreement funds are more likely to be spent on participants' small businesses and less likely to be given to a relative. This suggests that spending agreements may serve as commitments that support participants in making private investments such as investing in a small business, perhaps by insulating Rosca pots from family demands.

D. Alternative Rationales for Participation and Design

This article argues that self-commitment is a plausible rationale for Rosca participation in some settings. But the illiquidity provided by Rosca participation clearly provides several concurrent benefits, including safe storage for savings, no matter what the rationale for participation. This section examines some of the alternative explanations for participation. Both formal and informal savings and credit options are limited in this area of Kenya. In 78% of these Roscas, participants could not identify a moneylender within an hour's walk of the Rosca; formal credit mechanisms in the area are highly limited. There are some limited savings options. Post office savings accounts are available at local post offices, and, on average, Roscas are located about 4 kilometers from a post office and 15 kilometers from a bank. In ethnographic interviews about recent savings practices with 102 Rosca participants, 40% of interviewees reported that they had most recently hidden money in the house to save, 17% had used a bank account, 15% had used a post office account, and 15% had

[21] Food expenditures typically accounted for 62% of overall household expenditures in Kenya, while household items accounted for 0.5% and school fees 8% of household expenditures (Kenya Bureau of Statistics 1996).

TABLE 7
ROSCA PARTICIPANTS' REPORTED USE OF ROSCA FUNDS

Item Purchased (Average Proportion of Total Pot Spent on Item)	Mean for All Roscas (SD)	Mean for Spending Agreement Roscas	Mean for Nonspending Agreement Roscas
Household items (cups, plates, cooking pot)	.24	.25	.24
	(.36)	(.37)	(.36)
School fees	.25	.22	.28
	(.37)	(.37)	(.37)
Food	.14	.13	.15
	(.23)	(.23)	(.24)
Small business	.08	.10	.05**
	(.24)	(.27)	(.18)
Livestock	.05	.05	.05
	(.18)	(.19)	(.17)
Illness	.04	.04	.05
	(.17)	(.18)	(.18)
Clothes	.04	.04	.04
	(.17)	(.16)	(.18)
Farm	.03	.02	.04
	(.13)	(.12)	(.15)
Paid debts	.03	.03	.02
	(.11)	(.13)	(.09)
Ceremony (funeral, memorial service)	.01	.02	.01
	(.10)	(.11)	(.08)
Home construction	.02	.03	.01
	(.13)	(.15)	(.09)
Blanket	.005	.01	.001
	(.01)	(.06)	(.01)
Gave to relative	.01	.006	.02*
	(.07)	(.04)	(.10)
Other purchases	.04	.04	.03
	(.14)	(.15)	(.12)
Number of observations	291	177	114

Note. *T*-tests were run on the hypothesis of equal means between spending agreement and nonspending agreement Roscas. Data based on interviews with individual group members surveyed at their homes. For each women's group, the three executive officials and three randomly selected individuals were originally selected to participate in the interview, but not all group members selected were Rosca members. Responses were recorded for the most recent payments of funds they had received.
* Means are different at the 90% level.
** Means are different at the 95% level.

put money temporarily into their business, livestock, or held temporary food stocks as a way to save. On average, these individuals reported having $38 in post office accounts (excluding one person with $328) and $155 in bank accounts. Post office and bank accounts probably have both safety and commitment properties. For many individuals, travel to the post office or bank means a long trip in addition to potentially long lines in the office itself. In addition, at the time of this data collection there was a maximum daily

withdrawal limit of roughly US$5 in place for post office accounts, and banks had relatively high minimum-deposit requirements. One interpretation of these data is that just over 45% of those interviewed invested in some kind of illiquid savings—given the distance to a bank or post office savings account, this type of savings can be considered only semiliquid. While it is clearly impossible to rule out safe savings as an important motivation for Rosca participation, safe savings is probably a coexisting motivation, whether individuals join a Rosca for commitment, because of household conflict, or for insurance.

In addition to providing a safe way to store savings, Roscas could function as a mental accounting tool, helping individuals to separate their savings into streams.[22] Of the Rosca participants who were asked about Rosca participation outside the women's group, 47% reported that they participated in another Rosca; no data are available on the use of funds from those Roscas. But another reason individuals typically join more than one Rosca is to raise their average savings level. As noted above, individuals typically face a limited set of Roscas from which to choose. In addition, in order for the Rosca to succeed, contribution levels must be set low enough to recruit individuals members. Some individuals may therefore need to join multiple Roscas to achieve their savings goals. This also spreads risk, since all savings are not locked into one Rosca. It is impossible to rule out these alternative motives for participation; indeed, the multiple benefits provided by Roscas may be a key reason for their prevalence and durability.

VI. Conclusion

This article argues that individual or household needs for commitment in the face of savings self-control problems can form a rationale for Rosca participation and design. The evidence provided on 70 Roscas in rural Kenya is consistent with a commitment story and demonstrates how participation and design in these Roscas exhibit important inconsistencies with many other rationales for participation. The data cannot fully rule out all alternative hypotheses, and, indeed, I argue that all Roscas—whether formed for commitment, insurance, or financing lumpy durables—are able to meet simultaneous demands for safe savings and protection of funds from family demands. Moreover, household conflict and the demand for an indivisible durable good may be complementary motives for participation for many participants. The ability to fulfill simultaneous needs may explain the popularity and durability of Roscas, and the

[22] I thank an anonymous referee for raising this point.

adaptability of Rosca design may explain why we see different forms of Roscas across different institutional and social settings.

Future research on Roscas should set out to test the commitment hypothesis in more direct ways. For example, Ashraf et al. (2006) provide evidence through a randomized experiment in the Philippines that individuals reporting hyperbolic preferences are willing to adopt and pay for a savings commitment product and that such a product can induce higher savings. Similar direct tests on Roscas would be helpful. If self-control and commitment problems do form an important rationale for Rosca participation, this has important implications for the design of microfinance and savings products and policies. Anderson and Gugerty (2006) argue that discount rates may be even higher in developing than in developed countries and that these behaviors are more likely to influence resource allocation both because of their prevalence and because of the lack of institutional mechanisms to temper their effects. More broadly, the variation in design and participation in Roscas across settings presents an interesting case of endogenous institutional design and raises the question of how savings and credit products ought to be designed or customized in different contexts.[23] Clearly, Roscas do exist that fulfill durable financing and insurance needs. Future research to establish relationships between Rosca design and the characteristics of participants and their economic environments could provide important information for policy and savings product design. Providing the poor with the opportunity to commit to savings could have high payoffs in terms of savings mobilization and asset accumulation in many economies. For many individuals, it may be true, as many Kenyan Rosca participants noted, that "you can't save alone."

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