

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

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Abstract

This paper examines how and why individuals develop and maintain local-level financial savings organizations known as rotating savings and credit organizations, or roscas. Economic theories suggest that individuals join roscas to finance the purchase of a lumpy durable good, as a response to intra-household conflict over savings, or to provide insurance. The paper proposes an alternative hypothesis for rosca participation: saving requires self-discipline, and roscas provide a collective mechanism for individual self-control in the presence of time-inconsistent preferences and in the absence of alternative commitment technologies. Data from 70 roscas located in western Kenya show how rosca design supports individual self-commitment. As many rosca participants put it: “you can’t save alone.”

1. Introduction

This paper examines how and why individuals develop and maintain local-level financial savings organizations known as rotating savings and credit organizations, or roscas. 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.

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.

Given the riskiness and inflexibility of roscas, why would anyone join a rosca instead of saving alone? Economic theories suggest that individuals join roscas to finance the purchase of a lumpy durable good, as a response to intra-household conflict over preferences, or to provide insurance. The paper proposes an alternative hypothesis for rosca participation: saving requires self-discipline, and roscas provide a collective mechanism for individual self-control in the presence of time-inconsistent preferences and in the absence of alternative commitment technologies. As many rosca participants put it: “you can’t save alone.” A simple theoretical framework shows how roscas can serve as a commitment device. Theories of roscas participation are tested by examining rosca structure in a sample of 70 roscas and 1066 rosca members in western Kenya.

The commitment hypothesis is consistent with the rationale and design of these roscas. Roscas are usually repeated with the same order of allocation of funds and with no interest paid. Moreover, participants do not always value earlier positions in the rosca allocation more highly, implying credit may not be the primary reason for joining a rosca. Nor are rosca funds typically used for the purchase of a lumpy, indivisible good. A key feature of roscas is their public nature and the inflexibility of their organization. Payments are made publicly, and groups monitor and enforce an individual’s payments to herself as well as her payments to the group. Many rosca participants also “bind their hands” through the use of a pre-commitment mechanism in which participants agree in advance on how they will use their funds and the group monitors the individual to ensure that she honors her commitment. Finally, most rosca participants report that they join roscas in order to commit themselves to saving, “to get the strength to save.” Thus the inflexibility of roscas is precisely the feature that is most valued by participants.

The paper proceeds as follows. This section reviews the previous literature on roscas and on savings and commitment. Section 2 presents a simple framework to illustrate why individuals with time inconsistent preferences might want to join a rosca. Section 3 reviews the dataset used in the paper and Section 4 discusses the evidence on rosca design and commitment. The final section concludes.

1.1 Related Literature

One of the most surprising features of roscas is their prevalence. Roscas are found worldwide and in countries with vastly different levels of economic development. Ardener (1964) and Ardener and Burman (1995) document the prevalence of roscas in Asia, Latin America, the Caribbean, and Africa. Rosca participation is particularly high in Africa. Estimates suggest that in 1986, 50 percent of the adult population in the Congo belonged to a rosca, while participation ranged from 50 to 95 percent in many rural areas in Liberia, Ivory Coast, Togo, and Nigeria (Bouman 1995). In 1992, membership in roscas in Cameroon was estimated at 80 percent of the adult population (Bouman 1995) and in several villages in Nigeria in 1987, adult membership was found to be 66 percent of the population. A sample of 115 households in central Kenya showed that 45 percent were participating in a rosca (Kimuyu 1999).

While roscas are often found in economies where formal credit markets are thin or non-existent, they are also found in more developed areas where individuals have access to formal banking institutions. Roscas have been reported among employees of the IMF (Ardener 1995) and among bank employees in Bolivia (Adams and Canavesi 1992) and Ghana (Bortei-Doku and Aryeteey 1995). In a sample in urban Zimbabwe, 76% of urban market traders participate in a rosca, even though 77% of these traders have a banking account (Chamlee-Wright 2002). In

countries such as Taiwan with relatively well functioning credit markets, as many as 80 percent 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)

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. All individuals except the last improve their welfare by joining a rosca, as each receives the indivisible durable good sooner than by saving alone. Anderson and Baland (2002) use data from roscas in a low-income neighborhood in Nairobi, Kenya to argue that rosca participation is a strategy married women use to protect household savings against claims by husbands for immediate consumption.

Individuals might also form roscas in order to provide each other with insurance, particularly in a setting such as rural Kenya where formal markets for insurance are virtually non-existent. When funds are distributed via an auction mechanism, roscas can serve as insurance mechanism because participants may be able to access money when they need it. Klöpper (2003) shows how risk-averse participants in a bidding rosca can insure themselves against idiosyncratic risks. Calomiris and Rajaraman (1998) show that in Indian roscas with concurrent bidding, the actual amount received by the winner is subject to variation through the bidding process in a manner consistent with insurance.

This paper argues that a key feature of underlying the design of many roscas is missing from this literature. Roscas can provide a commitment mechanism that ties participants' hands and commits them to savings patterns, and sometimes to spending patterns as well. Ethnographic

and anthropological literature has often mentioned this feature of roscas (Ardener 1964; Bouman 1995; Chamlee-Wright 2002) but little systematic data has been collected on this aspect of roscas. Ambec and Treich (2003) present a theoretical model of roscas that argues that roscas are financial agreements that help individuals avoid social pressure for income sharing. The model of Anderson and Baland (2002) relies on the presumption that married women can use roscas as a savings commitment mechanisms if households are willing to purchase an indivisible good upon receipt of the rosca pot, even when households were not willing to save at all, *ex ante*.

Time inconsistency and self-control

This paper argues that roscas may help time inconsistent individuals to save. Under the standard assumptions about economic behavior, such mechanisms would not be necessary because individuals have preferences that are constant over time. These preferences are expressed by an exponential individual utility function in which individuals discount the future at a constant rate. These preferences imply that when individuals plan a certain course of action in the future, such as saving, when the future arrives their preferences will not have changed. Time inconsistent individuals, however, have preferences that change as the date of action nears.

The psychological evidence on preference formation suggests that self-control problems are widespread (Ainslie 1992) and finds that individuals often exhibit a declining rate of time preference (Frederick, Loewenstein and O'Donoghue 2003). This implies that the discount rate over long time horizons is lower than the discount rate over shorter time horizons. Thus, the discount factor, defined as $1/(1 + \text{discount rate})$, increases with the time horizon. Recent survey evidence from Vietnam, for example, suggests that individuals exhibit time-inconsistent preferences (Anderson et al 2004).

Individuals with a time inconsistency problem must find ways of committing themselves into the future, since they cannot credibly commit to future behavior. The psychology literature presents several mechanisms, both intrapersonal and extrapersonal, for encouraging commitment. Intrapersonal mechanisms include behavior such as removing the temptation from sight or making private rules with oneself governing behavior. Extrapersonal mechanisms may include physical or social constraints on future choices, such as opening a 401(k) account. Economists are not well equipped to explain intrapersonal processes,¹ and these processes may produce behaviors that are observationally equivalent to other strategies. The empirical emphasis has therefore been on identifying and modeling visible precommitment mechanisms, or what O'Donoghue and Rabin (1999) call "smoking guns."

Just how widespread are these commitment devices empirically? Many people join support groups to lose weight, quit smoking, or as in the present case, to save. As noted above, there is strong evidence that consumers, even in a market economy with low transactions costs like the U.S., are willing to pay to have their options limited. Laibson, Repetto, and Tobacman (1998) note that financial advice to consumers often involves removing money from bank accounts "before you can spend it." Ten million Americans still belong to Christmas Clubs, and "savings circles" run by churches are an increasingly popular mechanism for individuals to commit themselves to savings.

The use of commitment mechanisms is also widespread in developing countries. Shipton (1992) documents the use of "lock boxes" in the Gambia in which individuals hire carpenters to construct a box with no opening, except a small slit to push money through. Small amounts of money cannot be removed, except by smashing the box. Rutherford and others (1999) cite

¹ Although O'Donoghue and Rabin (1999) show that if individuals are aware of their self-control problem, they can create commitment mechanisms for themselves as long as they can correctly anticipate their future lack of self-

several commitment devices that villagers in East Africa use to stick to savings plans, including buying a lock box and throwing away the key. Ashraf, Karlan and Yin (2004) report on an experiment in which bank clients were randomly offered access to a savings commitment product; women who exhibited a lower discount rate for future versus current tradeoffs were more likely to adopt the savings commitment product.

The main limitation with many commitment technologies is that it is difficult to prevent oneself from renegeing on promises. Lock boxes can be smashed and business inventories easily liquidated. The strongest commitment technologies involve surrendering control over one's savings to someone else. Deposit collectors are another way of tying one's hands: in many countries individuals actually pay someone to collect and hold their savings for them (Robinson 1992; Wright 1999; Rutherford 2000). Rutherford and others (1999) report the use of "money guards" in which individuals entrust their savings to someone else so that they cannot spend it. This is similar to the strategy underlying a rosca. A collective mechanism is required because a time-inconsistent individual cannot make deals with herself. Future selves (with different preferences) will always be able to renegotiate this contract. The usefulness of a rosca is that funds paid in cannot be retrieved, and control over the funds is essentially given over to the rosca.

2. A Simple Framework for Time Inconsistency and Roscas

A common approach in the literature to capture 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

control.

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 can be characterized by a simple maximization problem:

$$[1] \quad U_t(u_t, u_{t+1}, \dots, u_T) = \sum_{t=t}^T \mathbf{d}^t u_T$$

Utility is the sum of utility in all periods up to T, discounted by \mathbf{d} , which lies between 0 and 1 and represents the time consistent exponential discount factor. A common approach to modeling hyperbolic preferences is to use what Laibson (1997) calls “quasi-hyperbolic” utility. Using a 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:

$$[2] \quad U_t = \mathbf{d}^t u_t + \mathbf{b} \sum_{t=t+1}^T \mathbf{d}^t u_t$$

In this case, \mathbf{d} represents standard exponential utility, while \mathbf{b} represents time inconsistent discount factor. When $\mathbf{b} < 1$, a person gives more weight to period τ when it arrives than in any previous period. In this case, the short-term discount rate is higher than the long-term discount rate. Following Laibson (1997) and O’Donoghue and Rabin (1999) I assume $\mathbf{d} = 1$ to abstract

away from time consistent discounting, leaving only \mathbf{b} , the time inconsistent parameter, so that utility is simplified to:

$$[3] \quad U_t = u_t + \mathbf{b} \sum_{t=t+1}^T u_t$$

The basic results follow with $\delta < 1$.

Imagine individuals live in a four period world, t_1 through t_4 . In periods t_2 and t_3 (for example, the “harvest periods”) each individual receives one unit of surplus income. In each period, the individual must decide whether to save or consume this surplus. Consuming the surplus gives each individual one unit of utility. If she saves both units of surplus, then in t_4 she may trade these in for a durable good, or enjoy higher consumption. The individuals have no access to credit markets.

If individuals have standard exponential utility as given in [1], assuming that $\mathbf{d} = 1$ and $\mathbf{b} = 1$, then the benefit of consuming their two periods of surplus (with $\mathbf{d} = 1$) is equal to two. If they save, they can buy a good in t_4 that gives a one-period benefit equal to c . Individuals will save as long as $c > 2$. Under time-inconsistent preferences ($\mathbf{b} < 1$), however, the decision to save changes over time. Viewed from t_1 , the benefit of consuming the surplus in t_2 and t_3 is given by $2\mathbf{b}$. If each individual saves his two periods of surplus, the benefit from saving realized in t_4 , viewed from t_1 is $\mathbf{b} c$. Individuals will save if $\mathbf{b} c > 2\mathbf{b}$ or $c > 2$, as in the time consistent case. At t_2 , however, the picture has changed. The benefit of consuming the t_3 surplus is now $1 + \mathbf{b}$, while the benefit of saving is $\mathbf{b} c$. Individuals will save only if $c > (1 + \mathbf{b})/\mathbf{b}$, which is greater than 2 for all $\mathbf{b} < 1$. The lower the discount parameter \mathbf{b} (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.

Two “sophisticated” individuals might therefore have a rationale to form a rosca that can credibly commit them to savings. The difficulty, however, is that the first individual to receive funds has an incentive to default and refuse to pay the other in the next round. The potential for roscas to provide savings discipline might therefore seem limited, but the folk theorem provides a mechanism for sustaining roscas: cooperation is possible in repeated games so long as players care sufficiently about the future. Two individuals can create an endogenous mechanism to sustain the rosca, by offering the opportunity to repeat the rosca once a round is complete. While no rosca member expects to live forever, or, indeed, for her rosca to last forever, the infinite horizon framework captures the situation where players are analyzing a long-term situation without assigning a specific status to the end of the world (Osborne and Rubenstein, 1994).

In a repeated prisoner’s dilemmas, cooperation can be maintained by a “trigger strategy” in which a player’s reaction function tells him to cooperate in this round if and only if all players cooperated on the previous round, otherwise defect forever (Fudenberg and Maskin 1986). In this example, the trigger strategy would be played if a player receives funds and then makes no further payments. If the first person defaults, for example, she would receive benefits $bc + b$, where the second term represents the additional benefit from default. The cost of default is exclusion from participation in future rounds of the rosca, with utility loss of bc in each round. Assuming no discounting within rounds, but a discount parameter of d across rounds, the rosca can be sustained as long as

$$\frac{bc}{1-d} > b \text{ or when } d > 1 - c.$$

As c increases, the rosca is sustained for more impatient individuals. The trigger strategy is not the only strategy that might sustain roscas in the context of infinite play. Nonetheless, it is clear that the cooperation necessary to sustain a rosca is possible within a range of punishment strategies and this helps to explain why individuals are able to sustain roscas even in the absence of strong community-based social sanctions (Gugerty, 2004) and, as is shown below, why so many roscas are repeated with the same membership.

3.0 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 agriculture projects, these groups may also provide emergency financial or labor assistance to members. Many groups also undertake an income-generating projects, which might include agriculture, fish farming, beekeeping, or handicrafts. These groups were originally identified to participate in an agricultural development project funded by a Dutch NGO working in the area. The NGO surveyed the existing women's groups in the areas in which they worked and identified 100 operational groups.² Eighty groups were selected from

² The included survey areas consisted of the catchment areas for the primary schools in which the NGO ran child sponsorship programs and development projects. A criteria for inclusion in the NGO project was that the groups be undertaking agricultural activity. This sample may therefore not be fully representative of all roscas operating in the area, although the enumeration of these groups did not produce a large number of women's groups beyond those

these 100 groups to participate in an NGO agricultural assistance program during the period examined here. 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 rascas. We restrict our attention to the 70 rascas 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, and secretary and group members were jointly interviewed and written rosca records reviewed to gather detailed information on the functioning of the rosca. Data were gathered on rosca structure, size, and meeting frequency, and 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.

Rascas operate separately from other group activities. Records are kept separately and not all group members participate in the rosca. This pattern of rascas embedded in mutual assistance groups is quite common in rural areas in sub-Saharan Africa (Siebel and Marx 1987; Shipton 1992; Bortei-Doku and Aryeetey 1995; Nelson 1995; Wright 1999; Anderson and Baland 2002). On average, 83 percent of the self-help group members participate in the rosca.

Table 1 gives characteristics of the rascas in the sample. The average rosca in the sample has been running for 6.5 years and has completed five cycles. In this paper, a "cycle" 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 and distribute funds to one

included in the project. However, there may be informal rascas operating in the area that were not captured by the enumeration.

³ Gugerty and Kremer (2004) 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. The rosca sample is evenly distributed between funded and unfunded groups. The rosca participants were interviewed twice: first in September-October of 1998, and then again in May-June of 1999.

individual. 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. The roscas are located in relatively rural areas. The average distance of a rosca to a paved road is 10 kilometers.

Membership 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, 64 out of 1066 participants or six percent of all participants in the sample left the rosca during the last round. In this same round, 20 percent of roscas had admitted new participants, but no rosca admitted more than two new participants.

4.0 Rosca Operations and Design

4.1 Rosca Design

Every rosca must make a number of decisions regarding organizational design, including how to allocate the funds to participants, and how to balance the size of the contribution, the number of participants, and the frequency of contributions. In addition, roscas must consider both how to prevent default once a member has received funds and how to prevent attrition during the rosca cycle. The allocation order for funds should help to ensure both that the first person to receive funds does not default and that the last person to receive funds is willing to participate. Funds can be allocated in a number of ways: by randomized draws, by bidding, or by some other criteria such as need, seniority, or residential patterns. The size and frequency of the contribution may be weighed against participants' ability to pay and the intended use of the

funds. The larger the membership the bigger the collective pot, but the greater the temptation of default. In addition, each member must wait longer to receive the funds unless the frequency of meeting is also increased. Rosca participants must also choose a method for making payments. Members may meet and exchange funds in a face-to-face interaction, or they may appoint a rosca “president” or other individual who collects and allocates funds (sometimes called an “impersonal” rosca).

In this sample, the average rosca has fifteen participants and the average individual contribution is just under two dollars, usually contributed on a monthly basis. The average rosca contribution, number of members, and frequency of meetings appear to be balanced so that each member receives the rosca money once in a year. Thus, the average rosca recipient expects to receive a pot of about twenty-five dollars, or roughly one-quarter of average monthly household expenditures.⁴ This is enough, for example, to pay school fees for a primary school student, to buy two bags of maize, or two iron roofing sheets, or a mattress or a blanket, but it is insufficient to buy a larger good such as a bicycle or to pay fees for a secondary school student.

4.2 Order of Allocation of Funds in Roscas

In ninety-six percent of roscas in this sample, participants know the order of allocation of funds before the rosca payments begin (table 2), thus at the start of the rosca cycle there is no uncertainty to resolve. This suggests that individuals are not joining roscas for insurance, as they are unable to access funds when needed through a bidding or auction mechanism. The use of such auction mechanisms in African roscas appears relatively limited (Shipton 1992; Ardener and Burman 1995; Platteau 1997; Anderson and Baland 2002). No rosca in the sample pays interest.

Moreover, in 37 percent of the *roscas* in this sample, the members repeat the order in which participants receive funds in each subsequent cycle. This pre-determined order of allocation suggests that these individuals join *roscas* for reasons beyond financing the purchase of an indivisible durable good (Besley, Coate and Loury 1993). 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*. 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 as each subsequent individual loses her motivation for participation.⁵

4.3 Preferences over timing of funds

If one views a *rosca* primarily as a credit mechanism, 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, 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. This may explain in part why participants see no need

⁴ Average rural monthly expenditures were estimated to \$105 in 1997 (Republic of Kenya, 2000).

⁵ 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, 2004). 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

to pay interest to individuals with positions late in the rotation, even when they hold those positions in multiple rounds (Seibel and Marx 1987; Platteau 1997; Anderson and Baland 2002). As one participant put it, “the system is fair, because even the first person will have to wait until the last person has received to receive again.”

Second, rosca participants state that they prefer to receive funds at particular times of the year rather than always preferring to receive earlier in the cycle. Most roscas groups report that they prefer to start their cycle in January and end in December. In practice, however, the starting month of roscas varies considerably. Not all participants can receive in a year, and roscas may also be suspended if there are adverse shocks that affect all members. As roscas are repeated, the starting month becomes increasingly arbitrary. The start date of the roscas in this sample is distributed relatively evenly throughout the calendar year, though the largest proportion start in January, as shown in Figure 1.

Figure 2 shows member preferences for the receipt of funds by the main seasons of the year. The “fees” period consists of the months January – March, when most school fees are due and the hungry season begins. April – June represents the hungry season just before the first harvest. Figure 3 shows the distribution of member preferences for the receipt of funds by month. The largest proportion of participants prefers to receive funds in the period just after the harvest. Participants felt that money received during this period was not obligated to be used for food or fees: “I can *do* something with the money, not just use it on the household.” Participants also felt they could use the money on their business or to buy food cheaply, either as stock for the household or to sell at a profit later. The holiday season (October – December) is the least favored time to receive the pot; participants report that money gets “used up” in the entertaining

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.

of visitors and preparations for holiday celebrations. Table 3 reports the two most commonly given reasons cited for these preferences, by month.

The valuation of one's position in the rosca depends on two additional factors. First, the cost of "hosting" the rosca may vary with season. Hosting a rosca during the hungry season means finding food for participants at a time when household stocks are low and food prices are high. Second, default rates on payments may be higher during the hungry season because individuals have more difficulty in obtaining funds to make payments. Figure 3 shows the average percentage of unpaid obligations over the calendar year and indicates that default rates are higher at the beginning of the year when school fees are due and the hungry season is beginning and again at the end of the year during the holiday season. Default rates are lowest during the harvest season. This may also explain why many participants prefer to receive funds during the harvest season.

4.4 Use of Rosca Funds

Rosca participants do not use their roscas payouts to purchase indivisible durable goods. Over half of rosca participants use their rosca payout for more than one purpose, and one-fifth use their winnings for more than two purposes. For individuals who use their funds for more than one item, the average proportion of the pot spent on the most expensive item is 62 percent. In addition, the expenditures generally favored by rosca participants (household items, school fees, and food) are often divisible. School fees may be paid in installments and food purchased in small quantities (though often at a higher cost). Table 4 shows that rosca purchases are not confined to indivisible goods. The two largest categories of expenditures are household items and school fees. School fees are generally due at the beginning of the school year in January.

Many parents are unable to pay fees all at once, but are allowed to pay in installments without penalty.

It is more difficult to characterize the divisibility of household items. Many participants use their funds for cups or plates that could be purchased individually, but may be purchased more cheaply (or more uniformly) as a set. Rosca funds do appear to be differently than household income. Food expenditures typically accounted for 62 percent of overall household expenditures in Kenya, while household items accounted for 0.5 percent and schools fees 8 percent of household expenditures (Kenya Bureau of Statistics 1996).

Table 5 examines the factors associated with the number of uses of rosca funds. There is no association between the use of an allocation mechanism that re-randomizes the funds in each round and the number of uses of rosca funds. This suggests that there is no relationship between the lumpiness of rosca purchases and the allocation mechanism as an indivisible goods model might suggest.

4.5 Intra-household participation in roscas

Empirically, rosca participation appears higher among women than among men in Kenya (Anderson and Baland 2002). Their explanation is that married women join roscas because of intrahousehold conflict resulting from different preferences for household goods between wives and husbands. Since this sample consists only of roscas run by women's groups, it is difficult to test hypotheses to explain female participation. Nonetheless, intra-household conflict over savings does not appear to be a key reason for participation in the roscas in this sample. In a sub-sample of 102 rosca participants, 41 percent 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 percent) also gave money to their husbands after they had received the pot, on average giving them \$14. This indicates that participation in roscas is often a household strategy, rather than a mechanism used to keep funds away from husbands.⁶ This is consistent with other evidence from Africa that husbands are often supportive of their wives' membership in roscas (Ardener 1995; Dzingirai 2000) and often contribute for payments (Niger-Thomas 1995).

Married women appear no more likely to participate in roscas than unmarried women or women who are household heads. In the current sample, women whose husbands live on the same compound with them are no more likely to participate in the rosca. Women participate in the rosca at higher rates than men on average, but women with formal sector income do not participate in the rosca at higher rates than women without formal sector income. Table 6 gives the results of a probit analysis for the likelihood that a women's group member belongs to the group's rosca. Among married women, those whose husbands are co-resident at the home are no more likely to participate in the rosca. This is consistent with other evidence from rural Kenya. Kimuyu (1999) notes that in a sample of 115 households in central Kenya, female-headed households are more likely to participate in roscas than are households headed by a man.

4.6 Rosca organization and location

The organization of the roscas in this sample does not support the idea that participants are using roscas to hide money from others. The meetings of roscas in this sample are public events. All the roscas but one meet at the home of the recipient of funds, who is called the

⁶ 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.

“host.” Meetings are generally celebratory events, as reflected in the local name for roscas: “merry-go-rounds.” Food is served in 85 percent of the roscas and singing and dancing may accompany awarding of funds. The host is responsible for providing the food, though in 20 percent of the rosca participants make a special contribution for food at the time of the rosca meeting.

This structure makes roscas particularly poor devices for hiding money from others. Fifteen visitors are likely to be noticed in a small community: the host’s spouse and all her relatives are therefore aware that she has received funds. A more conducive structure for hiding funds might be to randomly select a participant to receive the money at each meeting (which none of the roscas do). The public nature of roscas is consistent, however, with the use of roscas as a commitment mechanism.

4.7 Monitoring of Participants

A key feature of many roscas in this sample is the use of monitoring and precommitment mechanisms to further restrict individuals’ future choices. All roscas monitor participants’ payments through the public paying in of deposits at each meeting. Surprisingly, roscas also monitor participants’ payments to themselves. Meetings are held at the home of the recipient of funds, who must also contribute to the pot in front of her peers on that day. Her name is duly recorded in the register and her funds 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 the group follows up with her until she pays this debt to herself at a future meeting. This is an extreme form of self-commitment.

One of the strongest indications that the motivation for roscas is commitment is the widespread use of a precommitment mechanism by rosca groups. Fifty-nine percent of the roscas in the sample use such a spending agreement. In these agreements, rosca participants commit to the use of some or all of their funds before they receive them. Table 7 shows the use of these agreements among roscas. Of the roscas that agree on the use of funds, 15 percent agree at the start of the round that all members will receive the same item. In 17 percent of roscas, the member tells the group what she wants and the group brings the item or items to the rosca meeting. In 34 percent of roscas the members either buy the item for the host and bring it to her house or accompany her to purchase the item. In groups that do not purchase the item for the member, the group also monitors the member to make sure she has used the funds as agreed, either by visiting the person's home or by asking her to make a verbal report about the use of funds in the rosca.

If the sole purpose of joining a rosca is the expectation of receiving funds earlier than by saving alone, it is difficult to see why this form of inflexibility would be necessary. Participants are explicitly tying their hands by not only committing to savings, but by committing to spending as well. Participants report that they do this to avoid spending sprees once they have received funds.

4.8 Self-reported reasons for joining a rosca

Finally, rosca participants commonly cite self-commitment as a key reason for joining a rosca. 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."

“It is difficult to keep money at home as demands are high.”

Table 8, Panel A presents the responses 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?” 37 percent of respondents reported that it was difficult to save at home because money got used up in small household needs. 22 percent reported that it was difficult to save alone, that they “got the strength to save” by sitting with others. Only 10 percent of individuals reported that they joined a rosca as a response to household conflict, fear of theft, or demands by kin. The question was subsequently re-phrased to ask the respondent to choose the most important reason from among seven choices. Panel B of table 8 shows the seven choices given and the responses. The most frequently chosen response was that roscas gave individuals the “strength” to save. Again, only eight percent of respondents gave fear of theft or demands of husbands or families as reasons for joining a rosca. Individuals may have been uncomfortable talking about household circumstances to enumerators, but the overwhelming number of individuals reported difficulties in self-control rather than family or household control issues. This is also supported by many field studies of savings in developing countries, which indicate that many individuals lack good savings commitment technologies (Robinson 1992; Shipton 1992; Rutherford et al 1999; Wright 1999).

5. Discussion

The paper suggests that many roscas may play a role in savings that has been often ignored in the literature: roscas provide a collective mechanism for individual self-control in the presence of time-inconsistent preferences and in the absence of alternative commitment technologies. The commitment hypothesis is consistent with several empirical regularities already discussed. First,

roscas are often repeated with the same order of allocation, suggesting that individuals do not mind getting locked in to savings, even when they cannot reclaim their savings for long periods. Moreover, individuals who participate in a rosca with a repeated order of allocation or who have unlucky draws in random roscas do not realize any intertemporal gains by receiving funds sooner than they would by saving alone. This suggests that individuals value the commitment mechanism that roscas provide rather than its value in speeding the accumulation of funds.

Second, roscas share many features with defined contribution plans in more developed economies. Once a participant has entered the program, she has committed to making set payments at set intervals. Weekly or monthly meetings with one's peers help to ensure payment discipline in a setting where devices like automatic deductions are not available. In addition, funds once deposited are not easily refundable. They are given immediately to another participant and spent. While individuals who leave the group may be able to reclaim their savings, they lose the opportunity to benefit in future rounds.

As rosca participants would say, "you can't save alone." Roscas enforce personal savings through close monitoring of contributions, even to oneself. Many roscas participants also "bind their hands" through the use of a precommitment mechanism in which they agree in advance on how they will use their funds. The rosca group monitors the individual to ensure she honors her commitment. Participation in these roscas is costly-- in terms of both time and inflexibility—but this paper argues that the benefits of commitment make these costs worthwhile to participants. The paper suggests that self-control problems are widespread and that savings commitment mechanisms are desired and appreciated by the poor. 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.

References

- Adams, Dale W. and Delbert Fitchett. 1992. *Informal Finance in Low-Income Countries*. Boulder: Westview Press.
- Adams Dale W. and Marie L. Canavesi. 1992. "Rotating Savings and Credit Associations in Bolivia." in Adams and Fitchett, *Informal Finance in Low-Income Countries*.
- Ainslie, George. 1992. *Picoeconomics*. Cambridge: Cambridge University Press.
- Ambec, Stefan and Nicolas Treich, 2003. "Roscas as financial agreements to cope with social pressure." Centre for Studies in Economics and Finance, Working Paper No. 103, June 2003.
- Anderson, C. Leigh, Maya Dietz, Andrew Gordon and Marieka Klawitter. 2004. "Discount Rates in Vietnam." *Economic Development and Cultural Change*. 52 (4).
- Anderson, Siwan and Jean-Marie Baland. 2002 "The Economics of Roscas and Intra-household Resource Allocation," *Quarterly Journal of Economics*, August 2002.
- Anderson, Siwan and Jean-Marie Baland and Karl Ove Moene, 2002. "Enforcement and Organizational Design in Informal Savings Groups" BREAD Working Paper No. 074, June 2004
- Ardener, Shirley and Sandra Burman, eds. 1995. "Money-go-Rounds: The Importance of rotating savings and credit associations for women." Washington, D.C. BERG.
- Ardener, Shirley. 1964. "Comparative Study of Rotating Credit Associations." Reprinted in Ardener and Burman, 1995.
- Ashraf, Nava, Dean Karlan and Wesley Yin, 2004. "Tying Odysseus to the Mast: Evidence from a Commitment Savings Product in the Philippines." BREAD Working Paper No. 83, October.
- Besley, Timothy, Stephen Coate, and Glen Loury. 1993. "The Economics of Rotating Savings and Credit Associations." *American Economic Review*. 83 (4): 792-810.
- Besley, Timothy and Stephen Coate. 1995. "Group Lending, Repayment Incentives, and Social Collateral." *Journal of Development Economics*. 46: .
- Bishop-Sambrook, Clare. 2003. "Labour Constraints and the Impact of HIV/AIDS on Rural Livelihoods in Bondo and Busia Districts Western Kenya." A Joint Study by IFAD and FAO. 2003.
- Bortei-Doku, Ellen and Ernest Aryeetey. 1995. "Mobilizing Cash for Business: Women in Rotating Susu Clubs in Ghana. In Ardener, Shirley and Sandra Burman, eds, 1995. *Money-go-Rounds: The Importance of rotating savings and credit associations for women*. Washington, D.C. BERG.

- Bouman, F.J. 1995. "Rotating Savings and Credit Organizations: A Development Perspective." *World Development*. 23(3): 37-384.
- Callier, Phillippe. 1990. "Informal Finance: The Rotating Savings and Credit Association—An Interpretation." *Kyklos*. 43(2) 273-276.
- Calomiris, Charles and Indira Rajaraman. 1998. "The Role of ROSCAs: Lumpy Durables or Event Insurance?" *Journal of Development Economics*. 56(1): 207-16.
- Chamlee-Wright, Emily, 2002. "Savings and Accumulation Strategies of Urban Market Women in Harare, Zimbabwe." *Economic Development and Cultural Change*.
- Dekle, Robert and Koichi Hamada. 2000. "On the Development of Rotating Savings and Credit Associations in Japan." *Economic Development and Cultural Change*.
- Dzingirai, V. 2000. "Saving to death: A study of group based and other saving arrangements in rural Chivi District, Zimbabwe." FAO, Social Development Dimensions Report. www.fao.org/sd/Ppdirect/Ppre0071.htm.
- Frederick Shane, George Loewenstein and Ted O'Donoghue, 2003. "Time Discounting and Time Preference: A Critical Review" in Loewenstein and others, eds, *Time and Decision*. New York: Russell Sage Foundation.
- Fudenberg, Drew and Eric Maskin, 1986. "The Folk Theorem in Repeated Games with Discounting and Incomplete Information." *Econometrica*. 54, pp. 533-54.
- Geertz, Clifford. 1962. "The Rotating Credit Association: A Middle Rung in Development." *Economic Development and Cultural Change*. 10(3).
- Gugerty, Mary Kay. 2004. "Rosca Design, Social Sanctions and Default: Evidence from Kenya." Work-in-progress.
- Gugerty, Mary Kay and Michael Kremer. 2004. "The Rockefeller Effect," Paper presented at the Fourth BREAD Conference on Development Economics, Washington, DC, April.
- Kenya Bureau of Statistics, 1996. *Welfare Monitoring Survey, 1994*. Nairobi: Government Printers Office.
- Kimuyu, Peter Kiko. 1999. "Rotating Savings and Credit Organizations in Rural East Africa," *World Development*. 27(7): 1299-1308.
- Klonner, Stefan. 2003. "Rotating Savings and Credit Organizations When Participants are Risk Averse" *International Economic Review*. 44 (3).
- Laibson, David. 1997. "Golden Eggs and Hyperbolic Discounting." *The Quarterly Journal of Economics*. May 1997.

- Laibson, David, Andrea Repetto, and Jeremy Tobacman. 1998. "Self-Control and Saving for Retirement." *Brookings Papers on Economic Activity*, 1: 91-196.
- Levenson, Alec and Timothy Besley. 1996. "The Anatomy of an Informal Financial Market: Rosca Participation in Taiwan." *Journal of Development Economics*, Volume 51.
- Loewenstein, George, Daniel Read and Roy Baumeister, eds. *Time and Decision: Economic and Psychological Perspectives on Intertemporal Choice*. New York: Russell Sage Foundation.
- Loewenstein, George and Drazen Prelec. 1992. "Anomalies in Intertemporal Choice: Evidence and an Interpretation." *Quarterly Journal of Economics*. 107(2): 573-597.
- Nelson, Nici. 1995. "The Kiambu Group: A Successful Women's Rosca in Mathare Valley, Nairobi, 1971 to 1990. in Shirley and Sandra Burman, eds, 1995. *Money-go-Rounds: The Importance of rotating savings and credit associations for women*. Washington, D.C. BERG.
- Niger-Thomas, Margaret. 1995. "Women's Access to and Control of Credit in Cameroon: The Mamfe Case." in Ardener, Shirley and Sandra Burman, eds, 1995. *Money-go-Rounds: The Importance of rotating savings and credit associations for women*. Washington, D.C. BERG.
- O'Donoghue, Ted and Matthew Rabin. 1999. "Doing it Now or Doing it Later." *American Economic Review*. 89(1): 103-124.
- Osborn, Martin and Ariel Rubinstein. 1994. *A Course in Game Theory*. Cambridge: MIT Press.
- Otero, Maria and Elisabeth Rhyne, eds. 1994. *The New World of Microenterprise Finance*. West Hartford, CT: Kumarian Press.
- Phelps Edmund S. and Robert A. Pollack. 1968. "On Second-best National Saving and Game-equilibrium Growth." *Review of Economic Studies*. 35(2): 185-199.
- Platteau, Jean-Phillippe. 1997. "Mutual Insurance as an Elusive Concept in Traditional Rural Communities." *Journal of Development Studies*. 33(6): 764-796.
- Republic of Kenya, 2000. "Second Report on Poverty in Kenya, Volume 2, Poverty and Social Indicators." Nairobi: Ministry of Planning and Social Development.
- Robinson, Marguerite. 1992. "Savings Mobilization and Microenterprise Finance: The Indonesia Experience." in Otero, Maria and Elisabeth Rhyne, eds, *The New World of Microenterprise Finance*. West Hartford, CT: Kumarian Press.
- Rutherford, Stuart. 2000. *The Poor and their Money*. Oxford and New Delhi: Oxford University Press.

Rutherford, Stuart, and others. 1999. "Savings and the Poor: the Methods, Use and Impact of Savings by the Poor of East Africa." Report prepared for MicroSave-Africa, May 1999.

Schreiner, Mark. 2000. "Formal Roscas in Argentina." *Development in Practice*. 10(2).

Shipton, Parker. 1992. "The Rope and the Box: Group Savings in the Gambia." In Adams and Fitchett, *Informal Finance in Low-Income Countries*.

Siebel, Hans Dieter and Michael T. Marx. 1987. *Dual Financial Markets in Africa Case Studies of Linkages between Informal and Formal Financial Institutions*. Fort Lauderdale: Breitenbach Publishers.

Van der Brink, Rogier and Jean-Paul Chavas. 1997. "The Microeconomics of an Indigenous African Institution: The Rotating Savings and Credit Association." *Economic Development and Cultural Change*. 45(11): 745-72.

Von Pischke, J.D., Dale Adams, and Gordon Donald. 1992. *Rural Financial Markets in Developing Countries: Their Use and Abuse*. Baltimore: Johns Hopkins University Press.

Von Pischke, J.D. 1992. "Roscas: State-of-the-Art Financial Intermediation" In Adams and Fitchett, *Informal Finance in Low-Income Countries*. Boulder: Westview Press.

Wright, Graham. 1999. "A Critical Review of Savings Services in Africa and Elsewhere." Mimeo, Micro-save Africa, Kampala, Uganda. (www.undp.org/sum).

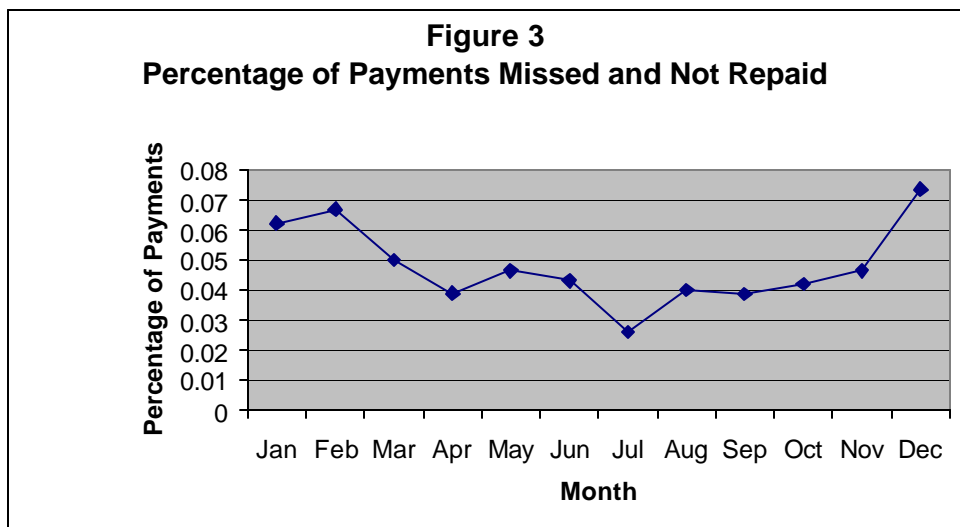
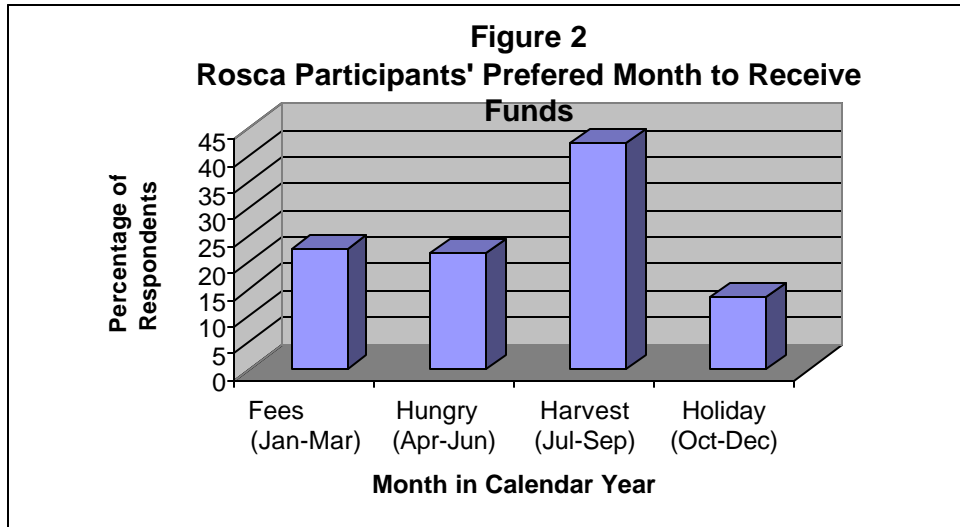
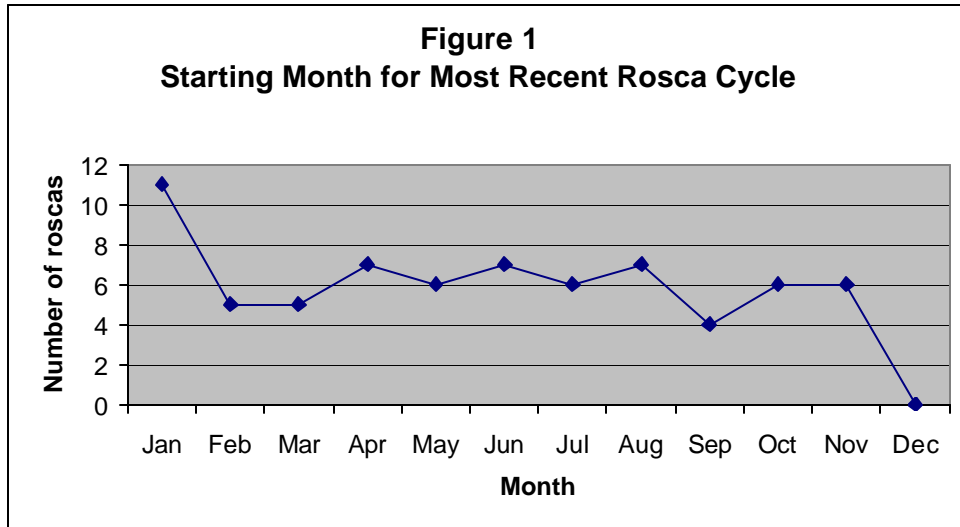


Table 1
Descriptive Characteristics of Roscas and Rosca Participants

| Variable | Mean | Standard deviation |
|--|--------|--------------------|
| <i>Characteristics of Participants</i> | | |
| Proportion who are women | 0.91 | 0.12 |
| Average years of education | 5.5 | 2.3 |
| Average age | 40 | 5.8 |
| Proportion who are married | 0.99 | 0.04 |
| Proportion of female participants whose husband lives at home | 0.69 | 0.23 |
| Proportion who have formal sector (salaried) employment | 0.12 | 0.14 |
| Proportion who report no regular source of off-farm income | 0.56 | 0.24 |
| Monthly non-agricultural income | 1045.8 | 1880.3 |
| Proportion of homes with iron roof | 0.50 | 0.237 |
| Proportion of women with post-primary education | 0.24 | 0.42 |
| Proportion of individuals with formal sector employment -women | 0.10 | 0.30 |
| <i>Descriptive Characteristics of Roscas</i> | | |
| Number of participants | 15.24 | 5.99 |
| Average number of rosca rounds completed | 5.21 | 4.59 |
| Average number of years rosca has been in operation | 6.48 | 4.92 |
| Proportion of roscas contributing items, no cash | 0.06 | 0.24 |
| Proportion of roscas contributing items and cash | 0.21 | 0.41 |
| Average distance in kilometers of roscas from a banking facility | 15.44 | 16.05 |
| Average distance in kilometers of roscas from paved road | 9.47 | 11.79 |
| Average daily agricultural wage in US \$ | 0.87 | 0.09 |
| <i>Rosca Structure</i> | | |
| Average number of weeks between meetings | 3.16 | 1.08 |
| Average contribution per meeting, in US\$ | 1.94 | 2.86 |
| Average amount hosts receives in US\$ | 24.9 | 31.95 |
| Number of Observations | 70 | |

Table 2
How do Roscas decide the order in which funds are allocated?

| How is the order of allocation decided: | Percentage of roscas using this method |
|--|---|
| 1. Decide order at the start of each cycle | 58 |
| How is order decided: | |
| <i>Use random allocation</i> | 36 |
| <i>Negotiate order among members</i> | 23 |
| 2. Repeat the same order as the last cycle | 37 |
| How was original order decided: | |
| <i>Use randomized allocation</i> | 17 |
| <i>Negotiate order among participants</i> | 11 |
| <i>Use order of joining, age, or residence</i> | 9 |
| 3. Decide next recipient one meeting prior to distribution | 4 |
| How was original order decided: | |
| <i>Negotiate order among participants</i> | 3 |
| <i>Use random allocation</i> | 1 |
| Total Number of observations | 70 |

Table 3
Rosca Participants' Preferred Month to Host a Rosca

| Month – primary characteristic | Percentage | Why is this your preferred month? (Two most frequent responses) |
|--|------------|---|
| January – school fees | 16.8 | Pay school fees – 52.1% Can use on business – 29% |
| February – school fees & start of hunger | 3.7 | Pay school fees - 40.7% Buy food (famine) - 33.3% |
| March –hungry season | 2.0 | Buy food (famine) - 80% Pay school fees - 20% |
| April- school fees & hunger | 9.7 | Pay school fees - 40.7 Buy food (hunger) -33.3% |
| May – peak of hunger | 7.1 | Buy food (hunger) - 78.9% Can buy food cheaply - 25% |
| June – start of harvest | 5.0 | Money not obligated elsewhere- 21% Buy food cheaply (stock) -21% |
| July – main harvest | 10.7 | Can put money into business -43% Buy food cheaply (stock) -21% |
| August – fees, main harvest | 25.2 | Can put money into business -29% Buy food cheaply (stock) - 25% |
| September – second harvest | 6.4 | Buy food cheaply (stock) -29% Money not obligated elsewhere - 18% |
| October – second harvest | 2.4 | Money not obligated elsewhere - 33% Can put money in business -33% |
| November – second harvest | 1.7 | Can buy Christmas items-50% Money not obligated elsewhere - 25% |
| December – holidays | 9.4 | Can buy Christmas items -50% Can pay school fees - 25% |
| Number of observations | 274 | |

Note: Based on responses of four randomly selected individual rosca members who had been interviewed at their home. This question was asked of individuals who had been part of the randomly selected individual sample and were also present during the group rosca interview. Not all of those who formed the individual sample were present on that day.

Table 4
Rosca Participants Use of Rosca Funds

| Percentage of total funds received spent on: | Mean (standard deviation.) |
|--|----------------------------------|
| Household items (cups, plates, cooking pot) | .24 (.36) |
| School fees | .24 (.37) |
| Food | .14 (.24) |
| Small business | .08 (.23) |
| Livestock | .05 (.18) |
| Illness | .04 (.16) |
| Clothes | .04 (.18) |
| Farm | .03 (.13) |
| Paid debts | .02 (.11) |
| Ceremony (funeral, memorial service) | .02 (.11) |
| Home construction | .02 (.12) |
| Blanket | .01 (.06) |
| Gave to relative | .01 (.08) |
| Other purchases | .06 (0.15) |
| Number of observations | 351 |

Note: Based on a randomly selected sample of 6 individual rosca members, surveyed at their homes. Responses were recorded for the most recent payments of funds they had received. Thus the recall period for each individual varied.

Table 5

Use of funds and rosca structure

| Explanatory variables: | Number of uses of funds (1) | Number of uses of funds (2) | Percent of funds spent on largest item (3) |
|--|--------------------------------|--------------------------------|---|
| Number of years rosca has been in operation | -0.01 (0.02) | -0.02 (0.02) | 0.006 (0.004) |
| Number of rosca participants | 0.03* 0.01 | 0.03* 0.02 | -0.006 (0.004) |
| Distance of rosca from tarmac | 0.02*** (0.004) | 0.02*** (0.007) | -0.005*** (0.002) |
| Average years of education of members | 0.02 (0.06) | 0.041 (0.06) | -0.003 (0.01) |
| Proportion of participants with formal sector income | 0.17 (0.69) | 0.001 (0.71) | 0.00 (0.16) |
| Indicator if roscas re-randomize order | | 0.07 (0.16) | -0.02 (0.03) |
| Geographic Indicators | Y | Y | Y |
| Zonal socioeconomic controls | Y | Y | Y |
| Number of observations | 68 | 68 | 68 |
| R-squared | 0.25 | 0.37 | 0.37 |
| MSE | 0.578 | 0.533 | 0.126 |
| Mean of dependent variable | 1.89 | 1.89 | 0.77 |

Significantly different than zero at 90% (*), 95% (**), 99% (***).

Note: OLS estimation with robust standard errors clustered at the zone (administrative unit) level. All regressions contain indicator variables for geographic divisions. Data on use of funds is unavailable for two roscas. Zonal socioeconomic controls are: the proportion of primary students living in houses with an ironroof, and the average years of education of mothers of primary school students in the zone.⁷

⁷ Zonal data are taken from surveys of primary school students attending schools who are participating in the NGO funding projects. These variables are the average across all students surveyed in each administrative zone.

Table 6
Rosca Participation and Gender

| Explanatory variables: | Probability of being a Member of the Rosca | | | |
|---|--|-----------------------------|-----------------------------|-----------------------------|
| | All group members (1) | Female group members (2) | Female group members (3) | Female group members (4) |
| Years in group | 0.003 (0.006) | 0.002 (0.006) | 0.002 (0.006) | 0.001 (0.006) |
| If female | 0.39*** (0.05) | | | |
| Years of education | 0.01*** (0.005) | 0.02*** (0.004) | 0.02*** (0.005) | 0.01** (0.005) |
| Age | 0.003 (0.002) | 0.003 (0.002) | 0.003 (0.002) | 0.002 (0.002) |
| Have a latrine in the home | 0.005 (0.055) | 0.010 (0.05) | 0.02 (0.05) | 0.012 (0.050) |
| Have an iron sheet roof | -0.08** (0.03) | -0.08** (0.03) | -0.08** (0.03) | -0.08** (0.03) |
| Have a salaried job | -0.11** (0.052) | -0.11** (0.06) | -0.10* (0.06) | -0.10* (0.06) |
| Member of the largest ethnic group in the rosca | 0.17*** (0.06) | 0.21*** (0.07) | 0.21*** (0.07) | 0.21*** (0.07) |
| Married | | | 0.07 (0.21) | |
| Husband lives on the same compound | | | | 0.02 (0.03) |
| Chi-squared | 72.78 | 32.48 | 32.28 | 29.21 |
| Pseudo R-squared | 0.11 | 0.04 | 0.04 | 0.04 |
| Number of observations | 1691 | 1338 | 1329 | 1248 |

Significantly different than zero at 90% (*), 95% (**), 99% (***)

Note: Probit estimation with robust standard errors. Coefficients are “dprobit” 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. All regressions contain indicator variables for geographic division.

Table 7
Use of Spending Agreements

| How does the spending agreement work? | Number of roscas | Percentage of all roscas |
|---|------------------|--------------------------|
| Group agrees at the start that each member should receive an item instead of cash | 6 | 15% |
| Member selects item, group brings it to her or him | 7 | 17% |
| Member buys item, group follows up with home visit or report | 14 | 34% |
| Group representatives go with the member to monitor the purchase | 14 | 34% |
| Total | 41 | 59% |
| No agreement | 29 | 41% |

Table 8
Self-reported Reasons for Joining a Rosca

| Panel A: What is the most important reason why you joined a rosca? (open-ended) | Number of respondents | Percentage of total |
|--|------------------------------|----------------------------|
| Can't save at home, money gets used on other things | 109 | 36 |
| Get strength to save from sitting with others/can't save alone | 65 | 21 |
| Group wanted to make sure that each member had a certain item | 50 | 17 |
| Can't save at home, my family will use | 18 | 6 |
| Can get a lump sum to buy a big item | 17 | 6 |
| Safer 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 | 22 | 7 |
| Number of observations | 303 | |
| Panel B: Here are 7 reasons why you might belong to a rosca, which is most important to you personally? | Number of respondents | Percentage of total |
| Get strength to save from sitting with others/can't save alone | 105 | 35 |
| Group wanted to make sure that each member had a certain item | 74 | 24 |
| Can't save at home, money gets used on other things | 51 | 17 |
| To visit each other's houses and see how the person is living | 39 | 13 |
| Safer place to save/ fear of theft | 11 | 4 |
| Can't save at home, my family will use | 6 | 2 |
| Can't save at home, my husband will use | 6 | 2 |
| Other | 5 | 2 |
| Number of observations | 303 | |