

THE ECONOMICS OF ROSCAS AND INTRAHOUSEHOLD RESOURCE ALLOCATION*

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This paper investigates individual motives to participate in rotating savings and credit associations (roscas). Detailed evidence from roscas in a Kenyan slum (Nairobi) suggests that most roscas are predominantly composed of women, particularly those living in a couple and earning an independent income. We propose an explanation of this based on conflictual interactions within the household. Participation in a rosca is a strategy a wife employs to protect her savings against claims by her husband for immediate consumption. The empirical implications of the model are then tested using the data collected in Kenya.

I. INTRODUCTION

Rotating savings and credit associations (roscas) constitute one of the most commonly found informal financial institutions in the developing world.¹ Recent studies reveal exceptionally high participation rates in these associations.² Average membership among adults ranges between 50 and 95 percent in the Republic of Congo, Cameroon, Gambia, and villages of Liberia, Ivory Coast, Togo, and Nigeria (see Bouman [1995] for references). Although roscas do exist alongside more formal financial institutions (see, for example, Levenson and Besley [1996] for Taiwan), they are often the sole saving and credit institution in many rural areas.³ The annual sums mobilized in these associations have been esti-

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1. See Bouman [1977], for a list of countries in parts of Africa, Asia, the Americas, the Caribbean, the Middle East, and early Europe where roscas have appeared.

2. There is a large anthropological literature on roscas beginning with the work of Ardener [1964] and Geertz [1962]. A recent book by Ardener and Burman [1995] compiles case studies of women's roscas and references previous work.

3. Roscas are also popular among immigrant groups in developed countries; see, for example, Light, Kwuon, and Zhong [1990], Bonnett [1981], Kurtz [1973], and Srinivasan [1995].

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mated to equal 8 to 10 percent of GDP in Ethiopia, one-half of national savings in Cameroon, and to be twice as high as the credit of the organized banking sector in Kerala, India (see Bouman [1995]).

In these associations, a group of individuals, who typically live in the same community, gather for a series of meetings. At each meeting, each contributes a predetermined amount into a collective "pot" which is then given to one member. The latter is then excluded from receiving the pot in future meetings, while still being obliged to contribute. The meeting process repeats itself until each member has received the pot. There is substantial variation among roscas as to the frequency of the meetings, the amount of the contribution, the number of members and the way the order of the winners is determined. In some, this process is randomly determined by drawing lots; in others it is a bidding process through which the pot goes to the individual bidding the highest.⁴

In the literature (see, in particular, the empirical analyses by Besley and Levenson [1996] and Levenson and Besley [1996]), roscas are usually viewed as a way for individuals with little or no access to formal credit markets to save for the purchase of indivisible goods.⁵ As there is no interest to be gained by saving in a rosca, the question is why do individuals choose to save through a rosca instead of individually accumulating savings? In their seminal contributions, Besley, Coate, and Loury [1993, 1994] argue that, on average, roscas allow individuals to receive the pot, and hence to buy the indivisible good, earlier than through individual savings. While, *ex ante*, all individuals are better off by saving through a rosca, the member who receives the pot last is *ex post* worse off.⁶

However, this hypothesis does not seem supported by the evidence we collected from a sample of 520 households in a Kenyan slum, called Kibera, located on the outskirts of Nairobi. The majority of roscas in Kibera (there are a total of 385 in our sample) do not systematically have a random or bidding order:

4. See Ardener [1964] for a detailed discussion of the various ways to allocate the pot. Kovsted and Lyk-Jensen [1999] compare the performance and efficiency of the bidding and random roscas.

5. Handa and Kirton [1999] and van den Brink and Chavas [1997] similarly find evidence that rosca funds are used for durable good purchases.

6. In fact, *at least* the last member is worse off (*ex post*) by joining the rosca. This follows because the savings rate (i.e., contribution) imposed by the rosca is feasible for this member if he saves on his own, but typically not optimal.

there is a predetermined order that is known before the rotation cycle begins.⁷ Typically, while the original order might have been chosen randomly, the order of the winners tends to be repeated throughout the cycles: 69.2 percent of the roscas in our sample do not change their order after a cycle. (The median number of cycles in our sample is 3.2, and the median length of a cycle is 6.1 months.) As a result, at least after one full cycle, there is no randomness in receiving the pot. The rationale proposed by Besley, Coate, and Loury [1993] does not apply here since it cannot explain why, after one full cycle, the last recipient would stay in the rosca (and by backwards induction why the rosca does not break down).

Another observation from our data is that an overwhelming majority of rosca members are women: 84 percent. This is unlikely to have arisen randomly, and the gender issue in roscas has yet to be investigated.⁸ We further find that these female rosca participants are typically married and earn an independent income. In Kibera the probability that a woman participates in a rosca is 40.0 percent. If she lives in a couple, this probability rises to 53 percent, while it falls to 25.3 percent if she does not live in a couple. When she is working, her participation rate increases to 68.5 percent, and to 74.4 percent if she simultaneously lives in a couple. By contrast, the participation rate of a working woman who does not live in a couple is only 54.7 percent. The participation rate for men is 10.1 percent, for working men 12.4 percent, and for working men living in a couple it is 9.6 percent.

In this paper we attempt to address the question of why married women join roscas? To this end, we develop a new argument based on intrahousehold conflict to explain rosca participation. We base our analysis on asymmetric preferences for household goods across men and women. Bruce [1989] cites numerous case studies, throughout the developing world, which illustrate tension within households over the use of income. Most studies

7. In contrast, Calomiris and Rajaraman [1998] find a prevalence of roscas with concurrent bidding. As a result, they suggest an insurance role for roscas instead of a device to purchase an indivisible durable good (see also Klonner [2000]).

8. There are several other studies which find that predominantly women join roscas. Ardener [1964] points to several case studies where roscas are composed only of women in India, Malaysia, Vietnam, Ghana, South Africa, Sudan, and Egypt. Geertz [1962] also finds that almost all women belong to several rosca groups in Eastern Java. A recent book, edited by Ardener and Burman [1995], is devoted entirely to the study of women in roscas. Tsai [2000] studies female-dominated roscas in China.

find that childrens' well-being is strongly correlated with women's income relative to men's, where women consistently devote a higher portion of their income to family needs than do men.⁹ Men withhold a portion of their income for personal use, even when families live in, or near, poverty. Bruce notes that these gender-based differences are most explicit in Africa, where it is commonly believed that men have a right to personal spending money, which they are perceived to need or deserve, while women's income is used for collective purposes. The work of Hoddinott and Haddad [1995] empirically verifies this claim for African households where, relative to women, men spend a greater portion of their income on goods such as alcohol and cigarettes, whereas women are more likely to purchase goods for children and for general household consumption.¹⁰ In the same vein, Thomas [1990] finds that unearned income in the hands of a mother has a bigger effect on a family's health than when under the control of the father; for child survival probabilities the effect is roughly twenty times larger. Pitt and Khandker [1998] estimate the impact of participation, by gender, in micro credit programs in Bangladesh. They find that credit has a larger positive effect on schooling and household expenditures and assets when women are the participants.

Based on such empirical evidence, Folbre [1986], Sen [1990], and others have suggested that instead of being atomistic, the household in developing countries is better modeled as conflictual. There is also evidence that economic opportunities for females do enhance their relative bargaining power within the household. Many case studies document a woman's access to employment outside the home increasing her domestic decision-making power and control over resources.¹¹ Similarly, Hashemi, Schuler, and Riley [1996] find that credit programs aimed at poor rural women increase their ability to make purchases and household decisions, ownership of assets, legal and political awareness, and decrease their vulnerability to domestic violence.

We model conflict within the household as arising from dif-

9. Refer to a survey by Strauss and Beegle [1996] for studies that find evidence from Cameroon, India, Kenya, Malawi, and the Dominican Republic.

10. Differential spending patterns across genders is not limited to developing countries. Browning et al. [1994] and Phipps and Burton [1998] show this to be the case in Canada, and Bourguignon et al. [1993] obtain similar results for French households.

11. See, for example, Acharya and Bennet [1982], Finlay [1989], Safa [1992], and Ecevit [1991].

ferent preferences for an indivisible good, the purchase of which requires accumulated savings. We assume that, relative to men, women always have a larger preference for the good. As a result, they would like to choose a higher rate of saving than men. Such a difference in preferences is conceivable for several types of household goods. As illustrated above, women may have a larger preference for a good such as school fees due to their greater concern for children.

We demonstrate that if men have a greater preference, relative to women, for present consumption than saving for an indivisible good, then women are better off if they save in a rosca than at home. Essentially, roscas provide a forced savings mechanism that the woman can impose on her household and thus help to increase the household's saving rate. The household may be willing to purchase the indivisible good *ex post*, when the wife returns home with the pot, even in those cases where, *ex ante*, it was not willing to save at all.

This notion that women use roscas to prevent men from "misusing" household resources has been noted by others. Mayoux and Anand [1995], in their study of women in roscas in South India, argue that roscas "play an important role in increasing women's control over resources which they can use to increase assets in the family. This has been important in cases where men were spending much of their income on alcohol and gambling" [p. 180]. Hospes [1995] notes a similar rationale for roscas among urban women in Indonesia, and so does Niger-Thomas [1995] who also states more generally that "women tend to develop financial strategies to preserve money for their personal needs and family responsibilities" [p. 107]. This concern for protecting women and their families from the irresponsible spending of their husbands extends to other institutions. In their study of informal lending institutions in Bangladesh, Goetz and Sen Gupta [1996] similarly argue that "informal credit exchanges between women often take the form of loans in kind, particularly rice, as women are able to retain control over this resource and can often bring it into the household without alerting male household members."

The paper is organized as follows. The next section provides ethnographic evidence from the Kenyan slum to support our argument for rosca participation. Section III presents a model of conflict in the household and derives empirical implications. The data are summarized in Section IV, and an empirical test of our

theory is subsequently provided. Alternative explanations are discussed in Section VI, and Section VII concludes.

II. ETHNOGRAPHIC EVIDENCE

Our main argument, that women use roscas to protect their income from their husbands, grew out of discussions with women living in the Kibera slum. We collected such information by conducting semi-open interviews with the governing bodies of 44 informal groups. These interviews were separate from the detailed household data collection. For many of these groups, we also examined their books of account, the minutes of their meetings, and their constitutions. Contrary to other informal groups (funeral help, medical insurance, investment, self-employment, . . .), roscas are typically exclusively composed of women. When they are mixed groups, membership is still dominated by women, and the few men participating are usually "muse" (which translates into elders, who command respect and social prestige).

Most womens' groups cite as their primary objective assisting the needs of children and the household. Aims of the groups are often written directly into their regulations such as: "The main objective of the group is to help poor women to educate their children" (Dobima Progressive Women Group). They describe roscas as the only means to save for large household expenses, most prominently school fees and uniforms, but also kitchenware or furniture. Some groups stress the importance of spending the money sensibly on items deemed valuable by the group. The Garden Women Group constitution insists that "Every member should make use of her money wisely, the first priority being buying books, uniforms and paying school fees for our school children." They often explicitly encourage women to use their savings for their own purposes, and to stand up against the demands of others.

Female members repeatedly complain about the difficulties of saving due to disagreements with their husbands. A woman interviewed remarks: "You cannot trust your husband. If you leave money at home, he will take it." When the representatives of Katieno Women Group are asked who initiated the organization, they reply that "the chair lady had money problems with her husband. (. . .) She found that women should be less dependent on their husbands. (. . .) The main objective of the group is self-sufficiency, we should not rely on our husbands." The Jisaidie

Women Group started with the purpose "to be more independent from their husbands."

The collegial support within groups appeared instrumental in empowering women in their interactions with their husbands. Solidarity is reinforced by a wide range of mechanisms. These include a formal commitment to help each other, as expressed in the mottos and names of the groups (Tumaini ("Hope"), Upendo ("Friendship"), Tushikane ("Being together"), or Amani ("Peace")), and written into their regulations or constitutions. Together with rules of good behavior designed to minimize tensions and potential conflicts between members. For example, the use of abusive language and gossiping are prohibited, and may lead to suspension.

Groups insist on the presence of the members at each meeting, absenteeism is often punished by a fine. "If a member misses to attend a meeting and without even sending his/her contribution, committee members must establish the cause of his/her absence with immediate effect. If any member misses for three consecutive meetings without any proper reason, he/she will be expelled from our group" (Kibera Nyakwerigeria Group constitution). In addition to meetings, social occasions are organized during which members can interact in a friendly and relaxed environment, away from their husbands and families. The Konyirkendi Group "holds meetings twice a year, where we have parties and dancing, to encourage spirit of friendship among members." "We wanted only women in the group, we are more free, and we can talk and laugh. Men always want to take the lead. They are like children . . . They are not interested in improving the situation of the family" (Jisaidie women group).

The need to protect their savings against husbands explains the importance of confidentiality and secrecy that groups insist upon. The punishment for violating this rule can be as stringent as expulsion from the group. Women emphasize that meetings must be kept secret also from husbands: "In our group we have secret meetings. Members cannot talk outside. There are bad husbands who take the money, and do not provide their wives with food and basic goods . . . People quarrel a lot especially with husbands" (Umoja Women Group). Such secrecy seems clearly aimed at protecting members against theft or malfeasance. That this risk of a misuse of savings possibly lies in the household is directly supported by women who claim that they cannot save at home: "Joining a merry-go-round (i.e., a local rosca) is the only way to save some money. If I leave it at home, it will disappear."

III. DISAGREEMENT IN THE HOUSEHOLD

As outlined above, conflict within the household prompts women to use *rosca*s as a way to accumulate savings out of their husbands' reach. This section provides a simple model of this conflict and its implications for *rosca* participation. The rationale for joining a *rosca* is indeed not straightforward given that the pot is eventually taken home. At this point, the husband has access to the money and may well decide to spend it on a purchase other than the indivisible good. Our model characterizes the conditions under which, although this is feasible, the man chooses not to expropriate the pot, even though he would expropriate the contributions if he could.¹²

III.1. A Basic Model

Consider a household composed of two individuals: husband and wife. The conflict between members of the couple centers around their different preferences for an indivisible good, the purchase of which requires savings. Relative to husbands, wives always have a larger preference for the indivisible good. As a result, they would like to choose a higher savings rate to purchase the good than their husbands would. Formal borrowing opportunities are not available, so the only means of saving is either through direct storage or through a *rosca*.

To formalize this in a simple way, consider a model with two periods and three goods. The utility of the wife is equal to

$$(1) \quad U^w = u(c_1) + u(c_2) + \delta D,$$

where c_i corresponds to current household consumption in period i , $u(\cdot)$ is increasing and concave, and D is equal to one if the indivisible good is purchased, and zero otherwise.¹³ By contrast, to reflect the lower preference of the husband for the indivisible good as simply as possible, we define his utility as

12. Given this, there is the question as to why sellers (or schools) cannot accumulate the women's savings for her instead of a *rosca*. There are several reasons why this may not be the case, such as inflexibility in the expenditure that such a scheme implies (for example, in case of an unexpected shock, one cannot change the nature of the good that will be purchased) and trust in an unfamiliar agent (and, if the buying of more than one good is considered, it requires trust in a corresponding number of traders). Additionally, the Besley-Coate-Loury argument still holds for at least some people who receive the pot earlier each cycle.

13. An alternative specification, used in Besley, Coate, and Loury [1993], considered that services yielded by the indivisible good extend to more than one period. The results discussed here, however, are robust to such a specification.

$$(2) \quad U^h = u(c_1) + u(c_2),$$

so that the husband never wants to save and buy the indivisible good. To abstract from issues arising from conflict over current consumption across family members, we also assume that husbands and wives have identical preferences with respect to present household consumption.

The difference in preferences between husbands and wives is a source of potential conflict, as household decision making is joint. They jointly decide whether to purchase the indivisible good, and thus choose household savings, $s \geq 0$, by maximizing the weighted sum of their individual utilities,

$$(3) \quad \mathcal{U} = (1 - \gamma)U^h + \gamma U^w,$$

where γ represents the relative weight of the wife in household decisions, and $0 \leq \gamma \leq 1$. We normalize the cost of D to equal one. The household chooses s and D (and therefore c_1 and c_2) to maximize \mathcal{U} subject to the following constraints:

$$(4) \quad \begin{aligned} s &\geq 0 \\ Y &\geq c_1 + s \\ Y + s &\geq c_2 + D, \end{aligned}$$

where Y is household income in each period.

To model the incentive to save, we rule out the possibility of purchasing the indivisible good in the first period. Therefore, purchasing the indivisible good in the first period is never optimal, even when $\gamma = 1$; i.e.,

$$(5) \quad u(Y - 1) + u(Y) + \delta \leq u(Y) + u(Y).$$

If the household decides to save for the indivisible good, it optimally chooses to equate consumption c_i across periods so that $s = 1/2$. We assume that, given this optimal saving pattern, the wife always wants to buy the indivisible good so that

$$(6) \quad u(Y) + u(Y) < u(Y - 1/2) + u(Y - 1/2) + \delta;$$

whereas the household decides to buy the indivisible good if and only if

$$(7) \quad u(Y) + u(Y) \leq u(Y - 1/2) + u(Y - 1/2) + \gamma\delta.$$

As is clear from the above condition, if the wife has a low relative weight in household decision making, i.e., γ is small, the house-

hold does not buy the indivisible good. It is this disagreement within the household that induces the wife to seek ways of influencing household saving decisions.

We now introduce the possibility of saving through a *rosca*. We assume that the wife takes the household decision described above as given, and chooses whether to participate in a *rosca* or not. If she decides to participate, she chooses her contribution to the *rosca*, s^R , in the first period. In the second period, she receives the "pot," and the household decides its use. We focus here on the subgame perfect equilibria of this game.

To keep the exposition simple, we assume that the wife always has access to enough income to purchase the indivisible good, i.e., to save through a *rosca*. We assume that there are a large number of *roscas*, so that she can choose the amount of her contribution, by joining the appropriate *rosca*(s). To differentiate our argument from that put forward by Besley, Coate, and Loury [1993], we assume that the household receives the pot in the second period which eliminates the expected gains from the random allocation of the pot. The implications of these assumptions for our results are discussed later in this section.

Joining a *rosca* involves some costs in terms of meeting attendance and other social obligations with other members of the group.¹⁴ A *rosca* also involves a rigid saving pattern, whereby constant amounts have to be contributed at prespecified dates, and cannot be made contingent on income shocks affecting the members, nor can it vary with time, as would be optimal in a more general model with discounting.¹⁵ Without loss of generality, we represent these costs and rigidities by a fixed cost, T . We consider here that these costs are never high enough to discourage wives' participation in a *rosca* at the optimal saving rate, $s^R = 1/2$. Therefore, T satisfies

$$(8) \quad u(Y) + u(Y) < u(Y - 1/2) + u(Y - 1/2) + \delta - T.$$

In a subgame perfect equilibrium, the wife joins a *rosca* and

14. In most *roscas*, it is not necessary for members to be present when they make their contributions, as the treasurer is usually in charge of visiting each member to collect the funds. However, general assembly meetings, typically scheduled once a month, are important social occasions and last three to four hours (including greetings, prayers, drinking tea, etc.). As mentioned in Section II, members who do not attend can be fined, and repeated absence can lead to exclusion.

15. To these costs, one should add the personal repercussions of hiding information and money from one's spouse (distrust, tensions, physical violence, ...).

contributes s^R provided that when she brings her accumulated savings home the household prefers to purchase the indivisible good in the second period than to increase its current consumption by the amount saved. The household is more likely to purchase the good the larger is her relative weight in household decision making. At one extreme, if her weight is high, the household decides to buy the good even if she does not save through a rosca. She therefore does not need to join a rosca. At the other extreme, if she has very little influence on household decisions, the wife again chooses not to join the rosca, given that the amount of savings to be accumulated and brought back home to convince her husband to purchase the good is too large. Hence the following proposition.

PROPOSITION 1. It is optimal for the wife not to join a rosca for very low and very high values of her relative weight in household decision making, γ . For intermediate values of γ , she chooses to join a rosca, and her contributions are decreasing and then constant over this range.

Proof of Proposition 1. (i) For all $\gamma \geq \bar{\gamma}$, such that $\bar{\gamma}$ satisfies condition (7) with equality, the household saves and buys the indivisible good, even if the wife does not join a rosca. Therefore, since rosca participation involves a fixed cost, the wife is strictly better off not joining.

(ii) For $\gamma < \bar{\gamma}$, the household does not want to save in order to purchase the indivisible good. As a result, if the wife still wants the good to be purchased, her only way to do so is to join a rosca and accumulate enough savings so that, in period 2, the household agrees to purchase the indivisible good. When she decides to join a rosca, her optimal saving pattern can be equal to or larger than $1/2$. Consider these two cases in turn.

(a) When $s^R = 1/2$, the household purchases the indivisible good in the second period if and only if

$$(9) \quad u(Y + 1/2) - T \leq u(Y - 1/2) + \gamma\delta - T.$$

By concavity of the utility function, there is a nonempty interval $[\hat{\gamma}, \bar{\gamma})$ of values of γ for which condition (9) holds, where $\hat{\gamma}$ is such that condition (9) is satisfied with equality.

(b) For $\gamma < \hat{\gamma}$, $s^R = 1/2$ is no longer sufficient to persuade the household to buy the indivisible good. In this case, we can define $\underline{\gamma}$ as the lowest value of γ such that there exists an

optimal amount of savings, s^R , for which the household purchases the indivisible good in period 2:

$$(10) \quad u(Y + s^R) - T \leq u(Y + s^R - 1) + \gamma\delta - T,$$

and, simultaneously, the wife prefers joining the rosca and accumulating this amount than not saving at all:

$$(11) \quad u(Y) + u(Y) \leq u(Y - s^R) + u(Y + s^R - 1) + \delta - T.$$

Comparing conditions (10) and (9), the amount of saving s^R which satisfies condition (10) is necessarily greater than $1/2$. Such a s^R exists as condition (11) strictly holds for $s^R = 1/2$, as follows from assumption (8). (This implies that $\underline{\gamma} < \hat{\gamma}$.) Therefore, for all $\gamma \in [\underline{\gamma}, \hat{\gamma})$, the wife chooses the smallest $s^R > 1/2$ such that condition (10) is satisfied with equality.

(iii) For $\gamma \in [0, \underline{\gamma})$, the wife decides not to join a rosca, and the household does not purchase the indivisible good. It should be noted that this interval is not empty as there always exists $\gamma > 0$ such that condition (10) is satisfied with equality if $s^R = 1$, but condition (11) is then necessarily violated by assumption (5).

QED

The basic intuition underlying our proposition is robust in more general settings, and in particular in a model with infinite horizon, where savings are accumulated and benefits of the indivisible good extend over more than one period, and where there may be more than one durable good.¹⁶ In this case, the main difference arises for high values of γ where the household decides to save, but the wife still joins a rosca in order to speed up the purchase of the indivisible good.¹⁷ However, for very high values of γ , the benefits from doing so fall below the cost of rosca participation (including the rigidity of the contribution schedule).

16. This case is properly modeled in an earlier version of this paper; see Anderson and Baland [2000]. In the two-period model, saving a small amount significantly lowers the marginal utility of consumption. Although this effect would not be large in a standard infinite-horizon model, it would be with the high discount rates that apply to the day-to-day context of the slum. The average interest rate on fully collateralized loans in the informal credit groups is roughly 20 percent a month, while inflation is approximately 15 percent a year, resulting in an annual real interest rate greater than 200 percent.

17. If sufficient savings have been accumulated in the rosca, the household may decide to save on its own (in addition to the rosca savings). The wife takes this into account when deciding her rosca contribution. Alternatively, it is possible that men have a preference for a different durable good than their wives. In this case, a woman still has incentive to accumulate extra savings in a rosca to convince her husband to also purchase her preferred durable good.

The welfare implications of the main result are immediate: a woman is better off by joining a rosca and her husband is worse off, compared with the situation prevailing when she does not join a rosca. This holds as long as the household is the last to receive the pot. As the potential conflict in the family is more severe the later the pot is received if, by chance, the household is the first to receive the pot, both the husband and wife are better off. In other words, when the order of the rosca is known, husbands' welfare may increase with rosca participation provided that the order is favorable enough.¹⁸ In addition, the conflict between the husband and wife is less severe the more desirable the good is for him (for more details, see Anderson and Baland [2000]).

Our driving argument is that, by contributing to a rosca instead of accumulating at home, wives render their savings illiquid and thus prevent their husbands from spending them. We implicitly assume that, once a woman has committed to a contribution schedule, sanctions prevent her husband from forcing her to renege on this contract.¹⁹ To support this assumption, we rely on the following observations. First, roscas typically do not reimburse past contributions of defaulting members. Since a man is unlikely to know when his wife initially joined, he may realize this too late. Moreover, as our ethnographic evidence shows, roscas are frequently kept secret from husbands, so that he remains unaware of her hidden savings until she returns home with the pot. (This coincides with the fact that husbands and wives typically have independent budgets and responsibilities for day-to-day expenditures.) Last, social sanctions and the loss of

18. Some may argue that households, even when husbands and wives have conflictual objectives, should agree on some Pareto-efficient outcome, as most conditions for efficient contracting are fulfilled. However, that household decisions may not always be efficient is discussed in Lundberg and Pollak [1996]. Udry [1996] provides strong empirical evidence that the household allocation of resources between male and female-controlled plots in Burkina Faso is not efficient. In our case, although the husband is potentially worse off when his wife joins the rosca, he cannot offer her a credible alternative contract, since he would be tempted to renege and renegotiate on any saving path he offers her. Moreover, it is not clear that, in any period, the woman can costlessly join a rosca corresponding to her preferred contribution. As a result, choosing not to join the rosca in the current period, on the basis of her husband's promises, renders her too vulnerable in the following periods.

19. Instead of a conflictual approach to these household decisions, we could alternatively consider that men agree to their wives' rosca participation because they have time-inconsistent preferences while their wives do not. In other words, men send their wives to join roscas as a self-disciplining device for themselves.

reputation for his household may prevent him from benefiting from other community-based institutions.²⁰

III.2. Empirical Predictions

The central implication of our theoretical analysis is that a woman's participation in *rosca*s is a strategy she employs to protect her income against claims by her husband for immediate consumption and, thus, to bias household choices toward her own preferences. As shown above, such a strategy is optimal for intermediate values of her weight in household decision making. To capture this empirically, a good measure of a woman's weight in household decision making, for a given level of household income, is arguably her share in household income, α .²¹

In our theoretical model, we ignored the possible impact of income constraints on *rosca* participation decisions; i.e., we assumed that the wife always had access to sufficient income to finance optimal *rosca* savings. However, for the purpose of our empirical work, we must consider when this assumption does not hold as, quite likely, women in our sample only have access to their own income. For low levels of her income, the wife may be income constrained, and cannot save in a *rosca* as much as she would like to. This reduces the potential benefits and thus her motivation for joining a *rosca*. Given our assumption that her weight in household decisions is related to her share in household income, α , the income constraint reinforces our result that she does not participate in a *rosca* for low levels of α . It also implies, that at low levels of female income, *rosca* contributions, if she

20. In Kibera, such social sanctions give the defaulting member a "bad name." As information spreads quickly in the slum, such a sanction effectively implies that he loses access to other informal groups. Indeed, new membership is never automatically granted, it is a decision taken by the general assembly of all members. It is usually preceded by (i) a discussion among all members about the new applicant, (ii) an enquiry and application approval by the governing body, and, often, by (iii) the acceptance by a member to sponsor the new applicant, for a specified period of time. If the applicant/new member defaults during this period, the sponsor is financially responsible for all of the obligations (due contributions, repayments, membership fees, etc.) the defaulting member has contracted toward the group. Such schemes illustrate the degree of care exercised by these groups, which makes "social sanctions" particularly effective. Note also that in many *rosca*s, a new member is often given the last number for some cycles, in order to test his/her trustworthiness (for more details, see Baland and Platteau [2000]).

21. There are possibly other ways to measure the wife's weight in household decisions, such as her relative work status, and her individual income, which we also explored empirically (see Anderson and Baland [2000]).

participates, are increasing in α until she can afford her optimal contribution.

The model predicts that when a woman's decision-making power, which increases with α , is very high, the household savings decision does not differ much from her own, and she will not join the rosca. Thus, for very high and very low levels of α the woman decides not to join a rosca. However, we do not empirically expect a zero participation rate at these values, since the Besley-Coate-Loury motive can still play a role in our framework. More precisely, we have motivated our explanation for rosca participation by our empirical findings of predominantly nonrandom roscas where the majority of participants are married women. The Besley-Coate-Loury explanation relies on the fact that there is randomness to receiving the pot and suggests that all individuals have a motive to join a rosca and hence cannot explain the demographic component of rosca participants. However, ignoring the issue of randomness, it may well be the case that the Besley-Coate-Loury explanation is an additional motive for women to join roscas. That is, women want to impose a higher savings rate on the household by joining a rosca (as our analysis suggests) but also receive the benefit of receiving the pot earlier than if they had saved at home. Allowing for these other motives to partially explain rosca participation, our theory then predicts that the potential benefits from joining a rosca are highest for intermediate values of α .²² In this sense, we expect the following.

CONJECTURE 1. The relationship between the probability of joining a rosca and female relative income share, α , is an inverted-U shape.

Regarding contributions, the empirical predictions are less clear. On the one hand, our theoretical model predicts that rosca contributions should be declining, and then constant, as α increases. However, this result is contingent on the assumption that only one durable good is consumed. Alternatively, contributions can increase in α as her incentives to save and acquire more than one durable good increase in her income. Moreover, if wives are income constrained, contributions should also increase in α , when α is low.

22. This prediction follows with or without fixed costs to joining a rosca as, according to our model, the potential benefits from a rosca tend toward zero as α approaches one.

In the next section we test empirically for the direct implications of α on rosca participation (Conjecture 1) and investigate its relationship with rosca contributions, although more generally we check the relevance of our main argument by exploring the impact of gender and marital status on rosca participation. In particular, we expect married women to be much more likely to join roscas. A secondary implication of our theory is that gender and marital status should have little effect on the amounts contributed. Also, while household income may matter for the amount contributed to roscas (as durables are normal goods), it should have less (or no) impact on the decision to participate, once female weight in household decision making is properly controlled for.

IV. DESCRIPTION OF THE DATA

The data used in the estimation were collected in 1996–1997 in the slum of Kibera which is situated on the outskirts of Nairobi and is one of the largest in Kenya. It extends over 225 hectares of land and houses a population of approximately half a million people. The inhabitants are very poor. They live with enormous risks to their health and income, with no access to formal insurance or credit institutions. There is little intervention by the State to improve the well-being of the slum population. As a result, individuals are left to their own devices to satisfy their most basic needs. These circumstances have given rise to the formation of numerous informal (credit) groups such as roscas, health insurance groups, funeral groups, saving and credit groups, and collective investment groups.

We interviewed 520 households, all living in the same area of Kibera, namely the village of Kianda. Households, selected through a random process, were interviewed over the course of four months during the spring of 1997. All household members were first surveyed for information on their education, work activity, and income. Households' expenditures were carefully recorded over a week, with frequent visits by one of the enumerators. During the second round, each member was asked detailed information on all informal groups which they belong to. From this process, we collected information on 620 groups, of which 385

TABLE I
BASIC INFORMATION ON ROSCAS^a

Variable	All roscas	Women only	Mixed
Number of members (median)	13	12	17
Months existed (median)	24	24	24
Contribute every day (proportion of roscas)	0.10	0.13	0.06
Contribute every week	0.35	0.36	0.30
Contribute every 2 weeks	0.06	0.09	0.01
Contribute every month	0.49	0.43	0.62
Monthly contribution (mean)	588.64	531.18	701.20
Length of cycle (median, in months)	6.07	5.83	11.33
Number of cycles (median, in lifetime of rosca)	3.21	3.67	2.57
Group comprises only women (proportion of roscas)	0.65	1.00	0
Group comprises only men	0.06	0	0
Group comprises both men and women	0.30	0	1.00
All members are same ethnicity	0.37	0.36	0.38
Order is unchanged each cycle	0.69	0.75	0.57
Started group with friends/relatives/neighbors	0.85	0.86	0.77
Group has secondary role (investment/insurance)	0.25	0.28	0.23
Number of observations	385	258	108

a. Information in this table uses only the data collected on the rosca groups in our sample. A single individual responded for each rosca group.

were roscas.²³ Table I lists some background information on these roscas, where the total sample is compared with women-only roscas and mixed gender roscas.

All female roscas tend to have smaller membership, shorter cycles, and lower monthly contributions relative to their mixed counterparts. A noteworthy difference between these two types of roscas is that in 75 percent of the all-female roscas, there is no randomness to receiving the pot. However, this number drops to 57 percent for mixed roscas, thus making it more likely that the

23. One-fourth of the roscas in the sample perform additional functions, such as health insurance schemes, long-term investment projects, and self-employment schemes. Such functions are almost always clearly demarcated from the rosca itself: typically, rosca contributions are distinct from contributions to the other activities of the group, and payments for the former are often made along a different pattern than payments for the latter. As a result, we have decided to consider all groups with a rosca as one of their activities in our sample. The alternative would have been to consider groups that are only roscas, but this could have led to a serious bias. In particular, in the survey, all possible alternative functions of the groups were carefully mentioned, even when the latter was clearly of secondary concern for the respondent.

Besley-Coate-Loury rationale holds for members of the mixed roscas.

Implicit in our theory of rosca participation, and in the rest of the literature, is that a rosca serves as a saving mechanism in order to purchase an indivisible good. An empirical prediction of this relationship, as Besley and Levenson [1996] have investigated with data from Taiwan, is that, controlling for income, households who participate in roscas exhibit higher ownership rates (or expenditure levels) of indivisible goods. This is well supported (for most income levels, expenditure and ownership were higher) in our data for twelve out of eighteen indivisible good categories.²⁴ These include the largest indivisible expenditures such as school fees which account for 36 percent of total nonfood expenditures and clothing at 18 percent (other large nonfood expenditures include rent at 22 percent and medical costs at 12 percent).²⁵ This coincides with the notion that women are saving for their children and the household well-being.

Let us briefly examine the broad characteristics of the individuals who participate in roscas. The 520 households interviewed represent approximately 2300 individuals. After omitting all individuals aged less than sixteen years, we are left with a sample of roughly 1300. Our main group of interest is married women who live with their husbands. There are 344 women who fall into this category (19 other women are married but do not live with their husbands). Table II contains summary statistics across the total sample and women in couples. A more detailed description of the particular variables is found in Appendix 1.

The most noteworthy differences between the first two columns are that the proportion of individuals who are female, working, and married is much larger for rosca participants than for the average individual in the sample. By contrast, most other variables are quite similar across the two groups. Average income, expenditure on children, and years lived in the slum are slightly higher among those who belong to a rosca. Comparing the first and third columns, we see that if a women lives in a couple, her rosca participation rate is more than double that of an aver-

24. This relationship is not well supported for samples that were extremely small (such as camera ownership) and for some goods for which close substitutes exist, such as charcoal burners and gas cookers.

25. School fees in this area are paid as a lump sum, usually each semester. Some delays in the payment of the fees are typically allowed by the school administrators, which help parents to schedule the payments according to their turn in the roscas.

TABLE II

MEANS AND STANDARD DEVIATIONS OF CHARACTERISTICS OF POPULATION AND ROSCA PARTICIPANTS: TOTAL SAMPLE AND WOMEN LIVING IN COUPLES^a

Variable	Total sample		Women in couples	
	All	Rosca members	All	Rosca members
Participates in a rosca	0.25 (0.44)	1 (0)	0.53 (0.50)	1 (0)
Total monthly rosca contribution	178 (514)	702 (821)	369 (721)	699 (870)
Female	0.53 (0.50)	0.84 (0.37)	1 (0)	1 (0)
Age	29.4 (9.6)	32.5 (8.4)	28.9 (6.5)	30.5 (6.5)
Married	0.59 (0.49)	0.71 (0.46)	1 (0)	1 (0)
Earns labor income	0.58 (0.49)	0.76 (0.43)	0.49 (0.50)	0.65 (0.48)
Has at least primary school	0.57 (0.49)	0.47 (0.50)	0.45 (0.50)	0.46 (0.50)
Monthly individual income	3141 (4909)	4001 (6252)	2457 (5860)	3599 (7471)
Female share in couple income	0.05 (0.16)	0.15 (0.22)	0.20 (0.25)	0.26 (0.25)
Female income share = 0	0.87 (0.34)	0.63 (0.48)	0.51 (0.50)	0.35 (0.48)
Female income share >0 & ≤25%	0.03 (0.16)	0.07 (0.26)	0.10 (0.30)	0.13 (0.34)
Female income share >25 & ≤50%	0.08 (0.27)	0.22 (0.41)	0.29 (0.46)	0.39 (0.49)
Female income share >50 & ≤75%	0.01 (0.12)	0.05 (0.21)	0.05 (0.22)	0.08 (0.28)
Female income share >75 & ≤100%	0.01 (0.11)	0.03 (0.16)	0.05 (0.21)	0.05 (0.22)
Household monthly income	8009 (9207)	8370 (9456)	7860 (9329)	9515 (9927)
Monthly food expenditures	5250 (3031)	4976 (2761)	5081 (2547)	5351 (2830)
Monthly luxury expenditures	368 (723)	367 (700)	343 (708)	349 (663)
Monthly children expenditures	1761 (2550)	1862 (2902)	1413 (2273)	1880 (2762)
Household size	5.05 (2.14)	4.8 (2.1)	4.96 (1.90)	5.38 (1.90)
Number of children	2.21 (1.63)	2.3 (1.6)	2.42 (1.58)	2.74 (1.55)
Years in Kibera	7.60 (6.19)	7.96 (5.84)	6.63 (5.04)	7.75 (5.32)
Native language: kikuyu	0.23 (0.42)	0.24 (0.43)	0.19 (0.40)	0.24 (0.43)
Native language: luhya	0.18 (0.39)	0.17 (0.38)	0.17 (0.37)	0.15 (0.36)
Native language: luo	0.40 (0.49)	0.38 (0.49)	0.44 (0.50)	0.43 (0.50)
Native language: kamba	0.06 (0.23)	0.07 (0.26)	0.06 (0.23)	0.07 (0.25)
Native language: kisii	0.10 (0.30)	0.10 (0.29)	0.10 (0.30)	0.08 (0.28)
Number of observations	1269	324	344	182

a. Information in this table is from the individual and household level data we collected from our random household survey. It includes only individuals sixteen years and older. Standard deviations are shown in parentheses.

age individual. The last two columns illustrate the differences between women living in couples who join roscas and those who do not. Most notably, rosca participants are more likely to work, earn a higher individual income, have a higher household income, and have a larger relative share in the income of the couple. This

last variable is central to our analysis. It is constructed using only the total income of the couple, not total household income. Approximately 20 percent of these couples come from extended households, and we are implicitly assuming that the conflict lies only between the couple and not the household. Women in couples who join roscas have also lived in Kibera longer. Other variables do not vary substantially across the two groups of married women: rosca participants do tend to have higher expenditures, larger households, more children, and are slightly older. The distribution by ethnic background (represented by native language) does not vary across the four columns. Comparing average household monthly income across the second and fourth columns, it appears as though married female rosca participants come from substantially wealthier households than other rosca participants (a difference of roughly 14 percent). However, if we look at the median values, the difference reduces to 4 percent.

V. EMPIRICAL ESTIMATES

We examine the implications of our model by estimating two main equations: the probability that an individual participates in a rosca, and their monthly rosca contribution. We allow for the possibility that the estimation of total rosca contributions is not independent of the probability of joining a rosca. The two-stage Heckman procedure is used to control for this potential sample selection bias. We alternatively could have used a Tobit estimation where it would have been implicit that a zero rosca contribution is equivalent to choosing not to participate in a rosca. This procedure seems somewhat restrictive given that the decision to join a rosca can be a separate phenomenon to simply making very small contributions. This coincides with our discussion above, where women must go against their husbands' wishes to join a rosca and also generally incur a fixed cost.²⁶

Table III reports the results from a probit estimation of the probability that an individual belongs to at least one rosca group. Since the functionings of roscas depend heavily on the trustworthiness of their members, both native language and years spend in Kibera enter into the estimation. These variables are used to proxy for individuals' trust in one another; as either they share a

26. It is worthwhile to note that our main results are essentially unchanged in a Tobit estimation. See Appendix 2.

TABLE III
 PROBIT ESTIMATION OF ROSCA PARTICIPATION^a

Variable	All sample (1)	All sample (2)	Females in couples (3)	Females in couples (4)
Female	0.226** (0.040)	0.226** (0.040)		
Couple	-0.119** (0.050)	-0.120** (0.050)		
Female × couple	0.178** (0.073)	0.173** (0.073)		
Household income	9.36e-07 (1.69e-06)	1.08e-06 (1.69e-06)	4.48e-06 (5.31e-06)	5.71e-06 (5.30e-06)
(Household income) ²	-2.13e-11 (4.14e-11)	-2.46e-11 (4.18e-11)	-2.53e-11 (1.12e-10)	-4.49e-11 (1.13e-10)
Female share of couple income	1.015** (0.199)		1.49** (0.294)	
(Female share of couple income) ²	-1.066** (0.243)		-1.52** (0.360)	
Lived in Kibera for at most 2 years	-0.086** (0.030)	-0.084** (0.030)	-0.115 (0.089)	-0.111 (0.089)
Number of children	-0.016* (0.008)	-0.017** (0.008)	0.033 (0.021)	0.031 (0.022)
Primary school degree	-0.034 (0.026)	-0.032 (0.026)	-0.012 (0.061)	-0.009 (0.061)
Age	0.055** (0.008)	0.056** (0.008)	-0.002 (0.036)	-4.93e-04 (0.036)
(Age) ²	-6.4e-04** (1.1e-04)	-6.4e-04** (1.1e-04)	2.03e-04 (5.75e-04)	1.74e-04 (5.78e-04)
Kikuyu	-1.6e-04 (0.042)	6.6e-04 (0.042)	0.171* (0.099)	0.186* (0.099)
Luhya	0.028 (0.046)	0.026 (0.045)	0.111 (0.102)	0.119 (0.104)
Luo	0.007 (0.038)	0.007 (0.038)	0.134 (0.089)	0.149 (0.090)
Kamba	0.199** (0.077)	0.203** (0.077)	0.283** (0.105)	0.301** (0.101)
Female income share > 0 & ≤ 25%		0.268** (0.098)		0.236** (0.083)
Female income share > 25 & ≤ 50%		0.243** (0.065)		0.286** (0.062)
Female income share > 50 & ≤ 75%		0.386** (0.147)		0.383** (0.076)
Female income share > 75 & ≤ 100%		0.020 (0.100)		0.042 (0.140)
Number of observations	1267	1267	344	344
Pseudo R ²	0.28	0.28	0.14	0.14

a. Data for the first two estimations are at the individual level from our household surveys, excluding individuals aged less than sixteen years. Data for the third and fourth estimations include only women living in couples. The dependent variable is equal to one if the individual belongs to at least one roscas group and zero otherwise. The coefficients reported are the derivatives of the probit function evaluated at the sample means. Standard errors are shown in parentheses. An asterisk after the coefficient denotes significance at the 10 percent level of the regressor and a double asterisk for 5 percent.

common culture, or sufficient time has elapsed to establish such bonds with other residents. Additional regressors include the number of children, where a larger number should increase the need to join a *rosca*. Household income should also be positively related to *rosca* participation, in the sense that there exists the means by which to do so.²⁷ Additional individual characteristics are included in the estimation, such as age and education. The first estimation includes married females' share in the income of the couple and its squared term (if an individual is either single or male, then this variable is equal to zero). The second estimation instead includes dummy variables reflecting different female income share categories, grouped into categories of 25 percent. The omitted category is a female income share equal to zero. The final two columns are the results from the same estimations run using only women living in couples, since this is the group to which our theory pertains.

Being a female, and being the female member of a couple are important determinants of *rosca* participation. (Married males, on the other hand, are less likely to join a *rosca*, as represented by the significant and negative coefficient of the couple variable.) Female share of couple income is also a significant determinant of *rosca* participation. The second estimation directly supports the inverted-U shape hypothesis, as predicted by our theory, where for a high female weight in household decision making, household savings are close to female savings and the need for a woman to join a *rosca* is less. This relationship is also found in the first estimation (higher order terms enter negatively and significantly) and again occurs when we limit the sample to only females in couples in the third and fourth estimations.

Most of the other results have the predicted sign, except for number of children which is negatively related, although this result is reversed when the sample is reduced to married females. Perhaps surprisingly, the general wealth level of the household is insignificantly related to *rosca* participation. However, it is con-

27. Total income in these estimations include net transfers. Additional estimations were run with total income excluding net transfers and transfers entering into the regression independently of income. The results for total income were essentially unchanged from the results presented here, and transfers on their own entered into the estimations insignificantly. It could be argued that household income is endogenous to *rosca* participation. To this end, we also ran estimations that used food expenditure, which is independent of durable good expenditure, to represent the wealth position of the household. Again, the main results were unaltered.

sistent with our theory which singles out the female's share of that income as the most important determinant. As would be expected, years spent in Kibera are a significant determinant of rosca participation, where individuals who have spent at most two years in the slum are less likely to join a rosca. Native language (or ethnic identity) is also significant, thus supporting the notion that familiarity and trust foster the possibility of informal collective arrangements. The age of individuals is significantly related to the probability of joining a rosca: the relationship is concave and begins to decrease at 35 years of age. This result coincides with the notion that individuals need time to establish themselves and to develop more long-standing relationships with others, but also with the idea that the demand for indivisibles tends to be higher among younger individuals as found by Levenson and Besley [1996]. The significance of age in determining rosca participation is lost when we reduce the sample to women living in couples.

The second-stage estimation regresses similar variables on total monthly rosca contributions of individuals. The variables to proxy for bonds and familiarity among group members (years spent in Kibera and ethnic identity) are left out of the determination of rosca contributions. We use these variables to identify the probability of joining a rosca in the first stage of the estimation. It is important to note that when these variables are included into the estimation of rosca contributions, they are in fact insignificant (see Appendix 2). This suggests that, once individuals have formed their rosca groups based on familiarity and trust, the actual amount of rosca contributions depends on other factors. Since we are analyzing the problem from the perspective of individuals rather than rosca groups, the dependent variable is the sum of contributions to all rosca groups that a given individual belongs to.²⁸ Table IV lists the results from the regression on total rosca contributions; again the third estimation includes only women living in couples.

28. Given that we are estimating rosca contributions, we are implicitly assuming that individuals have enough roscas to choose from, so that the amounts can vary. This is realistic given that roscas abound in the slum, and moreover, even within the same rosca group, the amounts may be adjusted across cycles, or secondary roscas may be organized within a subset of the members. Also, for 38 percent of the roscas in our sample, a member can give multiple contributions and thus receive the pot more than once within the same cycle. Additionally, when creating the rosca, potential members discuss the amounts to be chosen. Finally, more than 30 percent of rosca members belong to more than one rosca.

TABLE IV
ESTIMATION OF ROSCA CONTRIBUTIONS^a

Variable	All sample (1)	All sample (2)	Women in couples (3)	Women in couples (4)
Female	210.3 (282.5)	164.1 (282.5)		
Couple	68.0 (318.3)	97.9 (318.6)		
Female × couple	-209.7 (374.3)	-214.4 (373.2)		
Household income	.009 (0.007)	.010 (0.007)	0.029** (0.013)	0.032** (0.013)
(Household income) ²	-6.19e-08 (1.51e-07)	-7.02e-08 (1.51e-07)	-3.86e-07 (2.55e-07)	-4.14e-07* (2.47e-07)
Female share of couple income	2294.6** (998.3)		1149.3* (667.3)	
(Female share of couple income) ²	-2026.0* (1099.0)		-868.4 (831.0)	
Number of children	-34.3 (35.8)	-29.7 (36.2)	-24.20 (44.22)	-21.0 (44.4)
Primary school degree	-38.0 (100.0)	-39.1 (100.1)	-43.17 (128.8)	-62.5 (129.5)
Age	109.9* (65.2)	97.8 (65.7)	60.95 (78.10)	48.6 (79.0)
(Age) ²	-1.33* (0.80)	-1.18 (0.81)	-0.707 (1.21)	-0.516 (1.22)
Inverse Mill's ratio	-387.1 (400.0)	-311.5 (400.9)		
Female income share > 0 & ≤ 25%		288.6 (266.6)		68.26 (208.8)
Female income share > 25 & ≤ 50%		382.2* (219.7)		177.2 (156.1)
Female income share > 50 & ≤ 75%		927.0** (323.8)		685.0** (251.1)
Female income share > 75 & ≤ 100%		378.2 (314.6)		266.26 (325.9)
Constant	-1985.9 (1713.4)	-1649.9 (1721.8)	-778.3 (1180.5)	-565.6 (1196.7)
Number of observations	321	321	181	181
\bar{R}^2	0.04	0.04	0.07	0.08

a. Data for the first two estimations include all rosca participants from our total household sample, whereas data for the third and fourth estimations include only women living in couples. Standard errors are shown in parentheses. An asterisk after the coefficient denotes significance at the 10 percent level of the regressor and a double asterisk for 5 percent.

The estimates seem to confirm our theoretical analysis, as female share in couple income is a significant and positive determinant of rosca contributions. The estimation shows that this relationship might be an inverted-U shape, and this relationship is again confirmed when the sample is reduced to women living in couples in the third and fourth estimations. This relationship with contributions suggests that our argument, based on household conflict, might have some explanatory power which is independent of pure income effects.

It is interesting to note, that unlike the probit estimation, the general wealth level of the household is likely to be positively related, where higher order terms are negatively but not significantly related to the amount of the contribution for women living in couples. That household income determines rosca contributions, but not participation as such, is in line with our theory. More strikingly, in contrast to the participation decision estimates, marital status and gender have no impact on the contribution amounts, as predicted by our analysis. The inverse Mill's ratio is not a significant determinant of total rosca contributions.²⁹ This suggests that the two decisions are in fact independent. In other words, individuals do not choose whether to join the rosca depending on the contribution amount. This may be because there are typically many different roscas in which an individual can participate, which allows for some flexibility in the amount contributed. Alternatively, it may be because many roscas are formed with a small number of individuals familiar with each other and who then together negotiate the amount of monthly contributions. Nevertheless, a tobit estimation, which implicitly assumes that the two decisions are dependent, for women living in couples is listed in Appendix 2 which demonstrates that the main results again hold.

Since there is no interest to be gained by saving in a rosca, it is not the case that joining a rosca directly increases the participant's income, and hence relative income share. However, it is plausible that joining a rosca indirectly increases an individual's income by facilitating beneficial social connections. Similarly, there is potentially some correlation of unobserved determinants of rosca participation (such as a desire for saving for household indivisibles) with whether and how much married females work. As a result, a female's income share is potentially an endogenous

29. This result is further support against a tobit estimation.

regressor in the above estimates. The Hausman test does reject this potential endogeneity when we use the difference in total years employed in present occupation between the wife and husband to instrument for a wife's relative income share. It makes sense that this variable, which proxies for relative job stability, should affect relative bargaining power within the household but not necessarily directly affect income. In any case it is an insignificant determinant of rosca participation and contributions and a significant determinant of female income share. This being said, an ideal estimation would include some source of exogenous variation in female bargaining power, such as differential shocks to sex ratios or labor market opportunities across areas in Kenya.³⁰ With this information we could instrument for female income share and properly analyze how variation in female bargaining power affects rosca participation. Since our data are limited to one slum in Kenya, such an analysis is not possible at present.

VI. ALTERNATIVE EXPLANATIONS

The previous section has provided support for our theory of why married women join roscas. However, there exist rosca participants in our sample who are not married females. As discussed throughout the paper, the Besley-Coate-Loury [1993] story is not ruled out by our analysis, and for this reason, our theory should be seen as complementary, and as focusing on the gender aspect of roscas. Moreover, it appears in our data that the Besley-Coate-Loury story may be more relevant for mixed roscas as opposed to women-only membership. This being said, our ethnographic evidence suggests a related motivation for these other individuals to join roscas, as savings kept at home is more vulnerable to the risks of theft and the unexpected demands for help by relatives. Traditional solidarity networks usually pressure well-to-do households to provide financial support to their less fortunate relatives (see, for example, Platteau [2000]). Under these circumstances, rosca participation can be viewed as a way to resist these demands in a socially acceptable way or to reduce the risk of theft by rendering savings illiquid.

Suppose that a household faces a probability, p , at each period, of being stolen or asked to give their savings to a relative in need (and, as before, no one has access to formal credit mar-

30. We thank the Editor of this *Journal* for pointing this out.

kets). To keep the discussion simple, assume that the household saves a constant amount s for t periods in order to purchase an indivisible good which costs D —hence $D = ts$. It has a choice between accumulating savings at home or joining a rosca. Although it seems clear that, when putting their savings in a rosca, the money is safe from being stolen, however, what is still a concern is that when returning home with the pot, they risk losing the entire sum of their savings by an unexpected claim. This expected loss is equal to pD . If they were to save at home, their expected loss in the last period is similarly equal to pD . However, in addition to this risk, their expected loss in each period τ is equal to τps . Therefore, the total expected loss over all periods is necessarily larger than pD . In consequence, it is always worthwhile to join a rosca.

With a positive discount rate, however, the optimal saving rate is increasing; whereas in a rosca the savings rate is constant. Therefore, given the inflexibility of the saving scheme under a rosca, one might argue that joining a rosca is not worthwhile if the probability of claims or theft is sufficiently low. However, this is not the case since the household is still strictly better off by joining a rosca for which the contribution is equal to their optimal first period savings (i.e., the lowest amount), while accumulating increasingly excess savings at home. Note that we are assuming that the probability p is independent of the amount. But it is clear from the above reasoning that this assumption is immaterial to our main point, but it implies that rosca participation is more likely the richer the household.

A related explanation for rosca participation has been put forth by Gugerty [2000], whereby roscas provide a collective mechanism to discipline their members to save, in the presence of time-inconsistent preferences. In our setting, this argument can be tested by drawing a similar implication as the one above: as motives to save are increasing in income, one expects rosca participation and rosca contributions to increase with household (or individual) income.

However, neither of these explanations seems to be supported by our empirical findings.³¹ Indeed, if these constituted the main motives behind rosca participation, then household (or

31. We also ran estimations of rosca participation on various subsamples excluding married women (single women and men). In these additional estimations, income again did not appear as a significant determinant.

individual) income, rather than female share in household income, should be the main determinant of rosca participation. Albeit, as discussed earlier, the possible endogeneity of income on rosca participation has not been properly dealt with for lack of data.

By contrast, the fact that rosca members are predominantly female can be consistent with the stories above given that the division of labor within African households could entrust women with the management of household savings. In this case, to explain the predominance of married female participation, we could consider that women face a higher risk at losing their savings or are less disciplined at saving compared with men.³² However, in any case, neither of these interpretations can fully explain the importance of a woman's relative income share in determining rosca participation and contributions.³³

VII. CONCLUSION

The present paper is based on detailed field observations of informal saving groups in the slum of Kibera (Kenya). The starting point of our analysis is the observation that married women with a regular income-earning occupation were the most likely to participate in a rosca. To explain this phenomenon, we propose a new argument based on differential consumption choices between wives and their husbands. If women tend to prefer higher saving rates than the one chosen by the household, they will use roscas to accumulate more savings. Even though, *ex ante*, her husband and other members in the family would have preferred her not to start saving through a rosca, they may *ex post*, once she receives the pot, agree with her plan to spend the accumulated savings. Participation in a rosca thus increases a woman's welfare at the expense of her husband. We also show that rosca participation

32. Alternatively, one might argue that all individuals lack self-discipline and women are better at organizing themselves in order to resolve the problem. Another possibility arises from the fact that roscas select their members, and that married females may be viewed as more reliable and trustworthy than others. However, neither of these possibilities directly explains the importance of female decision making power in rosca participation.

33. As pointed out by a referee, an alternative interpretation of the inverted-U shaped relationship with female income share is that this variable represents the degree of diversification of income within the family (provided that income sources are not strongly correlated). This argument is entirely possible; however, it does not explain why gender matters for rosca participation, and is not consistent with our ethnographic evidence.

follows an inverted-U relationship with a woman's bargaining position within the household. The interviews held with women in the slum and the empirical tests carried out on our original data set give support to this explanation.

APPENDIX 1

1. Data Methodology

The household level questionnaire was administered in three parts. The first part covered the household composition, education, employment, nonrecurrent expenditures, and housing sections. The second part was administered over the subsequent week, where the household member in charge of daily expenses was asked to report on those expenses following a detailed list of items. They were assisted in this task by frequent visits by the enumerators. At the end of the week, we collected this information and administered the third part, which covered the participation of adult household members in informal groups. An interview typically lasted two hours for the first part, and one hour for the third part. The households were selected using a pseudo-random procedure, by which, every ten questionnaires, each enumerator would be randomly given a new starting point in the village of Kianda (by using a map), and would start from there following a prespecified geographical itinerary (fifth house on your left, take the first street on the right, third house on the right, seventh house on the left, . . .). While people never seemed to refuse answering the questionnaire (they were indeed compensated for their time with a bag of maize flour), empty households were rechecked at night, and were skipped if they were not at home during the enumeration in the selected location. The supervisors of the enumerators frequently paid visits to the interviewed households to check the accuracy of the responses, and each questionnaire was rechecked in the presence of the enumerator for incoherent or missing responses and consistency across the information collected and casual discussion about the household concerned. Enumerators were regularly sent back to the households until the questionnaire was approved. It should also be emphasized that eight out of the ten enumerators who collaborated in the study were living in Kibera itself, which greatly facilitated access to the households. Parallel to this, we also conducted semi-open interviews with representatives from the

informal groups to gain a better understanding of the inner functionings of the groups. The main findings of those interviews were discussed with all the individuals interviewed during a day-long seminar we organized in the slum.

2. *Definitions of Key Variables*

Individual income. All income from any income-generating activity which includes both formal and informal sector labor and self-employment. Across the total sample of working individuals: 40 percent work in the formal sector, and 60 percent in the informal sector, and 40 percent of these individuals are self-employed. For working women, only 23 percent are in the formal sector, and 67 percent are self-employed. For working women in couples, 21 percent are in the formal sector, and 83 percent are self-employed.

Female share in couple income. Female individual income divided by the sum of her individual income and that of her spouse.

Household income. Sum of individual income across all working household members, income received from rental property, and net transfers (cash and in kind).

Food expenditures. Includes grains, vegetables, fruits, and animal products.

Luxury expenditures. Includes cigarettes, tobacco, "mirao" (harmless drug), alcoholic drinks, eating in hotels and restaurants, and drinking in hotels and bars.

Children expenditures. Includes school expenses (tuition, uniforms, board, transport, and books), and toys.

Number of children. Total number of children aged less than sixteen years old.

Extended household. Household with more than one adult (sixteen years or older) female and one adult male in the household, where the other adult members are not children of the household head. In the cases of households with children sixteen years or older, almost all of these children were single; therefore, they were not considered extended households.

APPENDIX 2: ALTERNATIVE ESTIMATIONS OF ROSCA CONTRIBUTIONS³⁴

Variable	All sample (with instruments)	Women in couples Tobit estimation
	(1)	(2)
Female	-46.27 (223.0)	
Couple	201.95 (255.5)	
Female × couple	-317.27 (297.0)	
Household income	0.007 (0.007)	0.026** (0.012)
(Household income) ²	-3.48e-08 (1.49e-07)	-3.01e-07 (2.47e-07)
Lived in Kibera for at most 2 years	-49.82 (174.9)	-289.13 (204.3)
Number of children	-20.00 (33.74)	20.84 (44.44)
Primary school degree	22.53 (98.46)	-31.59 (127.16)
Age	40.39 (36.58)	34.31 (77.16)
(Age) ²	-0.526 (0.504)	-0.160 (1.20)
Kikuyu	269.66 (175.8)	542.16** (229.7)
Luhya	73.40 (180.3)	329.36 (239.7)
Luo	38.01 (157.0)	384.52* (204.3)
Kamba	-10.39 (227.1)	621.05** (312.8)
Female income share >0 & ≤25%	89.09 (201.3)	430.20** (208.3)
Female income share >25 & ≤50%	228.62 (147.6)	607.86** (149.3)
Female income share >50 & ≤75%	762.57** (243.9)	1300.41** (271.0)
Female income share >75 & ≤100%	338.00 (313.8)	315.27 (303.8)
Constant	-142.96 (653.1)	-1753.63* (1172.6)
Number of observations	321	343
Pseudo R ²	0.034	0.026

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34. Data for the first estimation include all rosca participants in our household survey, excluding individuals aged less than sixteen years. Data for the second estimation include all women living in couples. Standard errors are shown in parentheses. An asterisk after the coefficient denotes significance at the 10 percent level of the regressor and a double asterisk for significance of 5 percent.

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