THE ROTATING SAVINGS AND CREDIT ASSOCIATION - AN ECONOMIC, SOCIAL AND CULTURAL INSTITUTION

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[T]he claim that participant observation is the only way to get a true picture of society and its workings represents an untenable position. Equally untenable [...] is the position that [...] what cannot be measured is not 'scientific'. [T]here is much scope for an imaginative combination of the two approaches (Vaidyanathan, 1989, p. 14, 29).

Preface

This thesis represents the culmination of a 5 year Master study at the Department of Economics. During this journey, I have had the privilege of studying economics at three different universities in three separate countries. I spent my 3rd and 4th semester at the University of Dauphine, Paris in France and my 8th semester at the University of Namur in Belgium. The remaining time was spent at the University of Oslo where I worked as a research assistant to professors Halvor Mehlum and Kalle Moene during my 5th, 6th and 7th semester and as an Executive Officer for the Center for Equality, Social Organization and Performance (ESOP) during my 9th and 10th semester.

I would like to thank Halvor Mehlum and Kalle Moene for introducing me to the field of economic research. I could not have asked for a better introduction. I would also like to thank ESOP for the opportunity to work for the center and for the Student Scholarship I was granted for writing this thesis.

My stay in Namur was motivated by a desire to study development economics and rotating credit and savings associations (roscas) in particular, and I was able to attend courses with renowned professors, such as Jean-Marie Baland and Jean-Phillipe Platteau. Jean-Marie Baland had conducted a survey on informal finance in the Kiberan Slum of Nairobi, Kenya, which among other things served as the basis for a paper on roscas written with Siwan Anderson, Associate Professor at the University of British Columbia and Kalle Moene, Professor at the University of Oslo.

I would like to thank Jean-Phillipe Platteu and Jean-Marie Baland for teaching inspirational courses on the complexities of studying development issues, and Jean-Marie Baland for allowing me to use the data from the survey on informal finance for my thesis.

Finally, I would like to thank my supervisor, Kalle Moene. You truly inspire creativity and reflective thinking, making us all aware of our individual potential.

Contents

Abstract

This thesis investigates the rotating savings and credit association (rosca) as an economic, social and cultural institution. Roscas are one of the most common informal financial systems found in the developing world and provide goods or benefits that are missing or under-provided in the community. As an economic institution, the rosca is able to provide saving, credit and insurance opportunities. As a social institution, the rosca is able to serve as a social meeting place, a provider of social aid and a way of increasing savings when saving is difficult. As a cultural institution, cultural fairness norms affect the optimal organizational design of a rosca. Reciprocity and commitment to the group are essential in order for the rosca to be sustainable, and this is mainly achieved though social enforcement. In addition, the rosca must be sustainable as an institution among other informal and formal institutions. Their importance in Kibera, and their wide geographic range, both in developing countries and among immigrants in developed countries, indicate that roscas are sustainable in the presence of other institutions. The survey "Socio-Economic Survey on Poverty and Collective Action in Kibera", conducted in the slums of Nairobi, Kenya in 1997, is used throughout this thesis to give the reader an illustration of how data can be used to give an indication of whether various hypotheses about rosca participation and enforcement are valid.

1 Introduction

Imagine two farmers who both want to buy a cow, and the cow market is in town for two weeks. They both start saving at the same time and need 10 dollars to purchase the cow. The farmers earn 6 dollars each week, which means they need to save two weeks to buy the cow. The reason the farmers want to buy a cow is that the cow has a value for them every period after the purchase.

If the farmers have no way of obtaining credit, and do not cooperate, their only choice is to save for the cow on their own, in which case they need to find an optimal savings pattern for acquiring the cow. They will choose this savings pattern as long as the value of acquiring a cow by saving on their own is greater than the value of consuming the entire income as monetary consumption[1].

The question arises whether there is a way for the farmers to cooperate to improve their situation. Is it possible to make one or both of the farmers better off by pooling their resources? In the first period, each farmer has an income of 6 dollars, a total sum of 12 dollars which could be used to purchase a cow if they pooled their resources. In the next period, there would once again be 12 dollars in total which could be used to purchase the second cow. Both farmers would own a cow after the second week, and one farmer would enjoy the cow for an additional week, making one farmer better off, and the other just as well off as when saving on his own[2]. However, how would they decide who should be the first recipient? Should the farmer who waits his turn be given some compensation? And how do they ensure that the first recipient pays his share of the second cow once he has received the first cow?

The previous paragraph provided examples of how cooperating can improve one's situation in the absence of formal financial alternatives. Pooling limited resources into a pot which is given to each contributor (member) in turn is essentially what a rotating savings and credit association (rosca) does. Roscas are a form of reciprocity group which means that each member in the group relies on the other members in order for the rosca to function. It is essential that each recipient of

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[1]This strategy is discussed in section 3.1.1
[2]This strategy is discussed in section 3.1.2

the pot continues to contribute until all other members have received the pot as well. The rosca and the role of reciprocity in a rosca will be discussed in greater detail in section 2.

The farmers have a motivation to cooperate in order to receive the cow earlier than when saving individually. The cow is an illustration of an indivisible good, meaning it cannot be purchased in parts but only as a whole. This is an example of the "Early Pot Motive" (Besley et al., 1993), discussed in section 3.1, which illustrates an economic motive for saving in a rosca. The rosca, however, is not only an economic institution (section 3), but also a social and cultural institution (section 4). As an economic institution, roscas can provide saving, credit and insurance opportunities (sections 3.1 and 3.2) among other things. As a social and cultural institution they can serve as a social meeting place (section 4.3) and can provide social aid (section 4.4). In addition, they can help with social problems such as not being able to save on one's own, due to e.g. lack of discipline (section 4.1), or not being able to save at home, due to e.g. high demands from others (section 4.2). Also, when deciding how the order of recipients is chosen, cultural fairness norms enter in, discussed in section 4.5.

In order for the rosca to serve as an economic, social and cultural institution, it must be sustainable both in itself (internal sustainability, section 5.1) and as an institution among other institutions (external sustainability, section 5.2). In order for the rosca to be internally sustainable, each member must find it profitable to continue contributing to the pot once he himself has received the pot. If members default on their pot contributions, the rosca will not be sustainable. The rosca is able to use both economic and social enforcement to deter default, where social enforcement plays an essential role.

If no institutional alternatives to the rosca exist, only internal sustainability is needed, but in the presence of competing institutions, roscas must be externally sustainable. For instance, if formal bank institutions are available to rosca members and able to provide loans and collect savings, is there still room for the rosca as a saving and credit institution? Are roscas complementary institutions or do they become unnecessary in the presence of "more developed" institutions. This

is the topic of section 5.2.

A household survey entitled "Socio-Economic Survey on Poverty and Collective Action in Kibera" (Baland, 1996) was conducted in the slums of Nairobi, Kenya in 1997. The dataset is used in this thesis to give an illustration of roscas and to investigate whether the data supports various hypotheses. Kibera is a slum of Nairobi covering about 250 hectares. The population is estimated to be at least 700,000, making it the largest slum in Sub-Saharan Africa. Kibera is characterized by a lack of basic services and infrastructure, including most formal institutions (Umande Trust, Centre on Houseing Rights and Evictions (COHRE) and Hakijamii Trust, 2007).

The survey was conducted among individuals 16 and older in 511 households, generating 1270 individual observations. Respondents were asked about their membership in various informal groups, including money-go-rounds, which is the Kenyan equivalence of a rosca. The survey mostly concerns the organizational design of the groups and the degrees of formalism within the groups. The data is presented in more detail in section 6, and results from the data are reported both in section 6 and throughout the thesis when relevant.

This thesis aims to give the reader a further understanding of two main topics. The first is the understanding of how the rotating savings and credit association is able to provide goods or benefits that are missing or under-provided in the community though its role as an economic, social and cultural institution. The second is the understanding of the importance of reciprocity and commitment in order for the rosca to be sustainable, something mainly achieved though social enforcement.

2   A Savings and Credit Association

The example from the introduction of two farmers, each buying a cow is a simplified version of a rosca. A more general description has been provided by Shirley Ardener as: *An association formed upon a core of participants who agree to make regular contributions to a fund which is given, in whole or in part, to each contributor in a rotation* (Ardener, 1964).

To illustrate, imagine ten people who get together once a week for ten weeks and contribute ten dollars to a pot at each meeting. The pot, consisting of 100 dollars, is then distributed to one of the contributors each week, until each person has contributed and received 100 dollars. At the end of the rotation, when all ten contributors have received the pot, the group can decide whether to start a new rotation or not.

Nici Nelson, a social anthropologist doing field work in Kenya, observed a rosca in Nairobi, referred to as the Kiambu Group, from 1971 to 1993. She describes the rosca as follows, "When I began to attend their meetings in 1971 there were twenty members, all women from Kiambu who brewed buzaa beer and owned housing units in Mathare Valley. [...] At this time the group met once a week. The woman who would be receiving the fund that particular week would host the meeting and provide tea for the group. The contribution each week was K.sh 12/ plus a little extra to pay for the tea. That meant that each week someone in the group received at least K.sh 240/. This was more than the then monthly minimum wage in Kenya (150), and was the amount a hard working beer brewer could earn in a month. The cycle of contributions took five months to complete."[3](Nelson, 1996, p. 54).

Roscas provide goods or benefits that are missing or under-provided in the community and are one of the most common informal financial systems found in the developing world (Ardener, 1964; Geertz, 1962). Roscas are a form of reciprocity group which means that each member in the group relies on the other members in order for the rosca to function. Reciprocity implies "actions that are contingent on

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[3]K.sh 12, K.sh 240 and K.sh 150 were equivalent to 1.68 USD, 33.6 USD 21 USD respectively in 1997 (Heston et al., 2009).

rewarding reactions from others and that cease when these expected reactions are not forthcoming" (Blau, 1967, p.6). The reciprocity concept in roscas is introduced through the mutual understanding that every member receives the pot contingent on others contributing to the pot throughout the rotation. If one members has received the pot and ceases to continue contributing, then that member will have received a reward which he or she is not repaying, thus breaking the understanding of reciprocity.

The rosca is only one of many groups which could be identified as reciprocity groups, including both informal and formal groups. A group where the members agree to help each other pay for health expenses in the case of need, is an example of an informal insurance group with reciprocity. Microcredit, where loans are given out to a group of lenders which are responsible for each others repayment, is an example of a formal loan group with reciprocity. The next section (section 2.1) discusses such groups in further detail.

In order for the rosca or any other reciprocity group to function, it is vital that each member is committed to the group. This can either be through a strong sense of group mentality, or though mechanisms of enforcement so that the social and/or economic punishment of non-participation is large enough to encourage participation. Commitment for reciprocity groups will be discussed in section 2.2. Section 5 discusses enforcement and sustainability in the rosca in particular.

2.1 Reciprocity in informal and formal groups

In the household dataset from Kibera, the informal groups identified for in-depth questions were merry-go-rounds (roscas), health and insurance groups, welfare groups, employment groups and investment groups. Of these, merry-go-rounds, health and insurance groups, welfare groups and employment groups all portray an element of reciprocity in the way they function. Funeral and health insurance groups are groups that collect regular contributions which cover funeral and/or health expenditures of the group members when needed. By doing so, the group members ensure each other against the risk of unexpected large payments. Welfare

groups provide welfare services to the members, such as family planning and child care through regular attendance and/or fees. Employment groups organize laborers, and divide the income generated by some set criteria such as hours worked or equipment brought to the business.

These informal groups all rely on the other members of the group to function. Also, they are vital in filling a gap where formal alternatives do not exist or do not offer the needed services; roscas provide saving and credit opportunities, funeral and health groups provide insurance against expenditure-incurring risk, welfare groups provide vital services though cooperation, and employment groups provide work opportunities. Reciprocity groups are widely used to cover a number of financial needs, and seem to be the rule rather than the exception when formal financial alternatives are not available.

Microcredit institutions, such as Grameen bank, are examples of formal reciprocity groups. These institutions provide microloans to a group of small scale entrepreneurs and the group members are jointly responsible for repaying the loan. The idea is that self monitoring within the group will lead each member to work hard to succeed, and if some projects should fail while others succeed, the successful ones will cover the losses of the failures. Letting groups be self-selected is one way of ensuring repayment, as it is expected that close social ties will enhance internal pressure, group solidarity and peer monitoring.

Though there is much theoretical work to support the view that group lending helps enforcement[4], whether this is in fact the case is not undisputed. Wydick (1999) investigated group lending in Guatemala and found results indicating that while peer monitoring and group pressure have some effect on the performance of the group, social ties among members are statistically insignificant. "Social ties may even hamper repayment discipline if they lead to more forgivingness towards defaulters" (Abbink et al., 2006).

The Grameen bank reports repayment rates as high as 97% and the success stories

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[4]Stiglitz (1990), Varian (1989) and Rashid and Townsend (1994) emphasize peer monitoring, Floro and Yotopoulos (1991) emphasize social ties and Besley and Coate (1995) focus on social penalties.

resulting from the loans provided by the bank are many (Bornstein, 1996). Even so, the impact of microcredit, is also not undisputed. Snodgrass and Sebstad (2002) find no measurable income increases in average incomes for microlenders relative to the control group. Also, lending does not always lead to success. Mosley (1996) reports that the staff of Bolivia's BancoSol estimated that 25 percent of borrowers showed spectacular gains to borrowing, 60-65 percent stayed about the same and 10-15 percent went bankrupt (Armendariz and Morduch, 2007, p. 200). Abbink et al. (2006) point out that group lending does not always lead to high repayment rates as, "individual borrower's reliance on fellow borrowers to repay the loan gives the former an incentive to free-ride. Indeed, if the success of an individual project is not sufficiently verifiable by other group members the dominant strategy for each individual is to shirk and hold others liable for own default" (Abbink et al., 2006).

2.2 Commitment and Social Ties

All reciprocity groups are dependent on the group members being committed to participation in order to ensure sustainability. Encouraging commitment is, however, not always an easy task. For members in a reciprocity group, when considering their chosen strategy in economic terms, participation must be more profitable than non-participation for members to not default on payments. In roscas, for instance, there is a strong motivation to default on the remaining payments once a member has received a pot. In order for the rosca members to continue contributing, it must be the case that the benefit of participation, which entails continued payments, must be greater than the benefit of defaulting on the remaining payments.

In addition, if there is not complete information among members in the group, there might be an incentive to misreport either the success of a project (e.g. in a microloan group in order to decrease payments) or the degree of need (e.g. in a health insurance group, in order to receive increased financial aid), in which case members act as free-riders.

One way of preventing default is through strong social ties between group mem-

bers, which is thought to enforce reciprocity. This is the idea behind self selected microcredit loan groups, where social ties are supposed to work as a self monitoring mechanism among members. Social ties can encourage a strong sense of commitment to the group, which will deter default or shirking. However, they can also act as punishment mechanisms by e.g. being able to destroy a member's reputation in the case of non-participation.

Seeing that both informal and formal reciprocity groups rely on social ties for enforcement, in theory, it should be easier to apply functioning micro credit institutions where there are already strong social ties which encourage commitment. It might therefore be less risky to introduce microfinance group loans to villages where there is already a large occurrence of informal reciprocity groups, such as in the villages of Kibera. Villagers are already familiar with the concept of reciprocity in a group, and can utilize social enforcement to encourage repayment. Introducing microfinance group loans into areas where such groups do not exist might prove to be a less viable strategy. In Kibera, many such micro credit loan programs have been introduced (e.g. the Kibera Project and the Kibera Grass Roots Initiative), however, the rosca continues to play an essential role in the Kibera. Section 5.2 discusses the sustainability of roscas in the presence of formal institutions, such as microfinance institutions with individual or group loans.

When commitment to the group is ensured, the reciprocity group can serve its purpose as a provider of goods or services. In what follows we shall see how the rosca is able to serve this purpose as an economic, social and cultural institution.

3 The Rosca - An Economic Institution

"[P]oor people want what many of the less poor already enjoy: reliable, convenient, and flexible ways to store and retrieve cash and to turn their capacity to save into spending power, in the short, medium and long term. And they want it on a continuing, not a one-off, basis."(Morduch and Rutherford, 2003)

Individuals have various economic needs: They want to be able to save in a reliable way, they want to be able to borrow money at a reasonable cost and they want to be able to insure themselves against unexpected expenditure incurring events. The rosca as an economic institution can serve all of these purposes to a varying degree. Once the first member has received the pot, that member is indebted to other members for the remainder of the rosca rotation. The other members, meanwhile, are saving while waiting for their turn to receive the pot in the rotation. In this way, the rosca serves both as a credit and savings institution (section 3.1). In addition, being able to change orders in the rotation when a member is in need of the pot (section 3.2), allows the rosca to provide a certain degree of insurance. By deciding the order of recipients through bidding, rosca members are able to realize gains from trade between heterogeneous individuals that would otherwise not have been realized in a fixed contribution rosca (section 3.3).

These are all examples of various ways the rosca acts as an economic institution, the topic of this section.

3.1 Saving and Credit

"The most obvious function of these associations is that they assist in small-scale capital formation, or more simply, they create savings. Members could save their contributions themselves at home and accumulate their own 'funds,' but this would withdraw money from circulation: in a rotating credit association capital need never be idle." (Ardener, 1964, p.217)

In the introduction, we introduced the example of two farmers who both wanted to buy a cow, and discussed how they could use a rosca to pool their resources in order to purchase a cow already in the first period. In order to illustrate the

gain to the farmers from joining a rosca, we must first characterize their savings strategy in the absence of credit and compare this to the cooperative strategy where they form a random order rosca[5]. To generalize this example, the farmers are now referred to as individuals, and the cow is referred to as an indivisible good.

Two individuals, $i = 1, 2$, want to purchase an indivisible good which costs 10 dollars. Each individual earns 6 dollars and the good must be purchased within the first two time periods, $t = 1, 2$. The individuals care about monetary consumption, m, and the value of an indivisible good, c in every period, t. This gives us an instantaneous utility function, $u_i(m_t, c_t)$, where c_t is equal to 1 if the member owns the indivisible good in period t, and 0 otherwise. Each period's utility is discounted with a factor $\beta \in [0, 1]$, assumed to be the same for both individuals, which gives us the infinite horizon utility function $U_i = \sum_{t=0}^{\infty} \beta^t u_i(m_t, c_t)$.

3.1.1 Accumulation in the Absence of Credit

Let us first observe the strategy for each individual when saving on his own without access to credit.

The individuals can choose the following consumption pattern when saving for a indivisible good:

$$u_i(m_0, 0) + \beta u_i(m_1, 0) + \sum_{t=2}^{\infty} \beta^t u_i(6, 1) \qquad s.t. \quad m_0 + m_1 = 2$$

Also, since the individuals are interested in buying the indivisible good in the first place, it must be preferable to buy the indivisible good rather than consume the entire earnings:

$$u_i(m_0, 0) + \beta u_i(m_1, 0) + \sum_{t=2}^{\infty} \beta^t u_i(6, 1) \geq \sum_{t=0}^{\infty} \beta^t u_i(6, 0)$$

When maximizing the utility subject to the constraint, we arrive at the following optimal allocation:

$$u'_m(m_0, 0) = \beta u'_m(m_1, 0)$$

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[5]A random order rosca is a rosca where the order of recipients is decided by lottery.

The individuals will allocate their surplus after purchasing the indivisible good, 2 dollars, so that the marginal increase in monetary consumption is valued the same in both periods. In the special case where $\beta = 1$, so that there is no discounting and each period is valued the same, the optimal allocation is to equalize consumption across periods so that $m_0 = m_1 = 1$ [6].

3.1.2 The Rosca as a Cooperative Strategy

The individuals have economic incentives to cooperate. One possibility for cooperation is to use a lottery to decide who will receive the indivisible good first. The lottery could be such that each individual puts forth half of the money for buying the indivisible good in both period one and two, and a fair draw decides the order of recipients. This is equivalent to a rosca with a five dollar fixed pot and a random order allocation. Before the draw, both individuals have a positive probability of receiving the indivisible good for an extra period compared to the non-cooperative strategy, giving an expected utility gain from cooperation.

The expected utility of entering the lottery is:

$u_i(1,0) + \beta[(1/2)u_i(1,1) + (1/2)u_i(1,0)] + \sum_{t=2}^{\infty} \beta^t u_1(6,1)$

As long as the value of the cow is strictly positive, both farmers will prefer this lottery to the non-cooperative alternative, $u_i(1,0) + \beta u_i(1,0) + \sum_{t=2}^{\infty} \beta^t u_i(6,1)$.

To generalize our example, imagine now that there are n members saving for an indivisible good which costs nx. If they were to save on their own, they could save x each period and would have to wait n periods to receive the pot. However, if they join a rosca, every member could improve their outcome or be just as well off (the last recipient) with the same savings plan.[7] This means that members are better off ex-ante when saving in a rosca than saving on their own, giving us the "Early Pot Motive", proposed by Besley et al. (1993).

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[6]This follows from the utility function being single valued.

[7]If they choose to vary x when saving on their own, most members would be better off (Besley et al., 1993).

3.1.3 The Early Pot Motive

Besley, Coate and Loury "use the simplest model that can capture the essential features of the problem at hand" (Besley et al., 1993) to illustrate the gains of roscas. In their model, individuals earn an income, y, in each period which can either be consumed as monetary consumption, m, or saved in order to purchase an indivisible good at cost B. The indivisible good does not depreciate, and once purchased, it yields a constant flow of services for the remainder of an individuals lifetime, T. They make some further assumptions which simplify the framework:

1. *There is no access to credit markets for the members of the rosca.* This assumption implies that they cannot borrow money, eliminating both formal banks and money lenders as an option to finance the indivisible good. The only options left are to save on their own for the good or pool their resources by creating a rosca.

2. *Individuals have identical, intertemporally additive preferences.* This assumption removes any heterogeneity between individuals' valuations of goods. Also, the value of having a good in the present period is independent of having it in another period.

3. *There is no discounting.* Consumption today is valued the same as consumption tomorrow.

4. *An individual's instantaneous utility depends on monetary consumption, m, and on whether or not he enjoys the services of the indivisible good. This utility is denoted $u(m, 0)$ with no indivisible good, and $u(m, 1)$ when owning the indivisible good* [8]. *$u(\cdot, 0)$ and $u(\cdot, 1)$ are increasing, strictly concave and three times continuously differentiable in m.* The utility function displays standard properties.

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[8]The constant rate of consumption, m, is optimal because there is no discounting. In the case of discounting, consumption is more valued today than later, meaning it is optimal to have an increasing savings pattern.

Figure 1: Trade-off between consumption and saving time
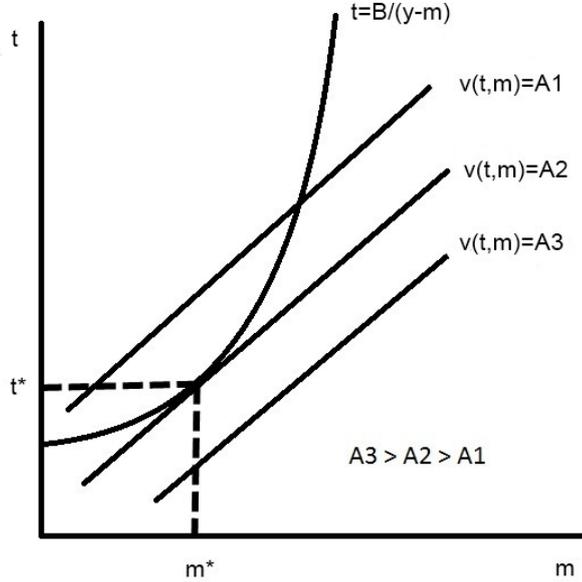
Individuals aim to maximize their lifetime utility subject to their budget constraint which yields the following utility function for an individual who finds it optimal to purchase the indivisible good:

$$max \{tu(m,0) + (T-t)u(y,1)\} \qquad s.t. \ \ t(y-m) = B, \quad 0 \leq m \leq y \ ^9$$

An individual can choose to consume or save, constrained by his income y. Once he has saved enough to purchase the indivisible good B, which occurs in period t, the individual can enjoy the indivisible good for the remaining time $T - t$. The choice for the individual is to find the optimal combination of t and m, where he prefers more consumption and less time saving.

Figure 1, illustrates this trade-off. The individual prefers more consumption and less time saving, so the indifference curves are upwards sloping. Utility level $A3$ is preferred to $A2$ which again is preferred to $A1$. An individual who wants to save a constant amount of his/her income, y, each period in order to purchase a good,

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[9] By setting $t = 2$, $B = 5$, $T = \infty$ and $y = 6$ and including discounting we return to the example of the two farmers.

13

B, is restricted to the budget constraint, $t = B/(y - m)$, illustrated by the convex curve. The optimal pair (t, m) is the one corresponding to the maximal utility the individual can obtain at this budget constraint, which in this case is $(t*, m*)$. After inserting the constraint, rewriting and solving the maximization problem, they find that the maximal value of lifetime utility, W_a, can be written as

$$W_a = Tu(y, 1) - B\eta(0) \qquad \eta(\alpha) = \min_{0 \leq c \leq y} \left[\frac{u(y, 1) - u(m, \alpha)}{y - m} \right] \qquad 0 \leq \alpha \leq 1$$

The first part of this expression tells us the lifetime utility if the indivisible good were free, and could then be enjoyed for the whole lifetime along with the maximal instantaneous consumption. The second expression shows the minimal utility cost of saving up for the indivisible good. Each individual is able to enjoy the indivisible good after t periods, where t is the same for all. This is not an efficient allocation, because in this situation, there is enough money in the collective group after t/n periods for someone to buy the indivisible good and start enjoying it right away, just as the example in section 3.1.2 illustrates.

The value of the parameter α in the equation above, measures the gain from a rosca. If each individual is able to join a rosca with the same preferred consumption pattern, so that m is equal to the rosca savings in each period and t is equal to the number of members, it is easy to illustrate the gain from receiving the pot early. At the one extreme, if you receive the first pot in a rosca, your valuation is $u(m, 1)$ for all t periods of the rosca rotation, so $\alpha = 1$. At the other extreme, you receive it last and are no better off, and your valuation is $v(m, 0)$ for all t periods, so $\alpha = 0$. For the recipients between these extremes, α is a decreasing function of the time until one receives the pot.

If the order of recipients is unknown when deciding to start a rosca, individuals must compare their welfare from saving for the indivisible good on their own with the ex ante expected welfare from saving for the indivisible good with a rosca. In a rosca with n members contributing B/n at meetings which are held at equally spaced dates for the duration t, $\{t/n, 2t/n...t\}$, and where the order of recipients is decided randomly, the amount of time each member expects to have the indivisible good in the interval $[0, t]$ is $\tau = [(n + 1)/2n] t$. For instance, if the rosca meets once

a month for six months ($t = 6$) and there are six members ($n = 6$), the meeting times would be $\{1, 2, 3, 4, 5, 6\}$ and τ would equal 7/12. If, however, there were only three members, the meeting times would be $\{2, 4, 6\}$ and τ would equal 2/3.

Their lifetime expected utility from joining a random rosca is:

$$W(m) = t \left\{ [(n+1)/2n] \, u(m, 0) + [(n-1)/2n] \, u(m, 1) \right\} + (T-t)v(y, 1)$$

By maximizing this problem and setting $\bar{\alpha} = (n+1)/2n$, we find the expression:

$$W_r = Tu(y, 1) - B\eta(\bar{\alpha}) \qquad \eta(\bar{\alpha}) = \min_{0 \leq c \leq y} \left[\frac{u(y, 1) - u(m, \bar{\alpha})}{y - m} \right] \qquad 1/2 < \bar{\alpha} \leq 1$$

When comparing this expression to W_a, the expected lifetime utility of saving for the indivisible good under autarky, Besley, Coate and Loury are able to show that the individual is ex ante better off when saving in a random rosca since $W_r - W_a$ is positive.

Besley and Levenson (1996) find that rosca members are more likely to own indivisible goods when controlling for income and the endogeneity of participation, which supports their model, but the results are only indicative (Armendariz and Morduch, 2007). As we shall see in the following sections, the "Early Pot Motive" is not the only possible motive for joining a rosca.

3.2   Insurance

"[T]he traditional social obligations to help kinsmen, and sometimes neighbours and workmates, quickly comes into effect as word gets around among members of the rosca, who will adjust the order of rotation to enable the unlucky one to receive a turn. The speed with which roscas can usually react to their members' needs can rarely be matched by distant, impersonal, banking systems. Some members are prepared, even prefer not to take an early turn. Even when no direct financial dividend is given to late takers, and despite the lack of the use of the capital sums which early recipients enjoy, they may prefer the element of insurance which waiting provides." (Ardener, 1995, p. 3)

Another motivation for joining a rosca is because a rosca might be able to provide some degree of insurance. If a member has not yet received the pot, and is suddenly in need of money due to e.g. funeral or health expenditures, he can receive an earlier order in the rotation conditioned on other members being willing to switch or change orders.

If a situation occurs where one member has an unexpected income loss and is in need of the pot, but where the member in line to receive the next pot finds it preferable to receive the pot sooner rather than later, there is a conflict of interest. The member with the unexpected income loss will have to rely on the strength of social ties and cooperation within the rosca in order to convince the other member(s) to change the order of rotations. This introduces a new dimension to the concept of reciprocity, as being willing to change the order of recipients in one rosca is expected to be reciprocated in a later rotation if the situation is reversed.

However, there might not always be a conflict of interest where the order of recipients is concerned. In order to illustrate this point, we can study the consumption stream of three individuals in an economy. There is no discounting which means that each individual wants to consume the same in every period and the individuals are heterogeneous, as they all have the same risk of incurring an income loss, μ, but the risk is present in different time periods for each individual. This leads to the following expected utilities:

1. $(1 - \mu)u_1(6) + \mu u_1(1) + u_2(6) + u_3(6)$

2. $u_1(6) + (1 - \mu)u_2(6) + \mu u_2(1) + u_3(6)$

3. $u_1(6) + +u_2(6) + (1 - \mu)u_3(6) + \mu u_3(1)$

Each individual incurs an income loss of 5 with probability μ in one period and has an irregular expected income stream for which he could increase his utility through insurance or credit markets. If these individuals were to join together in a rosca, they would all be able to improve their situation. Imagine the risk of income loss, μ, to equal 3/5, and $u_i(x) = x \forall i$ meaning that with no cooperation, expected income is 21/5 in the period with risk. The rosca could collect one

dollar from each member at each meeting so the the pot would contain three dollars. Each individual would want the pot in the period where he could use the pot to smoothen consumption. The first individual would want the pot in the first period, the second individual would want the pot in the second period and the third individual would want the pot in the third period. If these individuals coordinated their preferences so that the pot was distributed in this order, they could all be made better off by the rosca. Their new expected utilities would be as follows:

1. $(1 - \mu)u_1(8) + \mu u_1(3) + u_2(5) + u_3(5)$

2. $u_1(5) + (1 - \mu)u_2(8) + \mu u_2(3) + u_3(5)$

3. $u_1(5) + + u_2(5) + (1 - \mu)u_3(8) + \mu u_3(3)$

As we have assumed that $\mu = 3/5$ and $u_i(x) = x \forall i$, we can easily calculate that all individuals have an expected utility of 5 in each period after joining a rosca. They are all fully insured against income loss by using the rosca to pool the resources to the risky individual.

The heterogeneity of uncertainty in the example above is crucial for the result that they each prefer a separate order in the rotation. If all members are affected by the same expenditure-incurring risk in the same period, no pareto improving cooperation is possible. For instance, if all members are farmers who farm the same produce, and there is a bad harvest, this will affect every member the same. Therefore, there will be no way to distribute funds across individuals in the period with a bad harvest without making at least one individual worse off. This is an argument for creating a rosca with individuals who have heterogeneous risks.

Also, note that the second and third individual want to wait to receive the pot. The reason is that the rosca can no longer provide insurance once the pot has been received, and is in fact more detrimental in the case of income loss as the contribution to the pot still has to be payed. If an individual is at risk of incurring an income loss in future periods of the rosca rotation, he might value a late receipt date as this will allow for the possibility of insuring against the loss by changing orders in the rotation.

Some people are members in multiple roscas. As Shirley Ardener writes, *"[a]
Ghanaian [(Bortei-Doku and Aryeetey, 1996)] or a Cameroonian [(Niger-Thomas,
1996)], or an Indonesian [(Hospes, 1996), will often belong to a number of ROSCAs,
paying off for some funds received while contributing to sums which can be called
on in an emergency"* (Ardener, 1995, p. 3). This further highlights how roscas are
used to smoothen consumption under uncertainty. If an individual is a member
of many parallel or overlapping roscas, chances are greater that there will be one
in which he has not yet received the pot which will be willing to change the order
of receipts. Also, if there is a shock which affects all members in some roscas, but
not others, being a members of many different roscas is a way of spreading risk.

As the role of saving and credit and the role of insurance illustrate, there can be
valid reasons to want to receive the pot early or late in the rotation. In the next
section we shall see how one organization structure of a rosca, the bidding rosca,
can help decide the order of recipients among members with unequal valuation
of receipt dates (e.g. individuals with heterogeneous risk valuation) or unequal
valuation of goods (e.g. individuals with heterogeneous valuation of the indivisible
good).

3.3 Unequal Valuation

*"Insurance of net expenditure risk can explain the widely-reported prevalence of
concurrent bidding ROSCAs. Insurance may play a role in random and other non-
bidding ROSCAs as well, where there is evidence that secondary market trans-
actions perform a similar function to concurrent bidding. We do not claim that
insurance motivates all ROSCAs, but neither can the predictable consumption of
lumpy durables be the sole motive."* (Calomiris and Rajaraman, 1998, p. 215)

One way of sorting out these varying preferences is the bidding rosca where each
member bids for an earlier rotation, and the bid corresponds to the contribution
at each meeting. In such a way, the first recipients will be paying a higher price,
and the last recipients a lower price for the same pot. Thus members who are
impatient and members who are willing to wait are able to sort their preferences
though bidding.

Combining the "Early Pot Motive" framework with insurance would allow for a more realistic representation of roscas, but at the cost of a much more complex analysis. However, the gains from a bidding rosca can be represented even with simple framework with homogeneous individuals. By adding heterogeneity, either in the appreciation of the indivisible good (heterogeneous utility functions) or in the expected income (heterogeneous risk), there are even further gains from a bidding rosca.

Besley, Coate and Loury (Besley et al., 1993) use the framework from section 3.1.3 to illustrate how bidding roscas can be modeled with homogeneous individuals. Total contributions must be adequate to finance the acquisition of the indivisible good for the recipient of the pot at each meeting so that the sum of contributions equals the sum of costs. Equilibrium bids are so that no member could do better by outbidding another individual for his place in the queue. The equilibrium utility is:

$$t \left[\left(\tfrac{i}{n} \right) u(m_i, 0) + \left(\tfrac{n-i}{n} \right) u(m_i, 1) \right] + (T - t)u(y, 1)^{10}$$

Since all members have identical preferences and complete information, all individuals must be indifferent between bid/receipt date pairs, which means that each individual will have a pair (i, m_i) giving the same utility as any other pair $(i, m_i)'$. A fixed contribution rosca equalizes contributions across members while ex post utility varies. A bidding rosca, however, equalizes utility across members while contributions vary.

If this model is expanded to include individuals that have different valuations of the indivisible good, then individuals with the highest valuations will have the highest bids and will be the first recipients of the pot. Individuals could also have heterogeneous income risk. An individual with no income risk would prefer to have an early receipt, while an individual who knows an expenditure incurring event will occur sometime in the rotation, but does not know when, would possibly want to wait for the receipt such that he could use the rosca to provide insurance by changing receipt orders. The bids are a way of realizing gains from trade between

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[10]If we set $t = n$, this expression becomes $[iu(m_i, 0) + (n - i) u(m_i, 1)] + (T - t)u(y, 1)$, and i then represents the number of periods you wait before receiving the pot in period $n - i$.

heterogeneous individuals that would otherwise not have been realized in a fixed contribution rosca.

We can illustrate how a rosca can be used to compensate a member who is willing to wait his turn using the framework from section 3.1.1 where the individuals now choose a cooperative strategy with monetary transfers to decide who receives the first indivisible good. In both periods there are 12 dollars in the collective, and only 10 dollars are needed to purchase the indivisible good, meaning there is a surplus of two dollars. A portion of this surplus could be given to the individual who is willing to wait his turn. The first recipient can transfer an amount e in the first period and/or an amount d in the second period to the the second recipient, where $e, d \in [0, 1]$. By agreeing to some monetary compensation in exchange for receiving the first indivisible good, this monetary transfer scheme is much like the way a bidding rosca operates.

The first recipient of the indivisible good has the following utility with transfers:

$u_1(1 - e, 0) + \beta u_1(1 - d, 1) + \sum_{t=2}^{\infty} \beta^t u_1(6, 1)$

The second recipient of the indivisible good has the following utility with transfers:

$u_2(1 + e, 0) + \beta u_2(1 + d, 0) + \sum_{t=2}^{\infty} \beta^t u_2(6, 1)$

Are the individuals made better off by this cooperation? Let us look at the extreme case where either e or d is strictly positive and represents a marginal change. It is clear that the second recipient is better off than he was before as the chosen consumption pattern has strictly improved compared to the non-cooperative alternative. The first recipient will also be strictly better off as long as we assume that the value of receiving the indivisible good first is greater than the value of the transfers. If this is the case, then it is clear that there is a scope for cooperation.

In this example, if the transferred amounts are decided through bidding, the organization of the bidding game will be decisive in deciding e and d. Imagine a bidding game where the first recipient offers a bid which can either be accepted or declined by the second recipient. If the bid is accepted, the transfers will be

as proposed by the first recipient, and if the bid is declined, the non-cooperative strategy will be chosen. The second recipient will accept even with a marginal amount transferred, as he will still be better off than the non-cooperative strategy. The best strategy for the first recipient is then to do just this; propose a marginal transfer which makes the second recipient slightly better off. This is the lower bound of possible transfer schemes.

If, however, the game is reversed, the first recipient will accept any proposed transfers which makes him marginally better off than the non-cooperative strategy. The best strategy for the second recipient is therefore to do just this. This is the upper bound of possible transfer schemes.

The transfer scheme the individuals decide on can also depend on what they both consider to be "fair" (see section 4.5).

4   The Rosca - A Social and Cultural Institution

What if you find it difficult to save on your own? Today, you might find it profitable to save for two weeks in order to buy a good, but once the second week arrives, you lose interest in saving and consume instead. However, if you know you will lose interest in the second week, can you find a way to force yourself to save both weeks by tying your hands today?

What if demands at home are high, so that any attempt at saving is eroded away from the demands of family members and neighbors? Is it possible to save in order to buy a desired good even when demands are high?

What if you simply want to get together with your friends once a week in order to exchange advice, expand your social network and enjoy a friendly conversation? What if a member of the community is in need of assistance, and the community wants to get together to help? Is there any way to organize this?

And if it is possible to create a group which can meet such social and cultural needs, how should the group be organized so that all members consider the group to be fair?

These are all indications of various ways the rosca acts as a social and cultural institution, the topic of this section.

4.1   When You Can't Save Alone

"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." (Gugerty, 2007)

The "Early Pot Motive", suggesting that people join roscas because of impatience to receive indivisible goods, and the insurance motive, suggesting that people join roscas because they might be able to receive a pot early in the case of need, are not the only possible motivations for rosca participation. Gugerty (2007) finds

that most people do not save for a durable good, and finds evidence that most participants do not put an especially high value on getting the pot (Armendariz and Morduch, 2007, p. 63). Gugerty suggests that the motivation for joining a rosca is the ability to save in an effective way rather than impatience. "[S]aving 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" (Gugerty, 2007).

In Table 1, from her paper "You Can't Save Alone: Commitment in Rotating Savings and Credit Associations in Kenya", we can see what rosca members answered to the questions, "What is the most important reason why you joined a rosca?" which is an open-ended question and "Here are 7 reasons why you might belong to a rosca, which is most important to you personally?". The data she uses is from 70 roscas located in western Kenya, and there are 303 observations in total.

When answering the first question, we see that 36% of members reported that it was difficult to save alone because money was used for other things, and another 21% reported that they got the strength to save when sitting with others. Not being able to save at home because either the family or husband used the money, (relating to section 4.2) was reported to be the most important reason only among 6% and 1% of the respondents respectively. Making sure each member in the group had a certain item, which 17% responded, and using the rosca to obtain a lump sum to buy a big item, which 6% responded, are both though to be the more traditional reasons for joining a rosca. This is not to say that such motives are not important for the rosca members, but they were not reported to be the most important.

The answers to question two show a similar pattern. 35% reported belonging to a rosca in order to save because it was difficult to save alone, and 17% reported not being able to save alone because money got spent on other things. Making sure all group members obtained an item received 24% of the replies. It is also interesting to note that 13% reported that the most important reason was to visit each other's houses and see how the person was living, which closely relates to section 4.3.

Table 1: 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 [the money]	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 [the money]	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	

The reason why rosca participants need to save in a rosca, Gugerty argues, is that individuals have time inconsistent preferences, meaning that the discount rate does not capture all of the relevant information for individuals preferences. If individuals have a declining rate of time preference, we say they have hyperbolic discounting (Frederick et al., 2002), and their discount factor increases with the time horizon. A decision made today to save tomorrow, might not be optimal once tomorrow arrives. However, if an individual knows this will happen, he can attempt to "force" himself into a savings arrangement today that would force savings tomorrow even when preferences change. A rosca will do just this as long as the cost of not contributing tomorrow is higher than the benefit to consuming rather than saving.

Another reason why an individual would want to tie himself to a saving pattern would be the knowledge that he is prone to procrastination. Procrastination implies that the individual would rather save in the future than save today, because you can always start saving tomorrow. If there is a deadline to when savings must be completed, such as the example from the introduction where the indivisible good, the cow, had to be purchased within two weeks, then the larger portion of saving will take place closer to the deadline. This is, of course, if the individual decides to complete the task before the deadline. An individual can be either naive or informed about his tendency to procrastinate. If he is informed, he can look for a way to control his behavior in order to prevent procrastination. For instance, he can tie a fixed amount of saving every period to a rosca, by e.g. committing to a 5 dollar contribution every week for two weeks in order to buy an invisible good which costs 10 dollars. For more on procrastination, see O'Donoghue and Rabin (1999).

Deciding against one's better judgment due to weakness of will is also a reason why, even though saving is considered the best alternative, saving is not carried out. According to Jon Elster, "[w]eakness of the will consists in acting against one's own better judgment, in doing what one believes, all things considered, one should not do. The phenomenon, then, has four features, (i) There is a prima facie judgment that X is good, (ii) There is a prima facie judgment that Y is good, (iii) There is an all-things-considered judgment that X is best, (iv) There is the fact

that Y is chosen."(Elster, 1985, p. 250) If an individual finds that saving a certain amount is the best alternative (option X), but rather chooses to save less, or not at all (option Y), it is due to a weakness of will.

An individual who wishes to overcome weakness of will, must exert self control. One way of ensuring self control, according to Jon Elster, is to exploit "intrapsychic causal mechanisms to bring about preference change, so that one no longer wants to choose the earlier reward when the time arrives-not because it is linked to a negative benefit, but because it has become less preferred by itself."(Elster, 1985, pp. 256-257). This is essentially what a rosca is able to provide if the penalties associated with non-participation are large enough to deter default. The individual will no longer find it preferable to choose option Y, when joining a rosca has made option Y less preferred.

"It is good to have the group to answer to if you do not set that money aside each week. Otherwise, if you were on your own, when business is bad you might decide not to that week. The itega [rosca] of the Kiambu Group teaches us the faida (profit) of learning how to save money regularly"(Nelson, 1996, p. 54).

4.2   When You Can't 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." "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." "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." "You cannot trust your husband. If you leave money at home, he will take it." (Baland, 2009)

Anderson and Baland (2002) observed that rosca participants in their data from Kibera, Nairobi were more likely to be married women. In table 2, based on the same dataset, we see a comparison of individuals who are or are not participating in roscas. A majority of rosca members, 72.1%, are in couples. Of the rosca

participants, 85.3% are women, 60.9% are women in couples and 49.3% are working women, compared to respectively 43%, 18.2% and 8.6% of non-participants. Also, women who both work and are in couples constitute 33% of rosca participants compared to only 3.4% of non-participants. For men the situation is reversed as all of these characteristics are more likely among non-participants.

Table 2: Rosca Participation

	Proportion - no rosca	Proportion - rosca	Difference
In Couple	0.549	0.721	-0.172***
			(0.0296)
Female	0.430	0.853	-0.423***
			(0.0281)
Female in Couple	0.182	0.609	-0.427***
			(0.0255)
Female and Working	0.0857	0.493	-0.408***
			(0.0218)
Working Female in Couple	0.0339	0.330	-0.296***
			(0.0179)
Male in Couple	0.367	0.113	0.255***
			(0.0270)
Male and Working	0.260	0.102	0.158***
			(0.0248)
Working Male in Couple	0.235	0.0885	0.146***
			(0.0238)
Observations	1318		

Standard errors in parentheses
*p< 0.05, ** p< 0.01, *** p< 0.001

Anderson and Baland's proposed explanation for this phenomenon is a the "Household Conflict Motive", which is based on an intrahousehold conflict between immediate consumption and saving for indivisible durable goods. Women are thought to care about both consumption and an indivisible good, while men only care about consumption[11]. The household decides how to spend the joint income, and whether the decision to purchase the indivisible good is made, therefore depends

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[11]There are numerous studies which show that women consistently devote a higher portion of their income to family needs than do men, and such needs are often indivisible goods, such as

on the women's weight in the household decision. Roscas are found to be a possible way for women who would otherwise not have received the indivisible good to improve their situation in the household by ensuring a higher savings rate.

This mechanism is modeled using a two period model with three goods; consumption in period one, consumption in period two and the indivisible good. The household maximizes its joint utility subject to its intertemporal budget constraint. Joining a rosca, assumed to be womens decision without her husband's knowledge, allows her to save more than the household otherwise would have chosen to do. However, for the household to decide to purchase the indivisible good in the second period, it must be preferable to do so for the household, which may not be the case even with the additional savings. Anderson and Baland (2002) show that under certain conditions, where the wife is neither valued very low nor very high in the household, i.e. intermediate valuation, though it might not be preferable for the household to buy the indivisible good ex ante, it might well be preferable ex post when the wife brings home her rosca savings. Rosca participation can thus improve the situation for the woman in the household.

The wife's utility is $U^w = u(c_1) + u(c_2) + \delta D$, where c_1 is immediate consumption in period 1, c_2 is immediate consumption period 2 and D is the indivisible good, which is either equal to 1 or 0, and can be purchased at price $= 1$. The husband's utility is $U^h = u(c_1) + u(c_2)$, indicating that the husband only cares about immediate consumption in both periods, and not about the indivisible good. The joint household utility is $U^H = (1-\gamma)U^h + \gamma U^w$ where $0 \leq \gamma \leq 1$ and is the weight put on the wife in household decision. Savings cannot be negative, $s \geq 0$. The budget constraint in the first period is $Y \geq c_1 + s$ and $Y + s \geq c_2 + D$ in the second period. The household makes a joint decision about whether or not to buy the indivisible good, and if they decide to buy it, what amount they should save in each period.

The following two assumptions are made:

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school fees and kitchen supplies (Bruce, 1989). As Nelson, descibes it, "The women said that this group gave them access to a large sum of money, for which they could plan ahead. The commonest use for the money for those with children was to pay for school fees. Usually the childless women or older women with grown-up children used their money to capitalize a brewing business or obtain building materials to repair their housing units" (Nelson, 1996).

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

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

The first assumption justifies a savings motive for the wife. Buying the indivisible good in period one without needing to save, which yields a utility of $u(Y - 1) + u(Y) + \delta$ to the wife is never preferable to not purchasing the indivisible good, which yields $u(Y) + u(Y)$. The second assumption justifies the wife wanting to buy the indivisible good. Saving for the indivisible good with equal savings in both periods, which is the optimal savings pattern and yields a utility to the wife of $u(Y - 1/2) + u(Y - 1/2) + \delta$, is preferable to the wife to not purchasing the indivisible good, which yields $u(Y) + u(Y)$.

If the household decides to purchase the indivisible good, the household will choose the optimal savings pattern, saving $1/2$ in each period. This means that the household will decide to purchase the indivisible good when $u(Y) + u(Y) \leq u(Y - 1/2) + u(Y - 1/2) + \gamma\delta$.

The wife can choose to join a rosca in order to save for an indivisible good, and a fixed cost, T, is assumed to be associated with rosca membership. Rosca membership with optimal savings is assumed to be preferred to not buying the indivisible good for the wife. This assumption can be expressed as $u(Y) + u(Y) < u(Y - 1/2) + u(Y - 1/2) + \delta - T$. The fixed cost implies that in a household where it is optimal to purchase the indivisible good with optimal savings, it will never be preferable for a wife to join a rosca as this only leads to additional costs.

These assumptions lead them to the proposition that 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.

The logic behind the first part of this proposition is quite intuitive. If the wife is not weighted at all in the household decision, the only utility for the household is the utility that immediate consumption brings, which would mean there is no motivation to save for an indivisible good. If the wife decided to join a rosca, once

she brought home her savings in period two, they would all be spent on immediate consumption. Since she prefers to smooth her consumption over the two periods, she would be strictly worse off when joining a rosca. If the opposite is the case, meaning that the wife has the entire weight in the household, then assumption 2 indicates that she prefers to save optimally for two periods and then buy the indivisible good. Since her desires are weighted completely, this is what she would do, and since saving in a rosca incurs an additional cost, T, she is strictly better off when not joining a rosca. The upper bound of γ for joining a rosca is the lowest weight at which the indivisible good would be purchased even when not saving in a rosca.

The reason why a woman could want to join a rosca even when the household has decided it is not optimal ex-ante follows from the concavity of the utility functions. Ex-post, once the wife presents her savings in period two, it might be preferable for the household to buy the indivisible good. Since the marginal utility of immediate consumption is decreasing, given that savings has occurred, the household might now have a higher utility in period two from buying the indivisible good rather than just spending the savings and income on immediate consumption. The degree to which this is true depends on the weight of the wife in the household. This will be her preferred strategy until her weight in the household is so large that she can save on her own, which will constitute the upper bound of γ for joining a rosca. The condition for being willing to buy the indivisible good once the rosca savings have been brought home can be expressed as the following[12]:

$$u(Y - s) + u(Y + s) - T < u(Y - s) + u(Y - s) + \gamma\delta - T$$

Which can be rewritten as:

$$u(Y + s) < u(Y - s) + \gamma\delta$$

In the first period, the wife makes the choice to join a rosca with savings, s in each period with a pot of $2s$, and with participation cost, T. In the second period, the

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[12]We notice that the condition is independent of the fixed cost incurred by joining the rosca, T, and the consumption in the first period. This is because we are looking at the condition for whether the indivisible good is bought given that rosca participation has taken place.

wife brings home the rosca pot which the household can either choose to consume or to purchase the indivisible good. Choosing to consume the savings yields a utility of consumption of $u(Y + s)$, while choosing to buy the indivisible good yields a utility of consumption of $u(Y - s)$. Buying the indivisible good yields an additional utility to the household of $\gamma\delta$, the utility to the wife of the indivisible good multiplied by the utility to the household of the wife's utility. If buying the indivisible good in period two yields a higher household utility that consuming the rosca savings, then the indivisible good is bought. We see that this is more likely the higher γ and δ are.

If the household chooses not to buy the indivisible good without rosca participation, the condition $u(Y) + u(Y) > u(Y - s) + u(Y - s) + \gamma\delta$ holds. The interval for which rosca participation can be used to ensure the purchase of the indivisible good when it otherwise would not have been purchased is therefore:

$$u(Y) + u(Y) - T > u(Y - s) + u(Y - s) + \gamma\delta - T > u(Y - s) + u(Y + s) - T$$

Not buying the indivisible good without rosca participation, is preferred to buying the indivisible good with rosca participation, which again is preferred to not buying the indivisible good with rosca participation. This implies that joining a rosca has changed the household's decision from not purchasing to purchasing the indivisible good.

Optimal savings for the wife if she were saving on her own would be $1/2$ in each period. However, in order to ensure that the indivisible good is bought, the savings might be larger. The reason is that the larger the savings presented to the household in the second period, the larger the chance that the marginal utility of the last units of immediate consumption is so low that it is preferable for the household to also purchase the indivisible good. As the wife receives less and less weight in the household, she will increase her savings up to the point where the utility loss of consumption in period one is higher than the gain of receiving the indivisible good, or she has no more income left to save. At this point we have reached the lower bound of γ for joining a rosca. If it is lower, any effort she makes to save in a rosca will either not be worthwhile or possible, and she will not join a rosca.

To test their hypothesis, Anderson and Baland take a wife's share of the income in the household as proxy for the wife's bargaining power. They find that, when controlling for household income, the relationship between female rosca participation and the share in the household income is an inverted-U (Figure 2)(Baland, 2009), suggesting that females with intermediate bargaining power join roscas, as their proposition implies.

Figure 2: Rosca Participation as a Function of Female Share of Income
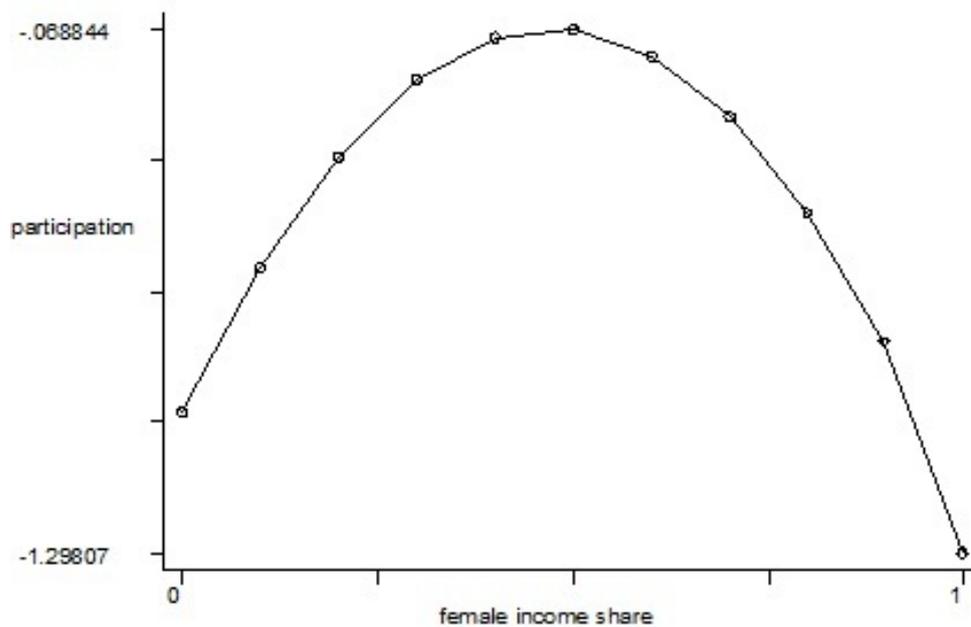
If we return to table 1 from page 22, we see that self reported reasons for not being able to save at home because the family or husband used the money was reported to be the most important reason only among 6% and 1% of the respondents respectively. However, in this model, they join the rosca in order to obtain an indivisible good. So even though they possibly are only able to do so by joining a rosca, the most important reason for joining may be obtaining the good, not protecting savings.

We should also be aware that other motives, such as meeting to socialize, the topic of the next section, could also indicate that more women join roscas. Women who

work have an income they can use for rosca contributions, and there might be more of a culture for joining roscas among married women which has nothing to do with protecting money from their husbands. However, the inverted-U relation between female income share and participation that Anderson and Baland find when controlling for characteristics such as gender, household income, children, education and age (Anderson and Baland, 2002), gives a strong indication that the "Household Conflict Motive" could be present among participants in their data.

4.3   Socializing

"The obligation on members of a rosca to meet to pay their contribution may provide justification, structure and discipline to their social gatherings. But because the social element is elaborated, and because its expense may even account for a significant part of the funds collected, we should not overlook the fact that socializing may have a cost-effective benefit. Members may receive considerable economics returns apart from rosca cash. From other members they may get valuable information on a wide range or topics, advice on many issues or unpaid labour , and so forth" (Ardener, 1995).

Meeting to socialize is, clearly, another example of the social role that a rosca can play. The social gain from joining a rosca need not only be friendship. Roscas can contribute to members' reputation and network, as well as being a source of information and help beyond the economic help that roscas provide. As Takutaro Sakurai writes, "The kou [Japanese rosca] has always been popular for encouraging friendship through the social pleasure offered throughout its history, beyond controversy over-isms, and beyond classes and social differentiations."(Miyanaga, 1996, p. 150, translated from Sakurai (1976)).

"Money-Go-Rounds: The Importance of Rotating Savings and Credit Associations for Women"Ardener and Burman (1996), a collection of articles on roscas by social anthropologists and development economists, highlights the importance of roscas for women, and illustrates the wide variety of roscas found around the world. Though some roscas are of a purely financial purpose, such as the ones found

in the market place among vendors where contributions are collected from each shop and distributed to the recipient without social interaction, many roscas have a strong social purpose and have a large gathering connected with each period's contribution. In the extreme case, the rosca contributions are collected for the sole purpose of paying for the social event which is organized by the recipient of the fund.

For instance, in Ghana, Bortei-Doku and Aryeetey (1996) identify two types of roscas; "the single purpose *susu* savings club and the mutual aid *susu* savings clubs with multiple functions"(Bortei-Doku and Aryeetey, 1996). The first type is a pure savings rosca, which has a minimal amount of socializing. In the second group, the value of the social gathering at each group meeting is essential. Kuniko Miyanaga, studying the kous (roscas) in Japan writes, "We should note that the purpose of the women's kou is to solidify the group identity of members though regular meetings combined with drinking parties, and other aspects such as credit-raising and religious elements are considered by ethnographers, including Embree [(Embree, 1946)], to be pretexts for such meetings" (Miyanaga, 1996, p. 153). In not being able to highlight this feature in economic models, the social motivation for joining a rosca is ignored.

It is particularly interesting to note that even when economically equivalent or superior formal alternatives exist (eg. formal savings institutions which provide rents), many still choose to join roscas. This could indicate that the social factor of being a part of a group is valued to such an extent that members do not choose the formal alternative. If this is indeed the case, we should expect to see a greater movement away from economic roscas than away from social roscas when formal alternatives become available.

In table 1 from page 22 we see that 13% of the respondents reported that the most important reason for joining a rosca was to visit each other's houses and see how the person was living. This indicates that many participants do indeed find the social aspect of a rosca to be important.

4.4 Social Aid

"In the kou formed to save an unlucky child who has just lost his parents, it often happens that the participants hold only one meeting, at which all the money raised is given to the child. Even in cases where a promise is made that the child will reimburse the same amount (though with no interest added) when he is grown up, none of the participants wish to collect such reimbursement."(Miyanaga, 1996, p. 156, translated from Sakurai (1962))

To varying degree, roscas can provide social aid to one or more of its members. In the example described above, the rosca had the sole function of being a one-time fund raising mechanism with no repayments required; a pure act of charity towards a person in a less fortunate position. The rosca is used to offer help to a person in need when his closest kinsmen are not able to raise the funds themselves. In the case where repayment is expected, but where no other pots are collected, the one-time rosca acts as a rent free loan with fixed repayments. The issue then becomes who should be the first to be repaid.

Another example of providing social aid is being willing to change the order of recipients so that a member in need is able to collect the pot before his set receipt date, as described in section 3.2 on insurance. Every member who adjusts his order to accommodate this change will be offering some degree of social aid to the recipient of the preponed pot. If members expect the same treatment if the situation were reversed, there is a reciprocity relation between members in need of social aid.

Also, many roscas collect funds in excess of the pot contribution at each meeting which are placed into an emergency fund. This fund is then distributed to a member in need, irrespective of the rosca pot receipts. When roscas have such emergency funds, there is a collective understanding in the group that members will offer each other social aid in the case of emergency. If everyone has the same expected risk that an emergency will occur, this fund serves as insurance. However, if there is a varying degree of risk, while contributions to the fund are uniform, members with a low risk perception are offering social aid to members with high risk perceptions in expected terms.

4.5   Fairness

If we consider the "Early Pot Motive" to be the reason why individuals join a rosca, there is a conflict of interest as to who should be the first recipient in the rotation. Each member increases their utility by receiving the pot earlier, so each member will have an incentive to argue that they should have an early receipt date. Also, if the rosca is repeated after the first rotation, the same problem arises, but recipients who had late receipt dates in the first rotation, might argue that they should have early receipt dates in the next rotation, and so on. In order for the rosca to function, members must agree on the organizational structure of the rosca, and this is where fairness concerns enter in.

Members might consider it to be fair for everyone to have the same expected receipt date, in which case the rosca should be organized so that the receipt dates are decided by a lottery at the beginning of each rotation. This is a random rosca, where the fairness norm is to equalize expected receipt dates (see section 3.1.3). If members are homogeneous, expected utilities and contributions are equalized whereas ex post utilities are not.

Another fairness norm might be to equalize utilities among members which can be achieved through a bidding rosca. Any member will outbid another for their receipt date as long as the utility gain from the earlier receipt date is greater than the loss from increased contributions. At each prevailing bid, members will be indifferent between all bid and receipt date bids (see section 3.3). Using this organizational structure, utilities are equalized whereas contributions differ.

However, Gugerty finds that in her sample of 70 roscas from western Kenya, participants do not always prefer to receive money sooner than later (Gugerty, 2007). In out data sample from Kibera, 69% of the roscas did not change order after each rotation, where as in Gugerty's data sample, 37% repeated the same order. Anderson, Baland and Moene argue that this is related to enforcement (Anderson et al., 2009) (see section 5.1). Gugerty, however, argues that this could be related to participants in a repeated fixed order essentially joining a rosca where each member saves a fixed amount every period which is repaid after a x periods, and this situation is the same for all members.

Gugerty writes, "This may explain in part why participants see no need to pay interest to individuals with positions late in the rotation, even when they hold those positions in multiple rounds", and one participant expresses that "the system is fair, because even the first person will have to wait until the last person has received to receive again" (Gugerty, 2007, pp. 16-17). So, when using this argument, the fairness norm is related to equalizing the waiting time between receipt dates, which would indicate the rosca has a fixed order of recipients. This fairness norm equalizes the situation for all recipients starting at a their own receipt date within a rotation and also equalizes contributions, but from the start of any rotation, the utilities across members differs.

Going back to the example from page 11, let there now be a second market which also lasts for two weeks some time after the first, where the individuals once again can save and/or cooperate to buy an indivisible good. The individuals are only able to save for the duration of each market. If the individuals decide to cooperate, they must choose not only how to decide the order of recipients at the first market, but also at the second. One option is to redo the lottery at each market so that the game is essentially the same at both markets, which is equivalent to a random rosca. The second is to let the first lottery decide the order of recipients at both markets. When doing so, one alternative would be to let the first recipient be the last recipient at the next market and vice versa. However, one could also consider an allocation based on the waiting time between new indivisible goods. Each individual might want to wait an equal amount of time to receive another indivisible good, in which case they might agree to always let the first recipient be the first recipient. This is equivalent to a fixed order rosca. All of these variations of the repeated rosca might be considered "fair" when using various fairness norms, as we have seen in the previous paragraphs.

The bidding rosca is another alternative that the individuals can choose if they consider it "fair" to receive a compensation for being willing to wait their turn. Economically, any compensation scheme that makes all participants better off than their non-cooperative strategy should be accepted by all participants (see section ??). However, if the first recipient in our example suggests a compensation scheme which the second recipients considers to be unfair, the second recipient might be

willing to accept a loss in order to punish the first recipient for not presenting a fair offer (altruistic punishment, see e.g. Fehr and Gaechter (2003)).

One scheme that both individuals could consider fair is one where each individual has an equal absolute or relative benefit from joining the rosca. If we consider the alternative where both individuals are made as well off in the cooperative scheme in the sense that both have the same increased utility from cooperating, we have the following condition:

$$u_1(1-e,0) + \beta u_1(1-d,1) + \sum_{t=2}^{\infty} \beta^t u_1(6,1) =$$

$$u_2(1+e,0) + \beta u_2(1+d,0) + \sum_{t=2}^{\infty} \beta^t u_2(6,1)$$

If we assume that we have a separable utility function, such that $u_i(m_t,c_t)$ can be written as $u_i(m_t) + v_i(c_t)$, where $v_i(0) = 0 \forall i$ we can interpret this expression further:

$$[u_1(1-e) + v_1(0)] + \beta[u_1(1-d) + v_1(1)] + \sum_{t=2}^{\infty} \beta^t[u_1(6) + v_1(1)] =$$

$$[u_2(1+e) + v_2(0)] + \beta[u_2(1+d) + v_2(0)] + \sum_{t=2}^{\infty} \beta^t[u_2(6) + v_2(1)]$$

Which can be rewritten as:

$$[u_2(1+e) - u_1(1-e)] + \beta[u_2(1+d) - u_1(1-d)] =$$

$$\beta[v_1(1) - v_2(0)] + [\sum_{t=2}^{\infty} \beta^t[u_1(6) + v_1(1)] - \sum_{t=2}^{\infty} \beta^t[u_2(6) + v_2(1)]]$$

We see that the utility added to second recipient from the transfers relative to the first recipient must equal the utility added to the first recipient from owning the first indivisible good relative to the utility of the second recipient from owing the indivisible good one period later. In this example, the utility functions of the two individuals need not be the same, which means they could value the indivisible good or monetary units differently, which will affect the amount of transfer. The amount of transfers needed will depend on the relative value of a indivisible good, the relative value of money and the discount factor, β. Both individuals thus have the same utility level after transfers.

5 Sustainability, Enforcement and Organizational Design

In order for the rosca to serve as an economic, social and cultural institution, it must be sustainable both in itself and as an institution among other institutions. In order for the rosca to be internally sustainable, each member must find it profitable to continue contributing to the pot once he himself has received the pot. In order for the rosca to be externally sustainable, the rosca as an institution must continue to serve a purpose even when other informal or formal institutions become available. Internal and external sustainability are the topics discussed in this section.

5.1 Internal Sustainability

"The overriding priority given to meeting ROSCA obligations, and the consequent comparative rarity of default, is a notable feature of these associations. The disgrace and humiliation which can fall on a defaulter is much feared."(Ardener, 1995, p.4)

In order for a rosca to function, each member must commit to the payments of the entire rotation. If members are not willing to keep contributing once they have received the pot, the rosca is not internally sustainable. How then, is it possible to encourage members to continue paying their contributions once they have received their awards? Are there economic punishment or incentive mechanisms that can ensure payments, or must the rosca resort to social punishment mechanisms?

The problems of sustaining a rosca and the possible punishment mechanisms in roscas with various organizational structures are the topic of the paper "Enforcement and Organizational Design in Informal Savings Groups", (Anderson et al., 2009). When comparing random order roscas to fixed order roscas they find that each structure has separate welfare and sustainability implications.

In this thesis, three separate organizational structures of roscas have been discussed; fixed, random and bidding. In a random rosca, the order of recipients is

decided randomly at the beginning of each cycle. In a fixed rosca, the order is fixed in each cycle. These two types correspond to the same thing when studying a one cycle rosca, but have different expected waiting times for a repeated rosca. The last structure, the bidding rosca, introduced in section 3.3, is such that members bid for receiving the pot. The highest bidder receives the first pot, and the second highest the next etc. The bid corresponds to the contribution in each period. Each one of these organizational structures has implications for the problem of committing to the group. Motivated by the observation of random and fixed roscas in the data from Nairobi, Kenya, Anderson et al. (2009) investigate the welfare and sustainability characteristics of these two organizational structures.

Individuals or households maximize their lifetime utility subject to each periods budget constraint:

$$U^i(\mathbf{c}, \mathbf{D}) = \sum_{t=1}^{\infty} \delta^t u^i(c_t, D_t)$$

subject to $y = c_t + s_t$, where $\delta < 1$ and $s_t \geq 0$

Lifetime utility is the discounted utility of immediate consumption and of consumption of the durable in each period. The utility is either individual, as presented by Besley et al. (1993) ($\sum_{t=1}^{\infty} \delta^t u^i(c_t, D_t)$), or joint for the household, as presented by Anderson and Baland (2002) ($\sum_{t=1}^{\infty} \delta^t u^H(c_t, D_t)$)[13]. Each period, an income y is received which can either be used for immediate consumption, c or saving, s.

The motive for saving is to buy the durable, which costs P and can be purchased after saving from period $k + 1$ to period $k + \tau$ (τ periods of saving).

$$P = \sum_{t=k+1}^{k+\tau} s_t$$

Once the durable is purchased it can be enjoyed only for that period, which greatly simplifies the calculations. The rosca is organized such that n members contribute

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[13]$U^H(\mathbf{c}, \mathbf{D}) = \beta U^m(\mathbf{c}, \mathbf{D}) + (1 - \beta)U^f(\mathbf{c}, \mathbf{D}) = \sum_{t=1}^{\infty} \delta^t(\beta u^m(c_t, D_t) + (1 - \beta)u^f(c_t, D_t)) = \sum_{t=1}^{\infty} \delta^t u^H(c_t, D_t)$

a fixed sum of $s_R = P/n$ to each meeting. There is one meeting in each period where one member receives the pot, $(P/n)n = P$ which is used to purchase the durable good. After n periods, each member has received the pot and they then start a new rosca rotation.

The expected utility of joining a random rosca for i or H , where the order of recipients is decided by lottery at the beginning of each rotation, is:

$$E(U_r^k(\mathbf{c}, \mathbf{D})) = \sum_{t=1}^{\infty} \delta^t u^k(c_R, 0) + \frac{1}{n} \sum_{t=1}^{\infty} \delta^t(u^k(c_R, 1) - u^k(c_R, 0))$$

$$= \frac{\delta}{1-\delta} u^k(c_R, 0) + \frac{1}{n} \frac{\delta}{1-\delta}(u^k(c_R, 1) - u^k(c_R, 0))$$

While the expected utility for joining a fixed rosca for i or H with rank g, where the order of recipients is fixed every rotation, is:

$$E(U_{g,f}^k(\mathbf{c}, \mathbf{D})) = \sum_{t=1}^{\infty} \delta^t u^k(c_R, 0) + (\delta^g + \delta^{g+n} + \delta^{g+2n}...)(u^k(c_R, 1) - u^k(c_R, 0))$$

$$= \frac{\delta}{1-\delta} u^k(c_R, 0) + \frac{\delta^g}{1-\delta}(u^k(c_R, 1) - u^k(c_R, 0))$$

For the whole time period, each member receives the utility from immediate consumption, $u^k(c_R, 0)$. In the random rosca, $1/n$ of the time each member expects to receive the pot and can consume the durable for that period. In the fixed rosca, a member with rank g receives the pot and consumes the durable in periods g, $g + n$, $g + 2n$.... Each period that a member consumes the durable, the utility is raised by $u^k(c_R, 1) - u^k(c_R, 0)$.

Random roscas are strictly preferred by a majority of members to fixed roscas at the beginning of a rotation[14]. How then, is it possible to explain the existence of both fixed and random roscas in the data?

The first observation is that the member facing the strongest enforcement problem is the first recipient of a pot. This individual knows that there are at least n periods until he receive the pot again. At the other end, the last recipient knows that there are no more than n periods until he receives the pot again. In the case of a fixed

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[14]This can be shown by comparing the utility of the next cycle for a member of a random rosca and a member of a fixed rosca of rank g and solving for g.

rosca, once the first recipient has received their pot, the first and last recipient are in the same situation; they have to wait n periods. In a random rosca, however, not only is the first recipient worse off than the last recipient, he is also worse off than the first recipient in a fixed rosca. The conclusion is that we can study the enforcement problems by focusing on the first recipient, and that enforcement problems are greater in a random than in a fixed rosca. We also note that when using the same line of reasoning, enforcement problems are further enhanced in a bidding rosca as the first recipient is paying more for the pot than the other members, and there is therefore more to be gained by defaulting.

One implication of this result is that there might be a trade-off between enforcement and members' preferences which causes the existence of both random and fixed roscas. Groups facing larger enforcement problems might choose to start a fixed rosca, while groups which are less concerned with default are able to organize themselves as random roscas. Bidding roscas, which have the greatest incentives to default, would have to consist of members who were even more certain of being able to prevent default though other mechanism.

If the organizational structure has implications for enforcement, are there other organizational mechanisms which can prevent default? Anderson et al. (2009) find that purely economic punishment mechanisms, such as membership fees or expelling members from future rosca participation, can never deter the first recipient from defaulting.

In the case of preventing a defaulting member from joining any future rosca, even if this were possible, the first recipient could always at least mimic the behavior of any rosca once the pot has been received, and this will therefore not be sufficient to ensure enforcement. In the case of having a membership fee which is repaid at the end of the rotation, the fee cannot be so high that it makes rosca participation unprofitable for any members, which creates an upper bound for the fee. Anderson et al. (2009) show that this fee can never be large enough to ensure enforcement because the level at which it would ensure enforcement is a level at which the first recipient finds it unprofitable to participate. Also, if the rosca is repeated after each rotation, members will view this membership fee as a sunk cost and will not

take it into consideration when considering default.

If there is no viable way of ensuring enforcement though economic mechanisms, this must mean that the social mechanisms are in fact what ensure enforcement. This highlights the strong social role that roscas play and should indicate that most roscas are formed by members who are strongly connected and are able to pose a credible threat of social sanctions on each other. Examples of such sanctions are described by Ardener (1995), "[M]embers would call on multiple sanctions to prevent defaulting. The group could mobilize links of friendships or kinship, shared neighbourhood ties, lack of mobility (because they were all house-owners) and the importance for these women of maintaining a reputation for reliability and honesty in their roles as brewers or wholesalers of beer, landladies or politicians.".

Besley et al. (1993) also recognize the importance of being able to prevent default in order to sustain the rosca. In order for the first recipient in a rosca to be willing to continue contributing, it must be because the punishment from default is so large that the first recipient does not find it profitable to deviate form the cooperative strategy. They find that the size of the punishment needed to ensure enforcement is decreasing in the duration of the rosca and the number of members.

There are various social sanctions that roscas use to prevent default. In Japan, Kuniko Miyanaga reports that "If he neglects to participate properly in these activities, an individual or his household members will be subject to harsh criticism and verbal abuse." (Miyanaga, 1996, p. 156). The social stigma associated with default is so large, in many places, that members will resort to nearly any measure in order to ensure payment.

"A member may go to great lengths, such as stealing (S. Ardener 1953, p.139) or selling a daughter into prostitution (Embree 1946, p. 147) in order to fulfill his obligations to his association; failure to meet obligations can even lead to suicide (Embree 1946, p. 1147)." (Ardener, 1964)

Anderson et al. (2009) investigate this further in their data by seeing whether rosca members considered to have more social ties to the community are more likely to

join random roscas, where the theory is that social ties facilitate enforcement, and they do find some indicative evidence of this.

Table 3 on page 45 shows that there are significant differences between the fixed order and the random order roscas in the dataset from Nairobi. Members of random roscas are more likely to have higher incomes, both for the individual and the household. They are also more likely to have permanent employment and less likely to work in the informal sector. The roscas themselves are also different in their design. Random roscas have existed fewer years on average, are more likely to be started by friends but less likely to be started by neighbors. With respect to formality, random roscas are less likely to keep written rules and minutes, and less likely to have (elected) governing bodies, chairmen or treasurers. Random roscas report having greater problems with leadership, money and theft, irregular attendance and irregular payments. In addition, random roscas are more likely to have penalties for not attending meetings, more likely to let the recipient spend the pot and are more likely to collect monthly contributions.

Table 3: Fixed Rosca Versus Random Rosca

	Fixed	Random	Difference
Order changes between rotations	0	1	-1
			(0)
Female	0.874	0.875	-0.000541
			(0.0392)
Has completed primary school	0.468	0.471	-0.00362
			(0.0591)
Monthly household income	7591.6	11999.3	-4407.8***
			(1124.8)
Monthly individual income	3621.1	5549.5	-1928.4*
			(898.6)
Has permanent employment	0.506	0.779	-0.272***
			(0.0562)
Works in informal sector	0.567	0.413	0.153**
			(0.0585)
Works in trade	0.455	0.519	-0.0643
			(0.0590)
From same ethnic group	0.318	0.452	-0.134*
			(0.0563)
Total number of members	14.46	17.05	-2.589*
			(1.273)
Length of existance years	29.39	19.23	10.16**
			(3.881)
Started with friends	0.489	0.721	-0.232***
			(0.0573)
Started with relatives	0.0687	0.0481	0.0206
			(0.0286)
Started with neighbors	0.245	0.0962	0.148**
			(0.0465)
Started with people from same profession	0.124	0.106	0.0187
			(0.0382)
Majority of members from Kianda	0.738	0.644	0.0940
			(0.0535)
Keep written rules	0.534	0.308	0.227***
			(0.0577)

Continued on Next Page...

Table 3 – Continued

Group is registered	0.129	0.0577	0.0711
			(0.0363)
Keep written minutes	0.485	0.260	0.225***
			(0.0570)
Has governing body or chairman	0.734	0.356	0.378***
			(0.0537)
Governing body or chairman is elected	0.732	0.350	0.382***
			(0.0539)
Group has a treasurer	0.511	0.192	0.318***
			(0.0556)
Group holds regular meetings	0.893	0.933	-0.0400
			(0.0346)
Penalties for not attending meetings	0.659	0.913	-0.253***
			(0.0504)
Possible to change number in rotation	0.751	0.904	-0.153**
			(0.0467)
Major problems with leadership	0.00858	0.0673	-0.0587**
			(0.0188)
Major problems with money and theft	0.0172	0.115	-0.0982***
			(0.0246)
Major problems with irregular attendance	0.124	0.529	-0.404***
			(0.0462)
Major problems with irregular payments	0.288	0.577	-0.289***
			(0.0551)
Money received is spent by recipient	0.914	0.990	-0.0762**
			(0.0283)
Contributions are payed daily	0.112	0.0577	0.0539
			(0.0345)
Contributions are payed weekly	0.326	0.240	0.0858
			(0.0540)
Contributions are payed monthly	0.292	0.625	-0.333***
			(0.0549)
Observations	337		

Standard errors in parentheses

*p< 0.05, ** p< 0.01, *** p< 0.001

We can not draw any causal conclusions based on these results. Ransom roscas are less formal which could indicate that members have strong social ties and do not see the need for formality. Higher incomes could indicate that people are more tied to the local community, but could also indicate that people have incomes that allow them to move more freely if they do default, so either way it is hard to make any hypothesis on how this reflects the ability to apply social enforcement. The fact that people are more likely to have permanent employment in random roscas can, however, indicate that it is easier to apply enforcement.

We notice that even in this table not all results are as expected. If random roscas are supposedly formed in the presence of fewer enforcement problems, why then do a larger proportion of the random roscas report having money, theft and irregular payment problems? Random roscas report having less formality which could possibly lead to more problems, but if this is the case, then changing the order of recipients could have nothing to do with these enforcement results.

5.2   External Sustainability

"The advantages of ROSCAs are the same as those of many other schemes in the informal sector: they are accessible and local, and do not involve travel to a banking centre which is often in a town [...]. Transaction costs are kept to a minimum; bureaucratic procedures are, in the main, absent, and there is a general appreciation of the 'secrecy' of such organizations." (Low, 1995)

In order for a rosca to be externally sustainable, it must be sustainable in the presence of other formal and informal institutions. This means that the rosca must continue to serve a purpose when members are able to join other financial institutions, such as informal health insurance groups or formal microlending groups.

If we are looking for evidence that roscas serve a unique purpose in an informal economy, we need not look any further than the dataset from Kibera. Five different informal financial groups were identified; merry-go-rounds (roscas), funeral and health insurance groups, investment groups, welfare groups and employment groups. Of the 1270 individual observations in the dataset, where respondents could report being a member of one or more groups in all five categories[15], 22.8% (289 observations) reported being a member of one or more roscas. The numbers were 12.5% (159 observations), 5.9% (75 observations), 1.73% (22 observations) and 0.6% (7 observations) for funeral and health insurance groups, investment groups, welfare groups and employment groups respectively. Also, 59 of the 78 investment group observations (75.6%) and 33 of the 166 funeral and health insurance group observations (19.9%) reported having a secondary activity as a rosca[16].

These numbers indicate that even when other informal groups are available, such as insurance and welfare groups, roscas serve separate functions. The wide geographic range of roscas (Ardener (1964), Low (1995)) also indicates the strength of the rosca as an institution among other informal institutions. When no formal institutions are available to members of a rosca, which is the case for most

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[15]Table 4, which can be found in section 6.1, reports the number of observations in each category.

[16]The dataset does not identify the specific groups, so different respondents could be reporting on the activites of the same group, especially for respondents from the same household. This means that there might not be 78 unique investment groups, for example.

rosca members in Kibera, roscas appear to be externally sustainable in an informal economy, surviving and even prospering among other informal institutions.

If roscas are externally stable in an informal economy, are they externally stable once formal institutions become available? In attempting to answer this question, it is important to remember that even when formal institutions become available in a society, this does not mean that they become available for all members within the society. Many individuals cannot access formal financial services, either because they are not considered reliable, do not have collateral or are not profitable customers because of the size of loans or savings they demand.

Sakurai (1991) writes, "The roles of such modern monetary organizations as banks, credit associations, and national loan associations in economy and business should not be underestimated. However, the recipients of the privilege of benefiting from associations with the modern monetary organizations are limited to manufacturers with large capital, trading firms, and security companies. Some intermediate and small-sized businesses may benefit, but the privilege is a remote one for ordinary people. They may have to resort to pawnbrokers or loan brokers, even knowing that the interest they charge is high. In this situation, the tanomoshi [ROSCA] is formed in many urban areas."(Miyanaga, 1996, translated from Sakurai (1991), p. 159)

Important steps have been made in the past few years to increase the availability of formal financial services to poor. Formal loans have the potential to offer loans with lower interest rates than those offered by loan brokers while formal saving have the potential to offer secure saving with interest. Also, formal insurance has the potential to offer increased consumption smoothening at reasonable costs. In this sense formal financial institutions are able to provide many of the services that roscas are able to provide in informal institutions. The question is then whether roscas disappear, prosper or are transformed when formal financial institutions are introduced to informal economies. Are roscas a "middle-rung" institution in a developing society, as Geertz claimed (Geertz, 1962), or do they continue to serve an important purpose in a developed society with formal institutions?

If roscas are indeed created to provide needed goods and services because formal

49

institutions are not available, then we should expect roscas to become redundant when such institutions do become available. Geertz described roscas as a product of a "shift from a traditionalistic agrarian society to an increasingly fluid commercial one" (Geertz, 1962, p. 260), calling them a "middle-rung" institution in a developing society. This would support the idea that roscas should disappear or transform as societies develop, and would also suggest that the "success" of a rosca should depend on its ability to transform (Nelson, 1996). This could mean transforming into a multi-functional institution (e.g. providing secondary services such as health insurance as well) or transforming into different institutions (e.g. investment groups).

However, roscas are still observed all over the developing world, as well as among immigrants in developed countries (see Srinivasan (1996), Summerfield (1996) and Light and Deng (1996) among others), suggesting that they not only continue to serve a purpose and are often preferred to a formal alternative, but also that the way we measure a rosca's success should not necessarily be their transformation ability. Transformation could imply higher contributions, as was the case with the Kiambu Group observed by Nici Nelson (Nelson, 1996), which could lead to the poorest members leaving the groups to join other less costly rosca groups. This would suggest that there is always room for a rosca at the bottom of the ladder.

If roscas are externally sustainable when formal institutions are available to members, this must be because roscas are able to offer goods and services that formal institutions are not able to offer, or offer at higher costs.

For the rosca to be externally unsustainable, rosca members must find it preferable to use a formal institution rather than a rosca to fill their financial needs. If members choose to use a combination of roscas and formal institutions, the demand for roscas might decrease, but the remaining roscas will still be sustainable. However, there are no clear indications that formal institutions are able to provide improved goods and services.

For instance, we can look closer at what what individuals choose when formal banks are introduced to the framework of section 3.1.2. If we view the bank only

as a loan provided with an interest rate, where individuals can choose either a bank or a rosca, an individual's optimal choice depends on the parameter values.

The bank is able to provide a loan L, in the first period which must be repaid in the second period. Assuming some interest rate, r, on the loan, the individuals will find it profitable to take up a loan rather than save on their own as long as:

$$u_i(6 + L - 10, 0) + \beta u_i(6 - (1 + r)L, 1) + \sum_{t=2}^{\infty} \beta^t u_i(6, 1) \geq$$

$$u_i(1, 0) + \beta u_i(1, 0) + \sum_{t=2}^{\infty} \beta^t u_i(6, 1)$$

Which can be rewritten as:

$$u_i(6 + L - 10, 0) + \beta u_i(6 - (1 + r)L, 1) \geq u_i(1, 0) + \beta u_i(1, 0)$$

If we assume that we have a separable utility function, such that $u_i(m_t, c_t)$ can be written as $u_i(m_t) + v_i(c_t)$, where $v_i(0) = 0 \; \forall i$ we can interpret this expression further:

$$u_i(6 + L - 10) + v_i(0) + \beta u_i(6 - (1 + r)L) + v_i(1) \geq u_i(1) + v_i(0) + \beta u_i(1) + v_i(0)$$

Which can be rewritten as:

$$[v_i(1) - v_i(0)] \geq [u_i(1) - u_i(6 + L - 10)] + [\beta u_i(1) - u_i(6 - (1 + r)L)]$$

As long as the gain from having the indivisible good is greater than the value of the lost consumption in both periods, the individuals will find it preferable to take up a loan. Inserting for L and r we can see that the higher the interest rate, the lower is the chance that taking up a loan is profitable:

- If $L = 5$ and $r = 0$, the gain will be $[v_i(1) - v_i(0)] > 0$, in which case they will take up a loan.

- If $L = 5$ and $r = 0, 2$, they will take up a loan if $[v_i(1) - v_i(0)] \geq [\beta u_i(1) - u_i(0)]$.

- If the interest rate is high (e.g. $L = 4$ and $r \geq 0, 5$) the loan will be too high to repay, and the farmer will not be able to take up a loan.

The economic gain of rosca participation is the chance of receiving the indivisible good early (section 3.1.3) or receiving some benefit from being willing to wait for the indivisible good (section 3.3). This gain can either be greater or smaller than the benefit from taking up a formal loan depending on the level of interest payments. There is therefore no clear answer to whether the individuals will choose a rosca or a formal alternative even in this simple framework. However, one would expect the probability of taking up a formal loan to increase as the interest rate decreases. The problem is further complicated as there might be benefits or disadvantages to both alternatives that are not captured in this framework.

For instance, there might be greater traveling distance, more bureaucratic procedures and higher transaction costs associated when comparing formal institutions, such as banks, to the rosca. Also, saving in a rosca can be an advantage to a member who does not want authorities or members of the community to know about their wealth. As a member of a Malayan rosca in Brittain reported, "If you save in a bank here they will ask a hundred and one questions as to where does the money come from, how have you got it, and so on ... and you also have to pay tax on your savings. [...] Look at any claim for benefits ... they want to know how much you have in your bank! And if you have more than 3,000 [pounds], your chances of getting anything are poor. You work hard to save and then you're penalized for saving! So I prefer to keep my money in a chitti [rosca] - even if I don't get any interest, no questions are asked." (Srinivasan, 1996, p. 206).

In addition, roscas provide basic banking needs in a social environment. As Raj Mohini Sethi writes, when describing informal institutions such as the rosca in contemporary Indian society, "Their importance lies in the fact that they help to channel non-active, liquid, household savings that are an extension of traditional forms of money-lending; they provide friendly, easy and informal access to credit in contrast to the indifference of the official machinery of the formal banking system." (Sethi, 1996, p.163). Roscas also have the potential to provide more flexible arrangements as a rosca can be postponed for a time period in the case of hardships for all the members, and restarted where it left off when the economic conditions have improved.

Banks, on the other hand, have the advantage of being able to provide a legal agreement between a lender and a borrower, which provides a certain guarantee that savings will be safe and loan agreement will be binding by both parts. As a saving institution, banks provide rents while roscas only do so for the last recipients of a bidding roscas (see section 3.3). Also, in contrast to the secrecy of roscas, the openness of banks can help make public the ability to save and repay loans which could help with other financial transactions. There are therefore both advantages and disadvantages to banks and roscas.

6 Informal Finance in the Kiberan Slum

Kibera is a slum of Nairobi covering about 250 hectares. The population is estimated to be at least 700,000, making it the largest slum in Sub-Saharan Africa. Kibera is characterized by a lack of basic services and infrastructure, which includes most formal institutions (Umande Trust, Centre on Houseing Rights and Evictions (COHRE) and Hakijamii Trust, 2007). In 1997, the household survey "Socio-Economic Survey on Poverty and Collective Action in Kibera" (Baland, 1996) was conducted in Kibera, where participants were asked about their participation in informal groups, where 22.8% reported being a member of a rosca. This section gives a description of the data and presents statistics and results on the organizational structure, degrees of formalism, participation and major problems in roscas in Kibera.

It is important to remember that any one period dataset on roscas, such as this one, only includes currently functioning roscas. A multiple period dataset would allow for a more detailed analysis of why people join roscas and why some roscas fail while others succeed. Also, the questions asked are somewhat limited in their scope and detail. For instance, there are no questions concerning what the funds are used for, when participants want to receive the pot, or why individuals join roscas.

6.1 Poverty and Collective Action in Kibera

The household survey, "Socio-Economic Survey on Poverty and Collective Action in Kibera" (Baland, 1996), was conducted in Nairobi, Kenya in 1997 among individuals 16 and older in 511 households, generating 1270 individual observations. Individual characteristics, such as education, migration, occupation, income, expenditures and a description of the household and facilities were collected as background/identifying information. The individuals were asked if they participated in one or more of the following groups; merry-go-rounds (roscas), funeral and health insurance groups, investment groups, welfare groups and employment groups and whether these groups had a secondary activity as one of the other five groups. For

each group the individual participated in, further questions were asked about the organization of the group and any problems encountered by the group.

In table 4, the number of responses to primary and secondary activities are reported in column 1 and 2 respectively. Total indicates the number of observations, where each group membership for each individual has one observation, ≥ 1 is the number of individuals in at least one group, and $= 1$ is the number of individuals in only one group[17].

Table 4: Number of Observations

Group	Primary Activity			Secondary Activity		
	Total	≥ 1	$= 1$	Total	≥ 1	$= 1$
Merry-Go-Rounds	338	289	249	22	21	20
Welfare	22	22	22	1	1	1
Funeral and Health Insurance	166	159	152	33	29	25
Employment	7	7	7	3	3	3
Investment	78	75	73	59	50	43

Table 5 reports descriptive statistics for primary activity merry-go-round observations. There is a large variation in the roscas observed. The mean number of members is 15, but one rosca reports having as many as 125 member, and while some roscas never have meetings, others meet daily. Also, the monthly contributions vary from 0.17 USD to 102 USD.

Table 5: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Members[1]	15.28	10.84	3	125	338
Length[2]	8.77	4.07	1.08	37.33	264
Meetings[3]	29.66	38.41	0	365	337
Monthly contribution[4]	10.18	12.26	0.17	102.16	337
Membership fee[5]	2.78	4.58	0.03	18.73	101

[1]Total number of members participating in the group, [2]How long the group has existed measured in years, [3]Average number of meetings held per year, [4]Contribution per month, measured in USD. 1 USD= 58,731 KSH in 1997 (Heston et al., 2009), [5]Membership fee to enter the group, reported if greater than zero, measured in USD. 1 USD= 58,731 KSH in 1997 (Heston et al., 2009).

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[17]For more on this table, see section 5.2

6.2 Organizational Structure

Individuals who reported being members of a rosca were asked various questions about the organizational structure of the rosca. Table 6 reports the results, where respondents could answer either yes or no to each question. The mean value reflects the fraction of respondents who answered yes to each question. We notice that almost all groups (94%) allow the money collected to be spent by the member who receives the pot, rather than the group spending the money on an item on behalf of its members. However, we do not know if all members are expected to buy the same item or are free to use the pot as they see fit, so it is hard to draw any conclusions from this information.

Most groups (80%) answer yes to the question, "In case of need, can a member change his number", number here indicating the order in which one receives the pot. This gives support to the insurance motive from section 3.2. 31% of the groups change the order of recipients randomly after each rotation, whereas the remaining 69% keep the order fixed. Sections 4.5 and 5.1 both discuss the implications of the order of recipients in a rosca.

Table 6: Organizational Structure

	Yes=1, No=0 mean
Formed by members of the same ethnic group	0.359
Majority of members are from Kianda	0.709
Money collected spent by member	0.938
Possible to change number if needed	0.798
Possible to have more than one number	0.389
Order changes after each round	0.309
Observations	337

6.3 Degrees of Formalism

In table 7 we observe various measures of formalism in a rosca. Respondents could answer either yes or no to each question and the mean value reflects the fraction

of respondents who answered yes to each question. Only 10% of the groups are registered, so it is clear that most of the rosca groups in the sample are indeed informal in the legal sense. However, some groups are more formally structured than others by having e.g. written minutes of the meetings or a governing body. Almost all (98%) of the governing bodies or chairmen are elected, and most groups (91%) meet at a regular basis. Also, a majority of the groups (74%) have penalties associated with not attending the meetings.

Table 7: Degree of formalism

	Yes=1, No=0
	mean
Written rules	0.468
Registered Group	0.109
Keep written minutes	0.423
Have a governing body or chairman	0.625
The governing body or chairman is elected[1]	0.976
Separate treasurer	0.417
Meetings at a regular basis	0.909
Bank account	0.0695
Penalties for not attending meetings	0.740
Observations	331

[1]For observations which have answered they have a governing body or chairman

Table 8 shows the correlation between some measures of formalism; whether they keep written rules and minutes, whether the group is registered, whether there is a governing body or chairman and whether there are penalties for not attending meetings. The measures are all positively correlated, indicating that groups with one measure of formalism are more likely to also have another measure of formalism. Formalism could be used as a way of enabling the group to credibly enforce punishment. If this is the case, we should expect to see a greater degree of formalism in groups with more enforcement problems. This has been investigated further in Anderson and Francois (2008).

Table 8: Correlation matrix

	written rules	registered	written minutes	governing body	penalties
written rules	1.00				
registered	0.37	1.00			
	(0.00)				
written minutes	0.76	0.41	1.00		
	(0.00)	(0.00)			
governing body	0.42	0.23	0.47	1.00	
	(0.00)	(0.00)	(0.00)		
penalties	0.30	0.10	0.23	0.22	1.00
	(0.00)	(0.07)	(0.00)	(0.00)	

Note: P-values in parentheses

6.4 Rosca Participation

We can investigate whether there are certain characteristics that separate rosca members from other individuals in the sample. Table 9 reports the mean characteristics among the non participants and the participants in roscas in column 1 and 2 respectively. Column 3 reports whether the differences are statistically significant[18]. We see that participants in roscas are more likely to be in a couple, are older and are less likely to have completed primary school. With regards to their work and income, rosca participants are more likely to have a job, to work in the informal sector and to work within the trade occupation and the individual monthly individual income is higher among participants. Roscas could require of their members to be established in the community in order to ensure that social punishment mechanisms, such as destroying a defaulting member's reputation, have an effect. We can hypothesize that individuals who have spent more years in Kibeara, live in couples, are older and have less education are more tied to the community, either from having a greater social network in the community or having fewer outside options. We note that many of these measures, such as years

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[18]A similar table can be found in section 4.2

spend in Kibera and age, are most likely correlated. This is, however, only a hypothesis which needs to be tested further.

Table 9: Rosca Participation

	No Rosca	Rosca	Difference
In couple	0.549	0.721	-0.172***
			(0.0296)
Years spent i Kibera	9.170	10.10	-0.927*
			(0.449)
Age	28.30	32.73	-4.430***
			(0.574)
Number of kids	2.195	2.277	-0.0822
			(0.0995)
Has completed primary school	0.608	0.477	0.131***
			(0.0301)
Has permanent employment	0.346	0.595	-0.249***
			(0.0294)
Works in informal sector	0.219	0.520	-0.301***
			(0.0269)
Works in trade	0.0889	0.461	-0.372***
			(0.0219)
Household income	7885.0	8687.3	-802.3
			(574.4)
Monthly individual income	2847.0	4294.1	-1447.1***
			(330.0)
Observations	1318		

Standard errors in parentheses

*p< 0.05, ** p< 0.01, *** p< 0.001

6.5 Major Problems

Of the 338 roscas observations, 172 reported the group having major problems. Table 10 reports the reason for the problems, where each respondent could answer yes to more than one answer. Irregular payments of contributions and irregular

meeting attendance are the two most reported problems with 74% and 49% respectively. Having problems with irregular payments of due contributions is a major problem as roscas are not sustainable if payments are not made. Reporting irregular meeting attendance as another major problem indicates the importance of the meetings themselves. This could be because meeting attendance serves as an indicator of commitment to the group. Encouraging group solidarity is a possible way to improve the sustainability of the rosca.

Table 10: Major problems encountered by rosca

Problem	Count	Percentage
Leadership and rivalry	9	5,23 %
Money and theft	16	9,30 %
Irregular meeting attendance	84	48,84 %
Irregular payments of due contributions	127	73,84 %
Some members do not obey the rules	15	8,72 %
Other	3	1,74 %
Total	172	

Table 11: Reasons for no longer participating in rosca

Reason	Count	Percentage
Could not pay regularly / amount was too high	92	40,17 %
There were problems with money/theft	19	8,30 %
There were problems with leadership and rivalries	35	15,28 %
Collapsed - leadership and rivalry problems	9	3,93 %
Collapsed - money problems/ theft	13	5,68 %
Collapsed - members could not pay	41	17,90 %
Collapsed - members lost interest	13	5,68 %
Other Reasons	7	3,06 %
Total Observations	229	

Members of rosca groups where asked whether they had participated in a rosca previously in which they were no longer a member. If they answered yes, they were asked to give the reason why they left the group. These questions were only asked to respondents who were a member of a rosca when the survey was carried out, so these numbers do not reflect individual who were rosca members previously but

not at the time of the survey. The results are reported in table 11, where there is only one response per individual. Of the 287 observations, 160 respondents had been a member of one or more roscas, generating a total of 229 groups which they were asked to give a reason for leaving. The inability to pay, either for one's own part or for so many members that the group collapsed, was the main reason why members left groups. Problems with leadership and rivalries were also a common problem.

7 Conclusion

A rotating savings and credit association is able to provide goods or benefits that are missing or under-provided in the community and is one of the most common informal financial institutions found in the developing world (Ardener, 1964; Geertz, 1962). The rosca as an institution can be characterized as being both economic, social and cultural.

As an economic institution, we have seen that the rosca is able to provide saving, credit and insurance opportunities. Besley et al. (1993) showed that the rosca is able to pool limited resources among its members, making (a majority of) the members better off by being able to obtain an invisible good sooner than they would have when saving on their own. This motive for joining a rosca has been named the "Early Pot Motive". The members of a rosca want to receive the good early in the rotation so that they can enjoy the indivisible good for a longer period of time.

A recipient of the pot is paying down what is essentially a loan from other members for the remaining periods while a member who is still waiting for the pot is saving each period. In this way the rosca is able to serve both as a savings and credit institution.

The rosca is able to provide insurance by allowing members to receive the pot earlier than their receipt date in the case of need. In order for the rosca to serve this purpose, the recipient must still be waiting for his receipt date. This gives an incentive for members to have a late receipt date if they consider it possible that they will have an urgent need for the pot at some point during the rotation. If the timing of uncertainty is known, rosca members want to receive the pot in the period where they have increased uncertainty in order to smoothen consumption. This gives a scope for members with heterogeneous risk profiles to join together in a rosca.

However, if the timing of uncertainty is unknown and members have heterogeneous risk profiles, members with high income risks might want to have late receipt dates because they consider the insurance motive to be more relevant than the "Early Pot

Motive". In this case, members differ in their valuation of receipt dates. Members can also be heterogeneous in their valuation of the indivisible good. One way of sorting these unequal valuations is to use a bidding rosca to decide the order of receipts, where the bid corresponds to each period's contribution. Members with low risk profiles and high valuations of the indivisible good will be willing to offer high bids to be early recipients of the pot. Rosca members in a bidding rosca are able to realize gains from trade between heterogeneous individuals that would otherwise not have been realized in a fixed contribution rosca.

As a social institution, we have seen that the rosca is able to serve as a social meeting place and a provider of social aid. In addition, the rosca is able to overcome social problems such as not being able to save due to inconsistent time preferences, procrastination, weakness of will or demanding family members and neighbors.

The rosca allows an individual who finds it difficult to save alone to tie their hands by joining a rosca. For instance, if the social and economic punishments associated with defaulting on contributions is large enough, an individual who would otherwise not have been able to save in the future might now find it preferable to continue paying contributions rather than defaulting in order to consume instead.

The rosca can also help an individual who finds it difficult to save at home when demands are high to ensure a higher savings rate than would otherwise have prevailed by joining a rosca. If the individual joins the rosca without her family's consent[19], continued membership might be considered preferable to defaulting from payment due to the harsh punishments associated with default. Once the pot is brought home, it might be large enough to ensure that the individual's needs are met to a larger extent than they would have been had she not joined a rosca.

As a cultural institution, we have seen that a rosca can be influenced by cultural fairness norms when deciding the organizational design of the rosca. Members might consider it to be fair to equalize expected receipt dates, implying that they should organize the rosca as a random order rosca. If they consider it to be fair

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[19]This motive for joining a rosca is associated with women protecting their savings from their husbands, but could also be valid for both men and women protecting their savings from their extended family and neighbours.

to equalize the waiting time between receipt dates, the rosca should be organized as a fixed order rosca. Finally, they might consider it fair to equalize the utility gain from joining a rosca across members, in which case they should organize the rosca as a bidding rosca.

We have defined the rosca as a reciprocity group, and for any reciprocity group to function, it is vital that each member is committed to the group. This can either be through a strong sense of group mentality, or through mechanisms of enforcement so that the social and/or economic punishment of non-participation is large enough to encourage participation. For roscas this entails that the punishments associated with defaulting on contributions have to be large enough to deter default. The rosca is internally sustainable when all participants contribute to the pot throughout the entire rotation.

In order to ensure internal sustainability, economic and social enforcement mechanisms can be used to deter default. Economic enforcement mechanisms include membership fees and preventing a defaulting member from joining another rosca in the future. However, Anderson et al. (2009) show that such economic enforcement mechanisms can never be large enough to deter default. This highlights the importance of social enforcement mechanisms in ensuring the internal sustainability of a rosca, which is also evident in how most rosca members consider the social stigma associated with defaulting on payments to be so large that doing so is unthinkable.

In order for the rosca to be sustainable, it must also be externally sustainable, which is to say that the rosca must continue to serve a purpose when members are able to join other formal and informal financial institutions. Their wide geographic range and their importance in Kibera, where a wide variety of informal institutions are present, indicate that roscas are externally sustainable in the presence of other informal institutions. For roscas to be externally sustainable when formal institutions are available to members, roscas must be able to offer goods and services that formal institutions are not able to offer, or offer at higher social or economic costs. Roscas are still observed all over the developing world, as well as among immigrants in developed countries (see Srinivasan (1996), Summerfield (1996) and Light and Deng (1996) among others), suggesting that roscas continue

64

to serve an important purpose.

The data from the household survey "Socio-Economic Survey on Poverty and Collective Action in Kibera" (Baland, 1996), has been used throughout this thesis to give the reader an illustration of how the data can be used to give an indication of whether various hypothesis about rosca participation and enforcement are valid. We have observed that members of roscas differ greatly from non-members, which can serve as a basis to hypothesize on why certain individuals join roscas. Observing that women in couples were more likely to be rosca members, for instance, motivated the "Household Conflict Motive" (Anderson and Baland, 2002), and observing that members in fixed order roscas differed from members in random order roscas along many dimensions motivated the theory on organizational design affecting enforcement (Anderson et al., 2009).

Throughout the thesis, various social aspects of the rosca have been highlighted. Social aspects play a vital part in many roscas, either as a motivation for membership or to ensure enforcement, and should always be considered when attempting to gain a thorough understanding of roscas. Understanding the interaction between social and economic roles can be a step forward both in improving the theoretical framework of roscas, which tend to be mainly economic, and in improving the conclusions we draw from participant observations, which tend to be mainly social. Here, there is much scope for further research.

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