

Rosca Participation in Benin: a Commitment Issue*

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Abstract

In the light of first-hand data from a Beninese urban household survey in Cotonou, we investigate several motives aiming to explain participation in Rotating Savings and Credit ASSociations. We provide anecdotal pieces of evidence, descriptive statistics, FIML regressions and matching estimates which tend to indicate that most individuals use their participation in a rosca as a device to commit themselves to save money and to deal with self-control problems.

Keywords: ROSCA, self-control, commitment device, Benin

JEL Classifications: G2, O16, O17

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1 Introduction

There have been numerous studies underlining the importance of rotating savings and credit associations (roscas) in developing countries. There, roscas are commonly found in rural areas and the poorer urban neighbourhoods and drive a considerable part of individuals' savings. Bouman (1995) refers to many african countries showing high rates of participation, from 50 to 95%, and highlights the importance of the savings mobilized in these organizations, in particular in Ethiopia, Kerala, Vietnam and Cameroon. In developed countries, these institutions are mainly used by migrants¹.

A basic description of these associations can be given as follows: A group of individuals gather on a regular basis for a cycle of meetings. At each meeting all members contribute a fixed amount of money to a common pot allocated to one of them. The latter is then excluded from the reception of the collective savings in subsequent meetings but is still obliged to bring her contributions for the rest of the cycle. This process repeats itself until each member has received the pot, which marks the end of a cycle. The rosca may then begin another cycle or decide to break up. Apart from this basic principle, groups vary widely in terms of amount of contributions, number of members, frequency of meetings and functioning. The pot can be allocated either according to a random process² (*random roscas*), through a decision imposed by the governing body of the group (*decision roscas*) or through a bidding process (*bidding roscas*).

Rosca members are mainly poor individuals who have little access to formal savings and credit markets because of high transaction costs and incomplete markets.³ In the literature roscas are usually regarded as a means for poor people to save money in order to make an indivisible expense. Empirical analyses by Handa and Kirton (1999) and van den Brink and Chavas (1997) confirm this view. Evidence we collected from a sample of 497 households in Cotonou, Benin, supports this as well.

Rosca participation implies costs. They do not provide interest rates. More-

¹See among numerous references, Srinivasan (1995) and Summerfield (1995) about migrants in the UK and Bouman (1995) on the capital role of roscas among Korean migrants in Washington DC.

²This can be done once at the beginning of a cycle (establishing the order for its entire duration) or the random draw can be repeated at the beginning of each meeting.

³Conditions for opening an account in any public or private bank of Cotonou - such as fixed guarantee deposit, possession of an identity card (the costs of which are prohibitive) and literacy skills - all act as strong deterrents against poor people.

over, members suffer from the risk of default from other members, from less flexibility than saving on their own - as the rosca saving rate is likely to differ from their optimal saving rate - and, in most cases, from opportunity costs of time spent by taking part in the group's meetings.⁴ Despite all these costs, these groups enjoy popularity which proves that it must be beneficial to their members. This brings the question as to *why individuals would decide to join a rosca instead of saving on their own*.

This important question has received various answers in the literature which are presented in the next section. In the light of our evidence it appears that, in Cotonou, the main reason for enrolling in a rosca is the need of commitment due to self-control problems. If people have present biased preferences or suffer from short-term temptations and are aware of their consequences, it is likely that they would prefer to limit the set of options available to them. They could join a rosca to bind themselves to their second best optimal saving rate thus securing part of their income against everyday temptations. Examined by Ambec and Treich (2007), this rationale was proposed by Aliber (2001) and Gugerty (2007) who indicate that in the absence of alternative commitment saving strategies, people aware of their time inconsistency problem would turn to roscas.

Our paper contributes to the literature in two ways. First it provides original empirical findings in favour of the self-commitment argument. After presenting the determinants of participation and amounts contributed to roscas, we turn to matching estimations of the average effect of roscas participation on some key variables. Second, it documents the fact that Beninese spouses evolve in a non-cooperative framework and that, as a consequence, joining a rosca is an individual decision. Furthermore, it underlines that there does not seem to be any gender effect as to rosca participation in Cotonou.

In the following section, we review the reasons for participation previously given in the literature. We then present in section 3 field evidence that describes how husband and wife interact with each other. Section 4 investigates the self-control commitment issue, section 5 presents conjectures and section 6 describes the survey on which our analysis is based. We offer in section 7 empirical estimates to support our conjectures and alternative explanations for joining a rosca. Section 8 concludes.

⁴Nevertheless our evidence shows that only a few members, if any, considered meeting as valuable time wasted. Several groups organize activities aside from the pot distribution (meals, singing, etc). Meetings are also a precious opportunity for exchanging information although it appears not to be driving membership in itself. Indeed, to the question 'What is the fundamental reason why you joined a rosca?', included in our survey, this reason was never mentioned.

2 Motives for Participation Put Forward in the Literature

2.1 Quick Financing of the Purchase of Durable Goods

As argued in Besley, Coate and Loury (1993), roscas allow individuals to receive the pot earlier than through individual saving which enables them to make the desired indivisible expenses sooner than if they had saved on their own. This applies to all members except the last one in the cycle. Ex-ante, saving through roscas having a non-predetermined order leads all their members to improve over autarkic saving in expectation. Once the indeterminacy of the entire cycle order is unraveled the last pot recipient's situation is ex-post worse provided that the saving rate imposed by the rosca is not optimal for her. Observations collected in Benin do not support such an hypothesis. Out of the 183 roscas included in our dataset 50% have their entire order known before the cycle begins, before any contribution has been paid. In those cases, when the cycle starts there is no uncertainty about the timing of the pot receipt. Either the order is determined by the governing body in a decision rosca according to various criteria (punctuality, good payment records, seniority, membership of the governing body, etc), either in a random rosca the entire order is chosen randomly and known at the beginning of the cycle. Thus as the cycle starts, the median cycle length being 11.54 months, the last recipient could well decide to opt out, ex-ante knowing to be in a worse situation. Backwards induction would then predict the breakdown of the rosca.⁵

Another piece of evidence rendering the Besley et al. (1993) reasoning unfit to the Beninese case is that only 24% of the rosca members in our sample declared that if they could choose they would prefer to receive the pot at the beginning of the cycle while a majority of rosca members (60%) preferred the end.⁶ For those wishing for an early reception of the pot we do not rule out the

⁵In our sample, 93% of all roscas change the order after each cycle is completed. The order of pot reception is therefore rarely repeated from cycle to cycle. But this does not change our argument. For half of the roscas having no uncertainty with respect to the order, members motivated by an early reception of the pot can still decide to opt out, whether or not the cycle order is repeated. Interestingly, according to our characteristic variables there is no difference between a representative member of a rosca with or without uncertainty with respect to the order.

⁶4% declared preferring to receive the pot at mid cycle and 12% were indifferent. Of those preferring to receive first in the cycle: 61% said that they would rapidly use the pot to invest

Besley, Coate and Loury rationale but it remains that this motive is more of an exception.

2.2 Insurance

Another motive for joining a rosca is that such an association can act as a substitute for insurance. This interpretation is mainly valid for the case of bidding roscas and not for random or decision roscas. Bidding roscas is indeed the type of rosca which can best combine the allocation process and the timing of pot reception with respect to members' specific shocks. In our sample only random (64%) and decision roscas (36%) are represented, bidding roscas being seemingly absent in Cotonou. However random and decision roscas can provide insurance to a small extent. Some flexibility can be provided by allowing a member in need to receive the pot at an earlier round. Of all the roscas surveyed 26% stipulated in their rules that changes in the ordering were permitted and to be agreed upon by either consensus of all members or by the governing body. Moreover 44% of all roscas allow two members to change order without knowledge of the rosca's governing body.

Roscas can also provide insurance by offering loans to their members as 20% of all roscas do. Before granting a loan 72% of all roscas carry on investigations to check the truthfulness of each demand. For most of those associations (94%) a loan can only be offered to a member who has not yet received the pot; the pot acting as collateral. In addition, conditions are often imposed (72% of these groups) as for what reasons the loan can be granted (disease, funerals, etc). Loans are regularly solicited in groups offering this opportunity: during the last six months 58% of them granted at least one loan.

Decision roscas, both those imposing an order for the entire cycle and those making meeting-to-meeting decisions often consider desires and needs of members. Half of these groups base their decision on individual member's needs. This insurance aspect is enhanced for roscas based on meeting-to-meeting decision. For roscas fixing the entire ordering before the cycle begins, the insurance they can provide is limited. It can only take into account foreseen or potentially known shocks.

Even though these two types of roscas incorporate some insurance aspects in their functioning, once the pot is received and a shock occurs, there is little

and ease the payment of future contributions with the profits earned, another 25% said that they could rapidly repay debts or enjoy the benefits of having the pot.

if nothing available. Beninese roscas are therefore an imperfect substitute for insurance.⁷ Instead surveyed individuals tend to resort to indemnity funds, a major informal institution for insurance services (LeMay-Boucher, 2008).

2.3 Intra-household Conflicts

Anderson and Baland (2002) present a model of intra-household conflicts in consumption decisions. In their cooperative bargaining framework, men and women, sharing a common budget, exhibit asymmetric preferences for household goods. Those asymmetries drive their model of intra-household conflict for an indivisible good: women have always a larger preference for the indivisible good and therefore want to save at a higher rate than men. In Kenya, members being of an overwhelming majority female⁸ would join a rosca in order to hide or secure their savings from their husband. They could then buy an indivisible good, which they prefer, whereas men would rather opt for present consumption. By joining a rosca, women thus commit part of the household's income against the husband's preferences.

This does not seem to comply with the evidence we collected in Benin. On the one hand, our dataset shows that women seem to participate less in roscas than men: while they represent 51% of all adults, women form a minority (45%) of all rosca members. According to our sample, in Cotonou, 15% of the women take part in roscas, this increases to 21% if in couple and 22% if working (24% if both). Compared to that, 19% of the men are members of such groups, 32% when living in couple and 31% if working (35% if both). Moreover, there is no tendency towards favouring women in group composition: 18% of all roscas surveyed were exclusively composed of women while 26% exclusively of men. For the remaining of groups 63% have a majority of male members. In addition, roscas are not primarily oriented towards women's needs. Our Heckman FIML regressions displayed in Section 7 confirm that this motive is not relevant to the Beninese context. Indeed neither the 'Female' nor 'Female * Couple' variables are significant in our selection in roscas regressions. This shows that gender does not seem to be a relevant variable explaining participation in roscas. As these variables are still non significant in our estimates of the monthly contri-

⁷Contrary to our field observations, Calomiris and Rajaraman (1998) evoke a prevalence of bidding roscas in India and stress their insurance role. See also Klonner (2001).

⁸This bias towards female participation is also confirmed by Ardener (1964), Geertz (1962), Tsai (2000) and Johnson (2004) who respectively focus on India, Java, China and Kenya.

butions for the members in couple, it seems that couple members do not exhibit asymmetric preferences with respect to saving decisions.

On the other hand, were roscas used as a means to put money aside from the husband, membership would have to be kept secret from the husband.⁹ However 40% of the groups of our sample allowing female membership impose spouse's approval for new members. Rosca meetings are usually only open to members but groups do not insist upon secrecy showing that participants are not primarily seeking to commit money against spouses.¹⁰ Moreover, among the 56% of groups which share the financial leftovers of the group, a majority organize a yearly celebration with dances and folklore where friends and neighbours are invited. Even defiles or marches precede those celebrations to attract attention from people in the neighbourhood, advertise the success of their association and generate new memberships.

3 Secrecy and Individual Decisions within Household

During our survey, we carried out several informal meetings with residents of Vossa and Enagnon. These showed us that, regarding money matters, secrecy is the rule between spouses. An important proportion of women and men with whom we spoke declared that their spouse was unaware of the course of their occupational activities and was therefore unable to guess their income. Many said, no matter the gender or age of the respondent: 'the less he/she knows about my activities, the better it is.' Or 'I don't want him/her to know my income otherwise he/she will ask me to meet the cost of such and such expenses.' Spouses are overwhelmingly secretive and it even seems that giving as little in-

⁹It can be argued that, once member of a rosca, a wife could use the threat of social sanctions to convince her husband to let her keep participating. However, this reasoning is valid only in the course of one cycle. Once the cycle is completed, one can freely choose to quit the group, what is commonly accepted. A recalcitrant husband could easily pressure his wife to quit the group at the end of a cycle without incurring social sanctions. Nonetheless, in what we observe in our sample, reasons given by members for leaving a group are not related to that motive (Dagnelie, 2008).

¹⁰Gugerty (2007) and Johnson (2004) find similar evidence in Kenya. In Gugerty's sample, roscas have a structure that is not designed to encourage secrecy among spouses. Gugerty and Johnson also present evidence against the intra-household conflict hypothesis. Indeed Johnson finds out that in the households she surveyed, a majority of couple members managed their money independently.

formation as possible to their partner is quite natural. Hence, spouses rarely ask questions concerning their partner's income or inquire about their activities. It is a kind of convention allowing each member of the couple to keep her income more or less secret. This gives each individual a lot of latitude in managing personal income. Thus by being secretive, spouses avoid sharing their personal earnings or making common budget and retain the sole control over their personal expenditures. LeMay-Boucher and Dagnelie (2008) substantiates this feature of Beninese couples by providing an empirical analysis of the determinants of spouses' patterns of consumption using the same sample.

4 Commitment Device Against Self-control Problems

Two different economic theories suggest that agents might prefer to commit themselves and limit the set of options available to them. Gul and Pesendorfer (2001 and 2004) present a dynamic consistent preferences explanation of this phenomenon, namely the temptation theories. According to their theory, agents undergoing short term temptations in conflict with their long run self interest would be 'unambiguously better off when ex ante undesirable temptations are no longer available' (Gul and Pesendorfer, 2001, p.1406). And even if they do not expect to succumb to the temptation in the future, individuals with self-control problems will expend resources to remove tempting alternatives from their choice sets (ibidem, p.1420). In this case, preference for commitment arises from a desire to avoid temptation rather than from a change in preference.

The second approach, well known in the literature, see Laibson (1996, 1997), O'Donoghue and Rabin (1999), departs from the dynamic consistent preferences hypothesis and corresponds to a reversal of preferences when the date of decision-making approaches. Psychological experiments show that people tend to have present-biased preferences - the shape of which is roughly hyperbolic - and discount time at a non constant rate - higher in the very short than in the longer term¹¹. An individual having self-control problems and being sophisticated - aware of the problem and its consequences - would prefer to commit herself. Her current self may want to restrict the choice set available to her future selves to overcome such time-inconsistencies.

Even if the underlying motives are slightly different according to each of the two theories presented above, their implications appear similar in terms

¹¹where $\delta \leq 1$ and $0 < \beta < 1$ in $U^t(u_t, u_{t+1}, \dots, u_T) = \delta^t u_t + \beta \sum_{\tau=t+1}^T \delta^\tau u_\tau$

of rosca participation. Roscas seem indeed to respond to a need of commitment against one's time inconsistent preferences and temptations. According to Gugerty (2007), in the absence of alternative commitment savings strategies, people having self-control problems and being sophisticated turn to rosca since they would indefinitely renegotiate with themselves¹² if trying to save money on their own. Ashraf et al. (2006) use empirical evidence from a randomized control methodology study in the Philippines to show that women with time inconsistent preferences desire commitment savings devices and rosocas.

Besides rendering the current savings illiquid and safe, rosocas restrict the set of future options as long as the end of the cycle is not reached, compelling the individual to go on saving. Our data do not allow us to identify if individuals in our sample manifest time inconsistency. Hence we cannot formally test the hypothesis according to which individuals having hyperbolic preferences are more likely to join rosocas. However, matching estimates of expenditures made on goods generating temptations, presented in section 7.2, allow us to indirectly test this hypothesis. Moreover, empirical evidence suggests that the need of commitment device is a major motive for membership. Indeed 89% of the rosca members (198 out of 222), answered that they joined a rosca to discipline themselves to save. 'Discipline' or 'the willingness to force savings' being by far the most cited answers suggest that a vast majority of members use the rosca as a means to commit themselves to save.¹³ Despite evidence presented in Table 2, according to which all members use the pot for indivisible expenses, the answer 'buying a durable good' came short as only 22.5% of all participants mentioned it as the reason of their membership.

Moreover the fact that 60% of rosca members prefer to receive the pot at the end of a cycle provides an additional argument.¹⁴ Of all those who preferred being at the end 78% said it was because they did not want to feel indebted towards the group. They consider receiving in the early turns of a cycle as a debt towards the group which they would prefer to avoid. Such debt aversion certainly confirms the incentive and disciplining role of the group which is exerted

¹²At each period, the current self would have present-biased preferences towards consumption and would renegotiate the savings decision made by the previous selves.

¹³Multiple answers could be provided by participants to the open-ended question 'What is the fundamental reason why you joined a rosca?'. Even then we still find that discipline is the most cited motive representing 52% of all answers. Aliber (2001) and Gugerty (2007) reports that a majority of respondents in South Africa and Kenya gave similar answers.

¹⁴This preference is not correlated to the duration of the group membership and therefore not likely to be related to any learning effect.

through peer pressure. As Aliber (2001) writes: 'The debtor-creditor relationships created by roscas between members are characterized by an uncomfortable sense of obligation by the former towards the latter.' An early reception of the pot means that an individual faces the risk of a negative shock throughout the cycle which might make her unable to repay the effective 'loan'. Moreover, in case of default, leaving prematurely the rosca can be costly since sanctions are more severe after pot reception. Thus preference for late reception may simply be due to the agents' risk aversion towards their own default and increased punishment and not to the need of commitment device. In this respect, we would expect that in our sample, salaried individuals, who receive a regular and certain income, are less risk averse than self employed. However we find that both types of agents have similar preferences with respect to the timing of the pot receipt. Furthermore, the most important pot use among the people preferring an early pot reception is 'small business' investment (46%) which is the only risk bearing pot use (see Table 2). This piece of evidence gives more credit to the commitment story. Still we argue that both reasons are likely to be intertwined. Many members told us in informal interviews that apart from minimizing the threat of sanctions, receiving the pot at the end of a cycle provides in itself additional motivation to make payments and complete successfully a cycle. Fear of sanctions and credibility of threats are important factors influencing preferences on the timing of pot receipt¹⁵. At the same time, they are key elements for making a rosca a good commitment device. Would members put too much value on potential sanctions they would quit the rosca and try to save on their own. In this case, we would notice high turnovers which is not what we observe: the average membership duration of all those who provided this answer is 47 months, and only 4.4% said that they joined the group for a fixed number of cycles (the vast majority not knowing how long they were to stay member). All this tends to demonstrate that for a substantial number of individuals, benefits from an early pot reception are outweighed by a mix of risk and debt aversions and the need of commitment.

5 Conjectures

Important implications can be derived from the intra-household consumption decision process that we depicted earlier. Secrecy protects individual earnings

¹⁵Multinomial logit regressions show that important sanctions (seizure, police) and worse sanctions after pot reception increase the probability of preferring the end of the cycle.

to a large extent from spouse pressure and gives husband and wife a very limited ability to bias his/her partner's choice. In the absence of a common decision over an aggregated household budget, spouses have the latitude to make decisions about their savings as if they were single. They both have the ability to manage their income according to their respective will. We can thus formulate a conjecture that would not allow us to test the commitment hypothesis, but rather the intra-household conflict hypothesis :

Conjecture 1 *The probability of joining a rosca does not depend on whether an individual is single or in couple.*

Should the commitment motive be valid, we would expect rosca participation and contributions to raise with individual income. It is likely however that both of them are concave in income as less risky and more flexible opportunities (as a bank account) become available when income rises.¹⁶ A similar prediction on commitment is also proposed by Ambec and Treich (2007) who theoretically investigate the formation of stable informal agreements in developing countries. However this would be a necessary but not sufficient condition for certifying our commitment hypothesis. The intuition would be that as income rises poor agents tend to further protect themselves against increasing temptations. Moreover, sophisticated individuals would want to overcome time-inconsistencies by restricting the set of choices available to their future selves. This forms a second conjecture:

Conjecture 2 *At least at low levels of income, payments made to roscas by individuals in need of a commitment device will be positively linked to income.*

In the next section we present the survey on which our analysis is based, then in section 7 we confront our conjectures with empirical findings.

6 Description of our Survey

Our data collection took place during the first three months of 2004 in the two districts of Vossa and Enagnon located on the outskirts of Cotonou (a city of about 1.1 million inhabitants). Respectively of 63 and 60.1 ha, both are known

¹⁶Our data show that, for the first income quantiles, practically no individual has a bank account contrarily to a maximum of 26% of individuals in the highest quantile.

to the city's authority as being the poorest. Apart from an adjacent slum called Enagnon-plage, Enagnon has been divided into plots in 1998. Vossa and Enagnon are near downtown Cotonou where a large part of their inhabitants work and commute everyday. No formal saving and investment institutions, either public or private, such as banks and NGOs were present in these two districts, the selection of which dates back to a first mission in 2002 that revealed that many informal groups were active there.

We surveyed 497 households: 110 in Vossa and 387 in Enagnon (of which 114 are located in Enagnon-plage). Selection of each household was done randomly. For a maximal accuracy, all members of each household were interviewed separately throughout the successive waves of our survey so that tricky issues related to expenses or income were only tackled privately. Particular attention was thus put on confidentiality which was strictly followed by our enumerators. Further details on our survey methodology can be found in a longer version of the paper.

Table 1 presents basic information on active roscas during our survey according to their gender composition. Exclusively female and male groups have memberships of similar median size. However the median duration (in months) for male only roscas is larger than female only roscas. Female only roscas tend to have a shorter length of cycle and a smaller monthly contribution. Male only roscas resort more frequently to monthly contributions and fewer of them were started by a group of friends or relatives. With respect to the way the pot is allocated, either randomly or by a decision, and to ethnicity composition there is not much of a difference between female and male roscas. It is to be noted that a large majority of roscas are not designed along ethnic or religious patterns. About one group out of five has a secondary activity, mainly providing insurance, which is clearly separated from the rosca activity.

As we saw previously while the quick financing rationale is unfit for our data, saving through roscas is done in order to make an indivisible expense. It is confirmed by Table 2 even though it is far from being the most mentioned motive for joining a rosca¹⁷. We asked all rosca members what they did or intended to do with the pot during the present cycle. Nearly all of them reported that they made or were willing to make an indivisible expense: 49% mentioned investment in their small business (buying stocks of provisions for stores, mo-

¹⁷Gugerty (2007) finds, in her kenyan sample, that more than half of rosca participants use rosca winnings for two or more purposes, offering thus evidence that roscas are not formed only to purchase lumpy durable goods. We however observe that only 14% of rosca members intended to use the pot for more than one purpose.

torcycle repairs for taxis, equipment for fishing, etc), 18% planned to repair or build a house, 11% reported plot purchasing, 7% paid for school tuitions¹⁸, 5% planned to reimburse a personal debt and 14% to buy a durable good. What is meant by 'other durable good' is any type of object or commodity such as tv set, radio, mobile phone, etc.

Incidentally if we look at answers provided by women, we find that 72% of them made an investment in their business. Men's answers are more diversified; they mainly use the pot for business, house repair or building, other durable goods and plot purchase. One can notice the significant difference between male and female expenditures on small business, other durable goods¹⁹ and on house repair and building which is likely related to the customary expenses pattern.

Besley and Levenson (1996) tested a hypothesis according to which, controlling for income, the rosca members would possess more durable goods than non members. We ran similar tests on the durable goods possessed by the households (such as fridge, freezer, stoves, tv set, vcr, stereo system, radio, bed, clock, watch, telephone, mobile phone) but obtained no significant differences between members and non members.

All the 497 households we surveyed represent 2083 individuals of which 894 are aged less than sixteen, our sample thus includes 1179 individuals, divided in 604 women and 575 men. We show in Table 3 relevant statistics according to gender and participation status. These are the variables used in our econometric analysis. We see an important difference in terms of age: mean age of total sample is significantly (at 5%) lower than those of rosca members. Women seem less educated than men as a significantly smaller proportion of them got a primary degree. A larger proportion of male is salaried, this being true whatever the participation status. Differences in monthly income show that rosca members are significantly richer than non members, this remains valid in the female subsample and in the male subsample for monthly expenses. It also appears that female rosca members have more dependents than female non members.

¹⁸Since a majority of public schools ask for very small tuition fees, school fees represent a low percentage. For other selective schools, high fees can be paid in several instalments.

¹⁹The large difference between 'small business' and 'other durable good' with respect to men and women is likely to be exaggerated since answers provided by a proportion of men could be counted in both categories.

7 Empirical Results

7.1 Heckman FIML

We check the empirical validity of our conjectures by estimating participation and contributions with a single procedure: Heckman Full Information Maximum Likelihood²⁰. As people self-select their participation in a group, the observations taken into account in the structural equation are not a random sample. In fact, we suspect unobserved individual characteristics to influence both the probability to join and the amount contributed. We have therefore to tackle the problem of selection bias, producing inconsistent estimates, induced by the correlation between the error term and the regressors. Heckman FIML addresses this problem by simultaneously estimating the selection and structural equations, allowing residuals to be correlated.

Since our survey was carried out in three different areas, we introduced fixed effects removing the area-specific component from the residuals and eliminating the endogeneity caused by unmeasured area characteristics. Taking account of correlation between observations coming from the same environment, we clustered our standard errors at the household level. This produces robust standard errors which would have been wrongly estimated without this correction. Furthermore, the design of our survey was such that the probability of being selected in our sample was different in the three studied areas. We therefore introduced sampling weights for our estimates to be independent of the sample design and consistent (Deaton, 1997).²¹

The first part of Table 4 displays empirical estimates with respect to participation, the dependent variable of the selection equation. We regress alternatively on the whole sample and on a subset incorporating only members in couple. The only difference between the first two columns and the last two is the addition of two regressors, namely female share of household income and its square.

We control for ethnic affiliation even though we suspect that it plays a mi-

²⁰We preferred this technique to the Ahn and Powell semi parametric estimator (the finite sample properties of which are barely known) as it is likely not to perform better than Heckman FIML in such a sample (around 1200 observations and a level of censoring about 80%). (see Fernández Sainz et al., 1999) Moreover, the Ahn and Powell estimator does not produce a selection estimate which is of primary importance in our analysis.

²¹Even if we think that the corrections for cluster and sampling design are appropriate in this case, our results do not depend on these features.

nor role in rosca participation in Cotonou as only a minority of groups are designed along ethnic patterns. These variables can be seen as very rough proxies for social identification and networking²². All the regression results show that ethnic identity is never significant which confirms our suspicion. We include additional regressors such as the dummies for having a primary degree, being salaried (not self-employed) and house owner. None of these is significant. The effect of the number of dependents (a proxy for household expenses) on the probability of joining a rosca is a priori ambiguous. A larger number of children could increase the parents' incentives for saving in order to face future indivisible expenses, conversely more children could involve additional expenses and reduce potential savings. Since this variable is not significant, none of these two interpretations can be confirmed. Stability in one's job, which we measure by whether one has kept one's present job for at least 24 months, affects positively and strongly the probability of joining a rosca. Individuals with more stable income flows over the past expect to be able to commit themselves more easily to regular payments to the pot. The district fixed effects, Vossa and Enagnon, are strongly significant suggesting that unobserved factors specific to each neighbourhood are important.

Most importantly, these estimates allow us to validate our first conjecture. In the first column the coefficients displayed show that neither couple nor the interaction variable between female and couple are significant. An alternative regression displayed in the third column confirms these results since the variables female share of household income and its square are not significant at 10% controlling for the same individual characteristics. This certainly provides evidence in favour of our framework where the decision to join a rosca is individual and independent of marital status considerations²³.

As anticipated, rosca participation is quadratic in income (a measure of individual earned income including transfers). However the maximum is reached at a very high level of income indicating that for most of our sample the proba-

²²Time spent in a neighbourhood could also represent a proxy for trustworthiness. However problems of convergence with FIML technique prevented us from using this variable. When used in the traditional Heckman two-step estimation, it was never significant. Individuals in our sample tend to have a rather long stay in their respective neighbourhoods with a mean of almost sixteen years: see variable 'Number of months same block' in Table 3. Movements across neighbourhoods and migration are more of an exception.

²³We also ran two tests of joint significance on the coefficients of couple and female * couple and on female share and its square. Results do not allow us to reject joint non-significance at a 10% level for both tests.

bility increases in income. Indeed only five individuals out of 1179 have a larger income than the maximum of this quadratic function. When regressing on the whole sample, age also exhibits an inverted U shape, the maximum being at 51 years. This tends to show that savings needs are increasing among young agents establishing a family or small commercial activities and decreasing as they get older²⁴. The significance of the pair of age variables disappears when restricting the sample to the individuals in couple. This could be explained by very similar distributions of age among individuals in couple and rosca members as confirmed by kernel density estimates.

The second part of Table 4 displays estimates with contributions to roscas as the dependent variable. Contributions, in 1000 CFA francs, are expressed in monthly equivalent of the payments made to all the roscas in which a member participates.²⁵ Regressors such as ethnic dummies and district fixed effect are overall non significant. Other personal characteristics: age, female share of household income, house ownership and the number of dependents have no significant effect on contributions. However significant at 10% in the first specification, as a whole gender seems to have no effect on contributions.²⁶

Clearly from our four different regressions only two variables have a consistently significant influence on rosca contributions: income and income square. Rosca contributions are quadratic in income, and only two rosca members have an income larger than the maximum value of this curve. Overall, income has thus a positive effect on contribution for the members of our sample and this confirms our second conjecture. As income increases one individual in need of commitment will raise the total amount of her contribution. It is only at very high level of incomes that alternative saving opportunities appear to be so interesting that the contributed amount could decrease with income. This result provides one additional argument in advocacy of the need for commitment. Another explanation of this result could be that agents make different kinds of

²⁴Note that 2005 estimates for the life expectancy at birth in Benin is 55 years. (Worldbank, 2007).

²⁵Monthly contributions vary between individuals who can decide to belong to several roscas. This is the case for only 6% of all rosca members in our sample. Moreover a member can give multiple contributions in one rosca and thus receive the pot more than once during the same cycle. This is allowed in 29% of the roscas in our sample.

²⁶For the first specification, joint non-significance with the variable 'Female * Couple' could not be rejected. Related regression analyses and descriptive statistics suggest that females who are not in couple make higher contributions than the other members. This could at least partly drive the results in the whole sample case, as confirmed by the regressions restricted to the individuals in couple.

expenses at different levels of income (e.g. richer individuals would tend to buy more expensive goods). However, this does not seem to be the case. Indeed there is no clear income pattern with respect to the type of expenses made with the pot²⁷. Moreover, whatever their income, members do not claim to have joined a rosca for buying specific durable goods and only 2% of the groups impose spending agreements.

Estimates of the structural equation are in accordance with our two conjectures: secrecy and non-cooperation allow spouses to make individual decisions concerning their expenditures net of household public good spending and hence to commit themselves according to their available income. The decisions as to participation and the amount of the contribution seem individual. As robustness checks, we ran other regressions, changing the specification and also using the traditional Heckman two-step procedure. Our conjectures were always verified.

Aside from the FIML estimations we ran tests on the independence of residuals between the selection and structural equations. The hypothesis that both equations residuals are independent is never rejected in all our different specifications. This suggests that the decision to join a rosca and the amount one will contribute in such a device are independent. We believe that individuals have the choice among a few roscas in their neighbourhood and others known through colleagues, friends or relatives. After this filter, the selection in this small set is likely to be made with respect to the amount contributed. Being familiar with other members seems to be the predominant criterion in group selection. In our sample, 68% of all rosca members indeed said that they had selected their group because they knew or had links with other members. The second most cited answer to 'why did you choose this specific rosca?' is because its president was known for well managing the group (14%). Following in importance are answers related to the amount of contribution (12%) and the strictness of the rules (10%). Once individuals have identified groups in which they are familiar with some members, they will join the one(s) more suitable to their saving preferences.

²⁷Even if descriptive statistics do not show any income effect in the pot uses, we cannot exclude that agents buying a plot or building/repairing a house are in general wealthier than the rest of the members. However, once we consider the size of the pot, the coefficient of income becomes insignificant showing that poorer agents could afford large expenses by joining large groups.

7.2 Average Effects of Rosca Participation

If agents join roscas to deal with their self-control problems and to discipline their saving behaviour, their expenditure pattern is expected to reflect this phenomenon. Sophisticated agents might participate in roscas since their long term self would prefer them to reduce their impulse spending, to save and make indivisible expenses. If this assertion is correct, we should be able to find an effect of rosca participation on the proportion of individual non essential (frivolous) expenses (i.e. alcohol, cigarettes, meals out, entertainment, etc.) and savings in the monthly total money uses²⁸. Alternatively, the difference of given transfers between members and non members of roscas could show us whether members use their participation as a means to protect their savings against social pressure.

As people self-select their rosca participation and we do not have experimental, longitudinal data or valid instruments, the only way to evaluate the impact of rosca participation is to turn to matching, selecting on observables. The idea is to create counterfactuals by matching observations presumed to differ only in their treatment status after controlling for covariates. Two conditions have to be satisfied for this approach to be valid: assignment to treatment must be independent on outcomes, conditional on the covariates - i.e. conditional independence assumption (CIA)²⁹ - and the probability of treatment must be bounded away from 0 and 1 - i.e. overlap or support assumption.

We estimate the average effect of treatment for the treated (ATT), τ^t , :

$$\tau^t = \mathbb{E}[Y_i(1) - Y_i(0)|W_i = 1]$$

where $Y_i(1)$ and $Y_i(0)$ are respectively outcomes when receiving and not receiving treatment and W is the treatment variable, here, rosca participation. Even though this technique does not eliminate completely the selection bias, controlling for a large set of covariates (X) should reduce it greatly. What ultimately matters to estimate the average effect for the treated is the following condition:

$$Y_i(0) \perp W|X.$$

If unobservables explain the treatment status but are not related to the outcomes to estimate, the conditional independence assumption is still valid (Im-

²⁸This variable includes expenses made on durable and non durable goods, money put in savings vehicles and transfers given.

²⁹This assumption is also known in the literature as unconfoundedness assumption, ignorable treatment assignment, ignorability assumption.

bens, 2004)³⁰. Although this assumption allowing identification is not directly testable, we acknowledge that it may be a strong assumption in our case. Hence, we check to which extent our results depend on the CIA by running a sensitivity analysis on the ATT estimates when the latter assumption is relaxed as put forward by Ichino et al. (2008) and Nannicini (2007). As is common in similar analyses, they consider that the CIA does not hold unless an unobserved binary variable³¹, U , is introduced in a way that:

$$Y_i(0) \perp W | (X, U).$$

The distribution of this binary variable is defined by the four probabilities that $U = 1$ in the four groups characterized by the treatment status and outcome value.³² U is then added to the set of covariates X for estimating the propensity score and computing the ATT. Simulating different distributions of U therefore allows us to test the sensitivity of the ATT estimates in different cases of the CIA failure.

We limit this sensitivity analysis to using confounders which could, even in the absence of a true causal relationship between Y and W , drive the ATT results obtained without any confounder. In our case, these simulated confounders threatening the baseline estimate (with no confounder) are characterized by simultaneously negative outcome and positive selection effects. As our estimated ATT is negative, we simulate an unobserved variable which simultaneously decreases the superfluous expenses in case of no treatment and increases the probability of belonging to the treated group. Ichino et al. (2006) demonstrate that these two effects are indirectly defined by $d = p_{01} - p_{00}$, the difference of $Pr(U = 1)$ according to outcome values in case of no treatment, and $s = p_{1.} - p_{0.}$, the difference of $Pr(U = 1)$ between the treated and the controls.³³ Table 6, presented in Appendix A, shows that the point estimates of the ATT are quite

³⁰Imbens also puts forward that ‘almost any evaluation of a treatment involves comparisons of units who received the treatment with units who did not’. The question is therefore ‘which units best represent the treated units had they not been treated’ and ‘not whether such a comparison should be made’. (2004, p. 7)

³¹Ichino et al. (2006) use Monte Carlo simulations to show that their two simplifying assumptions, a binary U and the conditional independence of U with respect to X , do not drive the results of their sensitivity analysis.

³²We use a binary transformation of our continuous outcome.

³³As U is associated with $Y_i(0)$ and W , the effects of U on the potential outcome in case of no treatment (Γ) and on the selection into treatment (Λ) have to be evaluated after controlling for X . More details are provided in Appendix A.

stable³⁴ and that very large outcome and selection effects are required to drive the ATT estimates to 0. As we use a set of 15 control variables to compute the selection into treatment, we believe that the existence of such a confounder is not plausible. The validity and robustness of our results are therefore confirmed. It is very unlikely that, in our context, selection on unobservables drives the results derived under the CIA.

The dependent variables of interest, in monthly equivalent, are: the proportion (in total money uses) of frivolous expenses, of savings³⁵ and of given transfers.

We consider several estimators of the average treatment effect on the treated: the bias corrected matching estimator put forward by Abadie and Imbens (2007), and three others based on propensity score matching: local linear regressions (Heckman et al., 1998), biweight kernel estimation and nearest neighbour with random replacement. The controls used for constructing the propensity score - i.e. the conditional probability of receiving the treatment - or for bias correcting are the variables included in the selection part of our Heckman FIML estimations with the exception of ethnic affiliations variables which violate the balancing properties. All our estimates respect the balancing and common support properties.

As 284 non rosca members present no frivolous expenses and therefore do not need to commit against temptations or time inconsistent preferences, we decided to exclude these observations from the sample of interest. Using the whole sample however never produced contradictory results. With the whole sample, the results are confirmed (and of larger magnitude) by the 'Abadie and Imbens' estimator; they are not significant with propensity score matching methods unless the estimates are restricted to the region of thick support (Black and Smith, 2004).³⁶ In this case, only the observations having $0.33 < \widehat{Pr}(W = 1|X) < 0.67$ are taken into account. This produces larger and very significant effects which, in this region, are likely not to be driven by self selection. As income is likely to be a key variable, we created another sample including all the adults of our survey whose individual income belongs to the restricted set of rosca members

³⁴Ichino et al. (2006), mention that the stability of the point estimates is the criterion on which a sensitivity analysis should be assessed rather than the significance of the estimations.

³⁵Contributions to roscas, informal insurance funds, money put in the bank and in money collectors are taken into account in this variable.

³⁶As selection on unobservables is more likely to occur in the tails of the propensity score distributions, Black and Smith suggest to restrict the analysis to the region where the estimated propensity score is included in (0.33, 0.67).

income, removing the 5% richest and poorest rosca members. The same conclusions apply to this case.

We ran similar estimations on the sample of individuals in couple which corroborate the results presented in Table 5. Whichever the estimator³⁷ and the sample used, our results prove quite robust. As bootstrap is not valid to estimate the variance of matching estimators (Abadie and Imbens, 2006), all these estimations use analytical variances³⁸.

As displayed in Table 5, the total money uses variable (1000 CFA), denominator of the three ratio variables, appears not to differ significantly between members and non members. Hence, we can directly compare the different ratios between members and non members and attribute the ratio differences to rosca participation. These estimations show that the proportion of frivolous expenses in total money uses is significantly lower for rosca participants. The magnitude of this effect is evaluated between 0.6 and 1.1 percentage points while the estimated average for non members is 4.5%. It means that rosca members spend, on average, 13.3% to 24.4% less on goods generating temptations, which we suppose their long term self would prefer not to buy.³⁹ As to the proportion of individual savings in total money uses, our results exhibit clearly that rosca members save around 10 percentage points more than non members (the estimated average saving rate of non members being 12.7%). From these two results, added to our previously displayed body of evidence, one is incited to believe that roscas indeed help agents to discipline themselves to save.

Regarding the ratio of given transfers, if rosca members were to use their participation as a protection from requests from friends and relatives, the estimated ratio difference should be negative. As the only weakly significant estimated effect exhibits a positive sign, this possibility seems to have to be discarded. These estimates seem indeed difficult to reconcile with the protection from relatives hypothesis. It rather brings additional credit to our self-commitment rationale. One could indeed object that our result is only a matter of simple accounting since if one item rises, within a fixed budget, an equivalent decline in one or several others should be observed. As the share of given transfers tends to increase with rosca participation, this mechanical justification does not seem at

³⁷We also used blocking-on-the-propensity-score estimations which produced the same results.

³⁸Our results however do not depend on this feature; bootstrapped standard errors produce similar results.

³⁹As frivolous expenses is a small budget item, the magnitude of this effect cannot solely explain rosca participation.

work here.

7.3 Alternative Explanations for Joining a Rosca

From the secrecy framework depicted in section 3, one could imagine that rosca are simply a tool for hiding money to one's partner and helping spouses reduce their contribution to the provision of household public goods. Once put in a rosca, money would not be available for the household's needs. This rationale is however not supported since the variable 'in couple' is never significant in our regressions.⁴⁰ Moreover, of the members in couple only 15% (23/157), mostly male, admit that their spouse is not aware of their rosca membership while 29% declare that the amount of the contribution is unknown to their partner and 54% concede that the time of pot reception is not known. Even if rosca can be a tool for helping secretive partners to hide money, these figures do not suggest it is a widespread motive for joining a rosca⁴¹.

In our sample, 20% of members mentioned that they joined a rosca to protect their savings. It can mean two things that cannot be disentangled. On the one hand, members can wish to put money out of reach from social pressure (financial help being requested on a regular basis from family, friends and neighbours) and potential requests from their spouse. As to the former respect, Platteau (2000) argues that by joining a rosca, one opts for a socially accepted alibi to protect one's savings against all types of social pressures. However, estimates of subsection 7.2 tend to give a lesser weight to this motive. Regarding requests from the spouse, the household budget structure and secrecy inside the couple are such that this kind of claims is greatly reduced. On the other hand, it can also mean protection against risks of theft, fire or other catastrophes which were also evoked during informal interviews. To reduce risks and protect cash money against such adversities people would prefer not to save at home and secure their savings in a rosca. Far from being the most important answer explaining members' participation, the fact that one out of five members emphasizes protection gives credit to this alternative rationale. Moreover protection of savings is a motive for participation which also satisfies our second conjecture. Indeed, an individual facing a fixed probability of theft and an

⁴⁰Besides the variables female or individual share of the household income were never significant in additional regressions.

⁴¹In fact this answer was not given by a single of the 222 members in our sample to the question: 'What is the fundamental reason why you joined a rosca?'

increasing demand from relatives in income can be strictly better off by joining a rosca at higher levels of income (Anderson et al. 2002).

Although our evidence leads us to think that people join a rosca to commit themselves against self-control problems, we cannot rule out that their participation may be also driven by the need to protect savings from hazards: theft, fire, etc.

8 Conclusion

Our empirical evidence shows that rosca participation is not a gender issue in Cotonou. Given secrecy and the household budget structure, each spouse retains the control over his/her spendings and therefore decides individually to join a rosca. This feature, probably pervasive in West Africa, should be taken into account before implementing policies designed to favour any gender.

Recent studies have emphasized that roscas can be used as a commitment device against two categories of potential threats. Individuals could join roscas to protect themselves against external threats such as pressure from their spouse stemming from asymmetric preferences, from the household expenses pattern or social pressure (assistance to relatives or friends). Alternatively, agents could be willing to secure their income against internal threats such as temptations and present-biased preferences. This commitment motive is in line with our regressions.

Our investigations lead us to think that, in Cotonou, most of the agents participate in roscas to discipline themselves to save. Our body of evidence and matching estimates suggest that self-control problems are widespread and that people, living in the poor districts covered by our survey, value savings commitment mechanisms as roscas. Projects favouring the establishment of formal saving and commitment vehicles in Vossa and Enagnon, and certainly in other poor districts of Cotonou, would therefore most probably meet with success.

APPENDIX

A Sensitivity Analysis

In Table 6, we present point estimates of the average treatment for the treated (ATT) to be compared to the baseline estimate with no confounder and a neutral

confounder. This analysis aims at making vary the outcome and selection effects to see the impact of the simulated confounders on the ATT estimates. Then, according to the magnitudes of the outcome and selection effects required for the ATT estimates to be driven to zero or to deviate substantially from the baseline estimate, the plausibility of the ATT under CIA is assessed.

$d = p_{01} - p_{00}$ and $s = p_{1.} - p_{0.}$ define the probabilities p_{ij} with $i, j = \{0, 1\}$, once $Pr(U = 1)$ (0.45 in our case) and $p_{11} - p_{10} = 0$ have been fixed, and indirectly determine Γ and Λ . Γ and Λ are average odds ratios of U and respectively represent the outcome and the selection effect of the simulated confounder. Γ is the effect of U on the relative probability to have a positive outcome in case of no treatment. Λ is the effect of U on the relative probability to be assigned to the treatment controlling for the set of covariates X .

In our context, one could imagine that the unobserved variable represents the discipline of the agent. Hence, as explained in Ichino et al. (2008), moving to the right across each row of Table 6, discipline has a greater influence on the selection into treatment (keeping the outcome effect fixed). On the contrary, moving down each column, discipline has a greater influence on the untreated outcome (keeping the selection effect fixed).

Compared to the baseline estimate of -0.009 (s.e. 0.003) and to an estimation of a neutral confounder (with neutral outcome and selection effects, $\Gamma=\Lambda=1$) of -0.007 (s.e. 0.004), we see that a strong perturbation of the ATT is only observed if both effects are combined and quite strong. We ran similar exercises with simultaneously positive and simultaneously negative outcome and selection effects, both of them leading to the same conclusion. We therefore think that the results obtained under the CIA are robust to plausible failures of this assumption.

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	All roscas	Women only	Men only	Mixed
Number of members (median)	22	19	20	28
Months existed (median)	36	12	24	60
Monthly contribution (median)	8667	4800	6000	8667
Length of cycle (median. in months)	11.54	6.92	15	11.54
Contribute every 4 days	0.11	0.125	0	0.16
Contribute every week	0.36	0.28	0.28	0.42
Contribute every 2 weeks	0.09	0.09	0.09	0.1
Contribute every month	0.39	0.34	0.64	0.29
Exclusively female group	0.17	1	0	0
Exclusively male group	0.26	0	1	0
Same ethnic affiliation for all members	0.22	0.31	0.36	0.125
Fixed order	0.36	0.25	0.32	0.4
Random order	0.64	0.75	0.68	0.6
Order is unchanged each cycle	0.07	0.1	0.09	0.05
Order known for the entire cycle	0.5	0.625	0.47	0.47
Order known for the entire cycle when fixed	0.34	0.375	0.27	0.36
Order known for the entire cycle when random	0.65	0.79	0.625	0.61
Group started with friends/relatives/neighbours	0.73	0.78	0.57	0.78
Group has a secondary activity	0.19	0.16	0.11	0.23
Number of observations	183	32	47	104

Table 1: Group Characteristics.

	All members	Women	Men
Do not know yet	0.02	0.01	0.03
Tuition fees	0.07	0.06	0.07
Health expenses	0.02	0.02	0.02
Financial aid / debt	0.05	0.07	0.02
Luxury expenses	0.05	0.08	0.03
Party / funeral	0.03	0.02	0.03
Brideprice	0.00	0.00	0.01
Plot purchase	0.11	0.10	0.12
House repair / building	0.18	0.08	0.26
Small business	0.49	0.72	0.30
Travel expenses	0.02	0.01	0.02
Other durable good	0.14	0.03	0.23
Other	0.02	0.03	0.01
Number of observations	222	97	125

Table 2: Pot Uses (multiple answers).

	Total Sample				Women				Men			
	All		Rosca members		All		Rosca members		All		Rosca members	
Participates in Rosca	0.17	(0.03)	1	(0)	0.15	(0.02)	1	(0)	0.19	(0.03)	1	(0)
Total monthly rosca contribution	1804	(256)	10492	(1452)	1646	(259)	10898	(1617)	1969	(274)	10161	(1329)
Female	0.51	(0.00)	0.45	(0.02)								
Age	33.1	(0.25)	39.8	(0.97)	32.9	(0.49)	39.7	(1.09)	33.3	(0.05)	39.8	(0.87)
In couple	0.52	(0.04)	0.74	(0.07)	0.52	(0.04)	0.69	(0.09)	0.52	(0.04)	0.79	(0.06)
Primary degree	0.28	(0.02)	0.23	(0.07)	0.18	(0.01)	0.12	(0.05)	0.40	(0.02)	0.32	(0.09)
Salaried	0.12	(0.01)	0.19	(0.02)	0.03	(0.01)	0.05	(0.03)	0.22	(0.01)	0.30	(0.02)
Monthly individual income	48223	(2672)	86377	(5235)	40554	(1739)	69386	(2673)	56237	(3720)	100212	(12663)
Monthly individual expenditures	30789	(2912)	47682	(2075)	27671	(2711)	43746	(3289)	34049	(3124)	50888	(859)
Number of dependents	1.91	(0.19)	3.18	(0.30)	2.05	(0.12)	3.37	(0.11)	1.77	(0.27)	3.02	(0.48)
House owner	0.70	(0.02)	0.72	(0.04)	0.70	(0.02)	0.77	(0.05)	0.70	(0.02)	0.68	(0.05)
Number of months, same job	85	(2)	159	(19)	82	(2)	155	(16)	87	(5)	163	(22)
Number of months, same block	191	(15)	226	(12)	174	(19)	183	(12)	209	(11)	261	(11)
Native Language : Ashanti	0.01	(0.00)	0.01	(0.01)	0.00	(0.00)	0.01	(0.01)	0.01	(0.01)	0.01	(0.01)
Native Language : Fon	0.33	(0.14)	0.29	(0.13)	0.31	(0.12)	0.23	(0.07)	0.34	(0.16)	0.34	(0.18)
Native Language : Popo	0.35	(0.05)	0.43	(0.09)	0.37	(0.04)	0.48	(0.13)	0.33	(0.07)	0.38	(0.08)
Native Language : Yoruba	0.04	(0.01)	0.04	(0.01)	0.04	(0.02)	0.06	(0.02)	0.04	(0.01)	0.03	(0.01)
Native Language : Fulani	0.03	(0.03)	0.03	(0.03)	0.02	(0.02)	0.02	(0.02)	0.04	(0.04)	0.04	(0.04)
Native Language : Goun	0.23	(0.12)	0.19	(0.14)	0.24	(0.10)	0.18	(0.13)	0.22	(0.14)	0.19	(0.14)
Vossa	0.58	(0.38)	0.53	(0.37)	0.58	(0.38)	0.56	(0.37)	0.58	(0.38)	0.51	(0.38)
Enagnon	0.31	(0.34)	0.25	(0.29)	0.31	(0.34)	0.23	(0.27)	0.31	(0.35)	0.27	(0.30)
Beach	0.11	(0.15)	0.22	(0.26)	0.11	(0.15)	0.22	(0.26)	0.10	(0.14)	0.22	(0.26)
Number of observations	1179		222		604		97		575		125	

standard errors in parentheses

statistics corrected with sampling weights

Table 3: Individual characteristics with respect to rosca participation.

HECKMAN FIML ESTIMATES OF PARTICIPATION AND MONTHLY CONTRIBUTION

	All sample		In couple		All sample		In couple	
<i>Selection equation: participation</i>								
Female	-0.200	(0.236)	-0.058	(0.205)	0.200	(0.587)	-0.058	(0.205)
Couple	-0.098	(0.213)			0.447	(0.595)		
Female * Couple	0.200	(0.229)			-0.205	(0.595)		
Individual income (1000 CFA)	0.008 ***	(0.002)	0.006 **	(0.002)	0.007 ***	(0.002)	0.006 **	(0.003)
(Individual income) ²	-7.10e-06***	(2.67e-06)	-5.07e-06 *	(2.61e-06)	-7.16e-06 **	(2.80e-06)	-5.11e-06 *	(2.78e-06)
Female share of household income					-2.080	(2.370)	-2.416	(2.247)
(Female share of household income) ²					1.677	(2.366)	1.988	(2.279)
Age	0.102 ***	(0.034)	0.038	(0.046)	0.105 ***	(0.034)	0.040	(0.047)
(Age) ²	-1.12e-03***	(3.95e-04)	-4.36e-04	(5.10e-04)	-1.14e-03***	(4.00e-04)	-4.48e-04	(5.24e-04)
Number of dependents	0.018	(0.040)	0.019	(0.048)	0.017	(0.042)	0.017	(0.050)
Primary degree	0.109	(0.259)	0.104	(0.343)	0.106	(0.239)	0.099	(0.313)
Same job for 24 months or more	0.393 **	(0.158)	0.414 **	(0.182)	0.400 **	(0.164)	0.423 **	(0.191)
Salaried	0.301	(0.263)	0.292	(0.309)	0.320	(0.260)	0.332	(0.313)
House owner	0.183	(0.157)	0.077	(0.195)	0.181	(0.154)	0.079	(0.194)
Ashanti	0.289	(0.520)	0.782	(0.593)	0.079	(0.542)	0.593	(0.609)
Fon	-0.166	(0.320)	0.130	(0.350)	-0.155	(0.317)	0.155	(0.329)
Goun	-0.157	(0.298)	0.204	(0.344)	-0.156	(0.295)	0.214	(0.326)
Popo	0.033	(0.299)	0.392	(0.338)	0.026	(0.296)	0.386	(0.317)
Fulani	0.390	(0.390)	-0.327	(0.597)	0.384	(0.389)	-0.322	(0.590)
Vossa	-0.525 ***	(0.169)	-0.582 ***	(0.206)	-0.548 ***	(0.165)	-0.624 ***	(0.202)
Enagnon	-0.641 ***	(0.142)	-0.785 ***	(0.172)	-0.660 ***	(0.144)	-0.825 ***	(0.180)
Constant	-3.239 ***	(0.684)	-1.998 **	(0.918)	-3.258 ***	(0.678)	-1.380	(1.117)

<i>Structural equation: monthly contribution (1000 CFA)</i>										
Female	5.160	*	(3.000)	0.163	(1.602)	0.361	(6.520)	0.102	(1.573)	
Couple	0.876		(2.242)			-0.555	(7.203)			
Female * Couple	-4.731		(3.320)			0.009	(6.650)			
Individual income (1000 CFA)	0.061	**	(0.028)	0.064	**	(0.028)	0.065	**	(0.027)	
(Individual income) ²	-6.41e-05	**	(2.76e-05)	-6.78e-05	**	(2.93e-05)	-6.70e-05	**	(2.82e-05)	
Female share of household income						1.779	(26.507)	0.457	(27.390)	
(Female share of household income) ²						3.045	(23.566)	4.455	(23.789)	
Age	-1.153		(0.825)	-0.545	(0.735)	-1.186	(0.832)	-0.598	(0.786)	
(Age) ²	0.013		(0.009)	0.006	(0.008)	0.013	(0.009)	0.006	(0.008)	
Number of dependents	-0.419		(0.309)	-0.348	(0.403)	-0.436	(0.321)	-0.357	(0.421)	
House owner	-0.596		(1.694)	-1.338	(2.035)	-0.577	(1.740)	-1.281	(2.068)	
Ashanti	-5.624	**	(2.819)	-7.120	*	(3.944)	-4.053	(2.974)	-5.832	(4.016)
Fon	0.387		(2.835)	-3.012	(3.092)	0.519	(2.889)	-2.720	(3.433)	
Goun	0.314		(2.407)	-1.295	(2.663)	0.431	(2.439)	-1.063	(2.925)	
Popo	-1.277		(2.097)	-1.965	(2.690)	-1.019	(2.224)	-1.525	(2.970)	
Fulani	-4.600		(3.146)	1.892	(4.291)	-4.334	(3.337)	2.804	(4.619)	
Vossa	7.029	**	(3.092)	7.460	*	(3.824)	7.204	**	(3.372)	
Enagnon	4.165		(2.861)	4.487	(3.481)	4.247	(3.068)	4.680	(3.953)	
Constant	32.717		(20.739)	22.421	(19.264)	33.289	(20.714)	22.226	(19.055)	
Number of observations	1179			587		1174		582		
Number of censored observations	957			530		953		426		
Number of uncensored observations	222			157		221		156		

standard errors in parentheses,

**** significant at 1%, ** significant at 5%, * significant at 10%*

Table 4: Heckman FIML.

	Matching ^a	Biweight kernel ^b	LLR ^c	NNM ^d
Ratio of frivolous exp.	-0.011(0.003)***	-0.006(0.003) **	-0.006(0.003) **	-0.009(0.003)***
Ratio of savings	0.116 (0.012)***	0.103 (0.012) ***	0.101 (0.012)***	0.116 (0.014)***
Ratio of given transfers	0.010 (0.005) *	0.005 (0.005)	0.005 (0.005)	0.007 (0.006)
Total money uses	-3.237(6.440)	0.309 (6.422)	1.112 (6.632)	1.764 (7.581)
Number of observations	895			
Controls		673	673	162
Treated		218	218	222

standard errors in parentheses

*** significant at 1%, ** significant at 5%, * significant at 10%

^a Bias corrected matching estimator a la Abadie & Imbens - Stata command: nnmatch

^b Biweight kernel based on propensity score - Stata command: psmatch2

^c Local linear regression with biweight kernel and propensity score - psmatch2

^d Nearest neighbour with random draw, replacement and propensity score - pscore

Table 5: Matching estimations of average effect of rosca participation.

	s = 0.1 $\Lambda \in [1.2, 1.52]$	s = 0.2 $\Lambda \in [1.78, 2.35]$	s = 0.3 $\Lambda \in [3.14, 3.84]$	s = 0.4 $\Lambda \in [5.63, 7.61]$	s = 0.5 $\Lambda \in [12.21, 15.14]$	s = 0.6 $\Lambda \in [61.37, 85.84]$
d = -0.1 $\Gamma \in [0.63, 0.68]$	-0.006 (0.004)	-0.006 (0.004)	-0.005 (0.004)	-0.005 (0.005)	-0.004 (0.005)	-0.003 (0.005)
d = -0.2 $\Gamma \in [0.40, 0.44]$	-0.007 (0.004)	-0.005 (0.004)	-0.004 (0.005)	-0.003 (0.005)	-0.002 (0.005)	-0.001 (0.005)
d = -0.3 $\Gamma \in [0.22, 0.28]$	-0.006 (0.004)	-0.005 (0.004)	-0.003 (0.004)	-0.001 (0.004)	0.000 (0.005)	0.002 (0.005)
d = -0.4 $\Gamma \in [0.12, 0.17]$	-0.007 (0.004)	-0.004 (0.004)	-0.002 (0.004)	0.000 (0.004)	0.002 (0.004)	0.004 (0.004)
d = -0.5 $\Gamma \in [0.04, 0.10]$	-0.006 (0.004)	-0.004 (0.004)	-0.001 (0.004)	0.002 (0.004)	0.004 (0.004)	0.007 (0.004)
d = -0.6 $\Gamma \in [0.002, 0.05]$	-0.006 (0.004)	-0.004 (0.004)	0.000 (0.004)	0.003 (0.004)	0.006 (0.004)	0.009 (0.003)

Standard errors in parentheses

All point estimates are averaged over 250 simulations.

ATT estimates - Stata command: sensatt (Nannicini, 2007)

Table 6: Sensitivity analysis on the share of frivolous expenses