Rosca Participation in Benin: A Commitment Issue*

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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, Full Information Maximum Likelihood (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.

I. Introduction

As put and emphasized by Rutherford (2000), the poor need, can and want to save and, although often understated, savings should play an important part in the elaboration of strategies aiming at poverty alleviation. Therefore, understanding through what means the poor manage to save and what motivates them to do so can have important policy implications. This research is aimed at enhancing our knowledge of one of the most pervasive savings vehicles in the developing world. Indeed, numerous studies underline the importance of Rotating Savings and Credit Associations (roscas) in developing countries where they channel a considerable part of individuals' savings (see Bouman, 1995).

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 pot in subsequent meetings but is still obliged to put in her contributions up until the end of the cycle. This process repeats itself until each member has received the pot, marking the end of a cycle. The rosca may then renew

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another cycle or choose to break up. Except for this basic principle, groups vary widely in terms of the amount contributed, number of members, frequency of meetings and functioning. The pot can be allocated either according to a random process (*random roscas*), based upon a decision imposed by the governing body of the group (*decision roscas*) or through a bidding process (*bidding roscas*).

Rosca members are mostly poor individuals who have little access to formal savings and credit markets because of high transaction costs and incomplete markets.[1] In the literature, roscas are usually regarded as a means for poor people to save money to make an indivisible expense (van den Brink and Chavas, 1997; Handa and Kirton, 1999). However, roscas present certain drawbacks: they do not provide interest on the money contributed. Moreover, participants are subject to other members defaulting and enjoy less flexibility than when saving on their own. Despite these flaws, these groups are very popular in developing countries. This provides evidence for them being beneficial to their members. This raises the question as to *why individuals would decide to join a rosca instead of saving on their own*.

This important matter has prompted various responses in the literature. In the light of our evidence it appears that, in Cotonou, the main reason for enrolling in a rosca is the need to commit because of self-control problems. If people have present-biased preferences or suffer from short-term temptations and are aware of their consequences, it is likely they will prefer to limit the set of options available to them. This rationale was proposed by Aliber (2001) and Gugerty (2007) who indicate that, in the absence of alternative commitment saving strategies, people would turn to roscas, mindful of their time-inconsistency problem.

Our article contributes to the literature in several ways. First, it documents that Beninese spouses act in a non-cooperative framework and that, as a consequence, the decisions to join and how much to contribute to a rosca are individual. This, along with other econometric results, enables us to discard the intra-household commitment motive and to put forward the self-control commitment rationale for rosca participation in Benin. Finally, we provide original findings from an indirect test of the hypothesis of commitment against self-control problems, using matching estimates of the average effect of rosca participation on savings and non-essential (frivolous) expenditures.

In the following section, we lay out field evidence that describes how husband and wife interact with each other, as well as the survey on which our analysis is based. Next, section III investigates the commitment issue, section IV presents our hypotheses and section V deals with empirical estimates to support them. Before concluding in section VII, we review in section VI some reasons for participation previously given in the literature and other explanations compatible with our econometric results.

II.   Field evidence and data

Several informal meetings with locals that were carried out during our survey showed us that, regarding money matters, secrecy is the rule between spouses. Partners do not

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[1]Conditions 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 the poor.

pool income. They have independent financial spheres and contribute to household public goods following social norms which allocate budget items within the household according to gender. LeMay-Boucher and Dagnelie (2009) substantiate this characteristic of Beninese couples and provide an empirical analysis of the determinants of spouses' consumption patterns using the same sample. This feature grants Beninese spouses latitude in managing personal income and enables them to retain control over their personal expenditures. To take account of the fact that a household is a collection of separate and individual economies, we had to survey husbands, wives and all other adult members of a household separately and in private so as to ensure confidentiality.

Our data gathering took place in 2004 in three survey areas located on the outskirts of Cotonou, Benin: Vossa, Enagnon and Enagnon-plage, known to be the poorest of the city. No formal savings and investment institutions, whether public or private, such as banks and NGOs were present in these three zones. Four hundred and ninety-seven households were randomly selected to be part of our survey: 110 in Vossa, 273 in Enagnon and 114 in Enagnon-plage. Enumerators were required to meet privately with each and every household member older than 15 years and to collect data not only regarding their socio-economic status but also on their own rosca membership. Since all the households were randomly selected, the selection process of roscas included in this analysis is also random.

All 497 households we surveyed represent 2,083 individuals of which 894 are less than 16 years of age. Our sample thus includes information at the individual level for 1,179 adults, divided into 604 women and 575 men. We show in Table 1 relevant statistics according to gender and participation status and use these variables in our econometric analysis. Women appear to be less educated than men since a significantly smaller proportion of them has got a primary degree. A larger percentage of men is salaried, this remaining true whatever the participation status. Differences in monthly income show that rosca members are significantly richer than non-members. It also seems that rosca members have more dependents than non-members.

III.   Commitment devices

Recent studies emphasize that roscas can be used as a commitment device against two categories of potential risks. Agents could be willing to secure their income against internal threats such as temptations and present-biased preferences. Alternatively, individuals could join roscas to protect themselves against external threats such as pressure from their spouse. Our analysis aims at disentangling one from the other.

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. According to the temptation theories, 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). In this case, the preference for commitment stems from a desire to avoid temptation rather than from a change in preferences.

TABLE 1

Individual characteristics with respect to rosca participation

	Total sample		Women		Men	
	All	Rosca members	All	Rosca members	All	Rosca members
Rosca participation	0.17 (0.02)	1.00 (0.00)	0.15 (0.02)	1.00 (0.00)	0.19 (0.02)	1.00 (0.00)
Total monthly rosca contributions	1.80 (0.25)	10.5 (0.92)***	1.65 (0.32)	10.9 (1.44)***	1.97 (0.31)	10.2 (1.12)***
Female	0.51 (0.01)	0.45 (0.03)*				
Age	33.1 (0.44)	39.8 (1.07)***	32.9 (0.56)	39.7 (1.42)***	33.3 (0.64)	39.8 (1.20)***
Part of a couple	0.52 (0.02)	0.74 (0.04)***	0.52 (0.03)	0.69 (0.06)***	0.52 (0.03)	0.79 (0.05)***
Primary degree	0.29 (0.02)	0.23 (0.04)	0.18 (0.02)	0.12 (0.06)	0.40 (0.03)	0.32 (0.06)
Salaried	0.12 (0.01)	0.19 (0.03)**	0.03 (0.01)	0.05 (0.03)	0.22 (0.02)	0.30 (0.05)*
Monthly individual income	48.2 (2.75)	86.4 (10.6)***	40.6 (1.52)	69.4 (4.77)***	56.2 (5.08)	100 (18.6)***
Monthly individual expenses	30.8 (0.97)	47.7 (2.46)***	27.7 (1.16)	43.7 (3.33)***	34.0 (1.46)	50.9 (3.45)***
Number of dependents	1.91 (0.07)	3.18 (0.19)***	2.05 (0.09)	3.37 (0.22)***	1.77 (0.08)	3.02 (0.23)***
House owner	0.70 (0.03)	0.72 (0.05)	0.70 (0.03)	0.77 (0.05)	0.69 (0.03)	0.68 (0.06)
Number of months, same job	85 (4)	159 (14)***	82 (5)	155 (13)***	88 (6)	163 (19)***
Number of months, same block	191 (8)	226 (17)**	174 (9)	183 (17)	209 (10)	261 (25)**
Native language: Ashanti	0.01 (0.00)	0.01 (0.01)	0.00 (0.00)	0.01 (0.01)	0.01 (0.00)	0.01 (0.01)
Native language: Fon	0.33 (0.03)	0.29 (0.05)	0.31 (0.03)	0.23 (0.07)	0.34 (0.04)	0.34 (0.06)
Native language: Popo	0.35 (0.03)	0.43 (0.05)*	0.37 (0.03)	0.48 (0.07)*	0.33 (0.04)	0.38 (0.06)
Native language: Yoruba	0.04 (0.01)	0.04 (0.02)	0.04 (0.01)	0.06 (0.03)	0.04 (0.01)	0.03 (0.02)
Native language: Fulani	0.03 (0.01)	0.03 (0.01)	0.02 (0.01)	0.02 (0.01)	0.04 (0.01)	0.04 (0.02)
Native language: Goun	0.23 (0.02)	0.19 (0.03)	0.24 (0.03)	0.18 (0.04)	0.22 (0.02)	0.19 (0.04)
Vossa	0.58 (0.02)	0.53 (0.04)	0.58 (0.02)	0.56 (0.06)	0.58 (0.02)	0.52 (0.05)
Enagnon	0.31 (0.01)	0.25 (0.03)**	0.31 (0.01)	0.23 (0.04)**	0.31 (0.02)	0.27 (0.04)
Enagnon-plage	0.11 (0.01)	0.22 (0.02)***	0.11 (0.01)	0.22 (0.03)***	0.11 (0.01)	0.22 (0.03)***
Share of frivolous expenses	0.04 (0.00)	0.04 (0.00)	0.03 (0.00)	0.03 (0.00)	0.04 (0.00)	0.04 (0.00)
Share of savings	0.12 (0.01)	0.23 (0.01)***	0.14 (0.01)	0.25 (0.01)***	0.10 (0.01)	0.22 (0.02)***
Share of given transfers	0.02 (0.00)	0.04 (0.00)***	0.02 (0.00)	0.02 (0.00)**	0.03 (0.00)	0.05 (0.01)***
Total money uses	52.9 (2.20)	93.8 (7.27)***	43.4 (2.01)	78.6 (7.02)***	62.8 (3.69)	106 (11.6)***
Number of observations	1,179	222	604	97	575	125

Notes: Clustered standard errors within parentheses, correction for sampling weights. Differences between members and non-members: ***significant at 1%, **at 5% and *at 10% levels.

The second approach (see Laibson, 1997, among others) departs from the dynamic consistent preferences hypothesis and allocates higher discount factors to earlier than to later time periods. Psychological experiments reveal that people are inclined to have present-biased preferences and discount time at a non-constant rate – higher in the very short-term than in the longer-term. An individual exhibiting such time inconsistency problems as well as being sophisticated (O'Donoghue and Rabin, 1999) – aware of the problem and its consequences – would prefer to commit herself by restricting the set of choices available to her future selves.

Even if the underlying motives are slightly different according to each of the two theories presented before, their implications appear to be similar in terms of rosca participation. Roscas indeed show signs of responding to a need for commitment against one's time-inconsistent preferences and temptations. According to Gugerty (2007), in the absence of alternative commitment savings strategies, sophisticated people experiencing self-control problems turn to roscas since they would indefinitely renegotiate with themselves if attempting to save money on their own. Ashraf, Karlan and Yin (2006) use empirical evidence from a randomized experiment in the Philippines to highlight that women with time-inconsistent preferences value commitment savings devices and roscas.

Besides rendering the current savings illiquid and secure, roscas 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 whether individuals in our sample manifest time inconsistency. Hence, we cannot formally test the hypothesis according to which hyperbolic discounters are more likely to join roscas. However, matching estimates of expenditures made on goods which generate temptations, presented in section V, allow us to indirectly test this hypothesis. Our empirical evidence suggests that the need for a commitment device is a major motive for membership. Indeed, 89% of the rosca members' responses (198 of 222) were that they enlisted to discipline themselves to save; 'discipline' or the 'willingness to bring themselves to save' being by far the most frequent answers.

This is further substantiated by the fact that the end of the cycle is the favoured moment for pot reception of 60% of rosca members.[2] Seventy-eight per cent of the latter value this reception timing since it enables them to avoid any sense of debt towards the group, see Aliber (2001). This aversion to debt reinforces the inciting and disciplining role of the group, exerted through peer pressure. An early reception of the pot exposes the individual to the risk of a negative shock throughout the cycle which might prevent her from paying back her 'loan'. Moreover, considering that sanctions in case of default are more severe after pot reception, a preference for late reception may simply be due to the agent's risk aversion towards her own default and not the need for a commitment device. In this respect, we would expect the salaried individuals of our sample, who receive a regular and certain income, to be less risk-averse than the self-employed. We find, however, that both types of agents have similar preferences regarding the timing of pot reception. Furthermore, among the people favouring an early pot reception, the most frequently quoted

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[2]This preference is not correlated to the duration of group membership and is therefore unlikely to be related to any learning effect.

use for the savings is 'small business' investment (46%), which is the only risk-bearing use of the pot. Although these pieces of evidence give more credit to the commitment story, we believe that both reasons are likely to be intertwined. Informal interviews reveal 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 successfully complete a cycle.

Fear of sanctions and credibility of threats are important factors influencing preferences concerning the timing of pot reception and are key elements for making roscas a good commitment device.[3] Should members attach too much value to potential sanctions, they would leave the group and try saving on their own, this in turn leading to high turnovers. We observe, however, that the average membership duration of those favouring an early pot is 47 months, while only 4.4% claimed that they joined the group for a fixed number of cycles (the vast majority not knowing how long they were to stay members for). All this tends to demonstrate that, for a substantial number of individuals, benefits resulting from an early pot reception are outweighed by a mix of risk and debt aversions and the need for commitment.

Commitment device within the household

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 over an indivisible good: women always have a larger preference for the indivisible good and therefore want to save at a higher rate than men. The members in Kenya, being by an overwhelming majority female, would join a rosca to hide or secure their savings from their husbands. They could then buy an indivisible good, 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, however, does not seem to comply with the evidence we collected in Benin. Our dataset demonstrates that women seem to participate in roscas less often than men: while they represent 51% of all adults, women form a minority (45%) of all rosca members. According to our sample, 15% of the women in Cotonou take part in roscas. This increases to 21% if they are part of a couple and 22% if they have a job – 24% if the two are combined. In comparison, 19% of the men are members of such groups, 32% if part of a couple and 31% if working – 35% if both. Moreover, group composition is not biased towards women: 18% of all roscas surveyed were exclusively composed of women while 26% solely of men. As for the remaining groups, 63% have a majority of male members. In addition, roscas are not primarily oriented towards women's needs. We met no group displaying clear primary objectives such as assisting women, or empowering them in their interactions with their husbands. Thus, gender does not appear to be an important variable in explaining rosca participation. Furthermore, given the Beninese household structure where spouses do not make consumption and savings decisions on a common budget, this

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[3]Multinomial logit regressions show that severe sanctions (e.g. seizure, police) and a gradation of sanctions with respect to the pot reception, increase the probability of preferring the end of the cycle.

rationale seems even less likely to apply in our case. We provide further empirical evidence on these two points in section V.

Besides, if roscas were used as a means to put money out of the husband's reach, membership would have to be kept secret from him.[4] However, 40% of the groups in our sample that allow female membership require the spouse's approval for new members. Moreover, among the 56% of groups sharing the financial leftovers, the majority advertise their group by organizing yearly celebrations involving dances and folklore to which friends and neighbours are invited.

IV. Hypotheses

Important implications can be derived from the intra-household consumption decision process briefly depicted earlier. To a large extent, secrecy protects individual earnings from spouse pressure and grants 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 manage their income and make decisions regarding their savings as though they were single. We can thus formulate a hypothesis to test the validity of the household decision process that we put forward:

Hypothesis 1: The probability of joining a rosca does not depend on whether an individual is single or part of a couple.

Should our data validate this hypothesis, doubts would be cast as to the relevance in Benin of the intra-household commitment motive à la Anderson and Baland.

In their theoretical work, Ambec and Treich (2007) investigate the formation of stable informal agreements in developing countries. They depict an economy where individuals are tempted by the purchase of a superfluous good and exhibit an interest in joining roscas and committing to regular payments to resist such temptations. They predict that rosca contribution increases with member's income as self-control problems intensify. So, should individuals be in need of a commitment device, we would expect to find contributions to roscas to increase with individual income. It is likely, however, that rosca participation and contributions are concave in income, since less risky and more flexible opportunities (i.e. bank account) become available when income rises. This forms a second hypothesis:

Hypothesis 2: At low levels of income, the level of payments made to roscas will be positively linked to income.

However, this represents a necessary but not sufficient condition for certifying our commitment hypothesis as it does not rule out alternative motives for joining a rosca, namely protection of savings against social pressure and risk of theft. We discuss those in detail in the following.

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[4]It can be argued that once a member of a rosca, the wife could use the threat of social sanctions to convince her husband to let her continue participating. However, this reasoning is valid only in the course of one cycle. Once it is completed, one can freely choose to exit from the group without incurring social sanctions, which is commonly accepted. Nevertheless, reasons provided for members departing from a group are not related to that motive in our sample (Dagnelie, 2009).

V.   Empirical results

Rosca participation

We check the empirical validity of our hypotheses by estimating participation and contributions with a single procedure: Heckman Full Information Maximum Likelihood (FIML). Since 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 probablility to join and the size of the contribution. We therefore have 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.

Because errors within households are likely not to be independent, we clustered our standard errors at this level to take account of the correlation between observations coming from the same environment. Furthermore, the design of our survey was such that the chances of being selected in our sample were different in the three studied areas. We therefore introduce sampling weights for our estimates to be independent of the sample design and thus consistent.

The first part of Table 2 displays empirical estimates with respect to participation, the dependent variable of the selection equation being a dummy variable for participating in at least one rosca (only 6% of all rosca members in our sample have multiple memberships). We run regressions alternatively for the whole sample and for a subset incorporating only members who are part of a 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 minor 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 networking.[5] All the regression results show that ethnic identity is never significant, which confirms our intuition. We include additional regressors such as the dummies for having a primary degree, being salaried (not self-employed) and owning a house. None of these are significant. The effect of the number of dependents – a proxy for household expenses – on the probability of joining a rosca is *a priori* ambiguous. Indeed, a larger number of children could increase the parents' incentives to save so as to meet indivisible expenses. Conversely, more children could imply additional expenses and reduce potential savings. Since this variable is not significant, neither of these two interpretations can be confirmed. Job stability, which we measure based on whether one's present job has been kept for at least 24 months, positively and strongly affects the probability of joining a rosca. Individuals with more stable income flows in the past expect to commit more easily to regular payments. Since our survey was carried out in three different areas, we introduce area-specific effects. The district dummies, Vossa and Enagnon, are strongly significant suggesting that unobserved factors, specific to each neighbourhood, are important.

[5]Time spent in a neighbourhood could also represent a proxy for trustworthiness. However, problems of convergence with the FIML technique prevented us from using this variable. When introduced in the traditional Heckman two-step estimation, it was never significant.

TABLE 2

Heckman FIML estimates of participation and monthly contribution

	All sample	In a couple	All sample	In a couple
Selection equation: participation				
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 (1,000 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)

(continued overleaf)

TABLE 2
(Continued)

Structural equation: monthly contribution (1,000 CFA)	All sample	In a couple	All sample	In a couple
Female	5.160*	0.163	0.361	0.102
	(3.000)	(1.602)	(6.520)	(1.573)
Couple	0.876		−0.555	
	(2.242)		(7.203)	
Female × couple	−4.731		0.009	
	(3.320)		(6.650)	
Individual income (1,000 CFA)	0.061**	0.064**	0.065**	0.069**
	(0.028)	(0.028)	(0.027)	(0.031)
(Individual income)^2	−6.41e-05**	−6.78e-05**	−6.70e-05**	−7.17e-05**
	(2.76e-05)	(2.93e-05)	(2.82e-05)	(3.23e-05)
Female share of household income			1.779	0.457
			(26.507)	(27.390)
(Female share of household income)^2			3.045	4.455
			(23.566)	(23.789)
Age	−1.153	−0.545	−1.186	−0.598
	(0.825)	(0.735)	(0.832)	(0.786)
(Age)^2	0.013	0.006	0.013	0.006
	(0.009)	(0.008)	(0.009)	(0.008)
Number of dependents	−0.419	−0.348	−0.436	−0.357
	(0.309)	(0.403)	(0.321)	(0.421)
House owner	−0.596	−1.338	−0.577	−1.281
	(1.694)	(2.035)	(1.740)	(2.068)
Ashanti	−5.624**	−7.120*	−4.053	−5.832
	(2.819)	(3.944)	(2.974)	(4.016)
Fon	0.387	−3.012	0.519	−2.720
	(2.835)	(3.092)	(2.889)	(3.433)
Goun	0.314	−1.295	0.431	−1.063
	(2.407)	(2.663)	(2.439)	(2.925)
Popo	−1.277	−1.965	−1.019	−1.525
	(2.097)	(2.690)	(2.224)	(2.970)
Fulani	−4.600	1.892	−4.334	2.804
	(3.146)	(4.291)	(3.337)	(4.619)
Vossa	7.029**	7.460*	7.204**	7.750*
	(3.092)	(3.824)	(3.372)	(4.414)
Enagnon	4.165	4.487	4.247	4.680
	(2.861)	(3.481)	(3.068)	(3.953)
Constant	32.717	22.421	33.289	22.226
	(20.739)	(19.264)	(20.714)	(19.055)
Number of observations	1,179	587	1,174	582
Number of censored observations	957	530	953	426
Number of uncensored observations	222	157	221	156

Notes: Clustered standard errors within parentheses, correction for sampling weights: ***significant at 1%, **at 5% and *at 10% levels.

But mostly these estimates allow us to validate our first hypothesis. 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 'female share of household income' and its square are not significant at 10%. This provides evidence in favour of our framework where the decision to join a rosca is individual and independent of marital status considerations.[6]

As anticipated, rosca participation is quadratic in income.[7] However, the maximum is reached at a very high level of income indicating that for most of our sample the probability of participation increases with income. Indeed, only 5 individuals out of 1,179 have a larger income than the maximum of this quadratic function. When regressing for the whole sample, age also exhibits an inverted U shape, the maximum being 51 years. This tends to show that the need to save is increasing among young agents and decreasing as they get older.[8] The significance of both age variables disappears when restricting the sample to those part of a couple. This could be explained by very similar age distributions when comparing the subset of individuals with a partner and the subset of rosca members, as confirmed by kernel density estimates.

The second part of Table 2 displays estimates with contributions to roscas being the dependent variable. Contributions, in 1,000 CFA francs, are expressed in monthly equivalent of the payments made to all the roscas in which a member participates.[9] Regressors such as ethnic dummies and district fixed effects 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. Although significant at 10% in the first specification, as a whole, gender seems to have no impact on contributions.[10] Since neither 'female' nor 'female $\times$ couple' variables are significant in both the selection and structural equations, members who are part of a couple do not appear to exhibit asymmetric preferences with respect to savings decisions. This, in addition to Beninese spouses seeming to make individual decisions regarding budget matters, makes it unlikely for roscas to be used as a commitment tool against intra-household conflicts.

It clearly stands out from our four regressions that only two variables have a consistently significant influence on rosca contributions: 'income' and its square. Rosca contributions are quadratic in income, and only two rosca members have an income larger than the maximum value of this curve. Thus income has largely a positive effect on the amount contributed by the members of our sample, which complies with our second hypothesis and the self-control explanation. It is only at very high levels of income that alternative savings opportunities look interesting enough for the contributed amount to decrease with income. These regressions, however, cannot rule out alternative motives for joining a rosca, which we discuss next.

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[6]We also ran tests of joint significance on the coefficients of 'couple' and 'female $\times$ couple' and on 'female share' and its square. We cannot reject joint non-significance at a 10% level for both tests.

[7]Our measure of individually earned income includes all income-generating activities from both formal and informal sectors, as well as earnings from interest on loans made, rents on houses or apartments and received transfers.

[8]Note that the 2005 Worldbank estimate for life expectancy at birth in Benin is 55 years.

[9]Moreover, a member can contribute several times in one rosca and therefore be given the pot more than once during the same cycle. This is allowed in 29% of the roscas in our sample. Thus, our dependent variable takes into account both multiple memberships and multiple contributions within one rosca.

[10]For the first specification, joint non-significance with the variable 'female $\times$ couple' could not be rejected.

Another explanation for our results could be that agents have different expenditure preferences at different levels of income (e.g. wealthier individuals would tend to buy more expensive goods). However, this does not seem to be the case. In fact, there is no clear income pattern with respect to the type of expenditure when using the pot.[11] Moreover, regardless of their level of income, members do not claim to have joined a rosca to buy specific durable goods and only 2% of the groups impose spending agreements.

Estimates of the structural equation are in accordance with our two hypotheses: secrecy and non-cooperation enable spouses to make individual decisions as to their expenditures, net of household public goods spending and hence to commit themselves according to their available income. The decisions regarding participation and the amount of money contributed seem to be individual. By way of robustness checks, we ran other regressions, changing the specification and also following the traditional Heckman two-step procedure. Our hypotheses were always verified.

To ensure that our results are not an artefact due to omitting considerations of the different kinds of roscas people join (community roscas, workmate roscas, friend or relative roscas), we ran regressions correcting selection bias with a multinomial logit for the participation equation, exploiting this stratification of roscas by type. Both our hypotheses remain valid across all specifications.

Average effects of rosca participation

If agents join roscas to deal with their self-control problems, their savings and expenditure on non-essential (frivolous) goods are expected to reflect this. Sophisticated agents might participate in roscas since their long-term self would prefer them to reduce their impulsive spending and rather save money to make indivisible payments. If this assertion is correct, we should be able to find an effect, respectively negative and positive, of rosca participation on the following variables: the shares of individual frivolous expenses and savings over total monthly money uses.[12] Alternatively, the difference in transfers observed between rosca members and non-members could tell 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. Two conditions have to be satisfied for this approach to be valid: assignment to treatment must be independent from outcomes, conditional on the covariates [i.e. conditional independence assumption (CIA)] and the probability of treatment must be bounded away from 0 and 1 (i.e. overlap or support assumption).

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[11]Although descriptive statistics do not show any income effect in the uses of the pot, 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, revealing that poorer agents could afford large expenses by joining large groups.

[12]We define respectively: frivolous expenses as the sum of expenditures made on beverages (alcohol, fizzy drinks, etc.), sweets, cigarettes, meals out and entertainment; savings as the sum of money invested in four different savings vehicles namely money collectors, informal indemnity groups, roscas and formal savings accounts; and total monthly money uses include expenses made on durable and non-durable goods, savings and transfers made.

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

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

where $Y_i(1)$ and $Y_i(0)$ are outcomes when receiving and not receiving treatment, respectively, and W is the treatment variable: rosca participation. What ultimately matters in estimating the average effect on the treated is the following condition: $Y_i(0) \perp W \mid X$. If unobservables explain the treatment status but are not related to the outcomes to be estimated, the CIA remains valid (Imbens, 2004). Although this hypothesis allowing identification is not directly testable, we acknowledge that it may be strong in our case. Hence, we verify the extent to which 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, Mealli and Nannicini (2008) and Nannicini (2007). As is common in similar analyses, they consider that the CIA does not hold unless an unobserved binary variable, U, is introduced in a way that: $Y_i(0) \perp W \mid (X, U)$. 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.[13] 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.

Our analysis, available in a working paper on the authors' web pages, shows that the point estimates of the ATT are quite stable, and that very large outcome and selection effects are required to drive the ATT estimates to 0.[14] 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. Therefore, the validity and robustness of our results are confirmed. It is thus very unlikely that, in our context, selection on unobservables should drive the results derived under the CIA.

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 regression, biweight kernel estimation and nearest neighbour with random replacement. The controls used to construct the propensity score or to correct bias 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 decide to exclude these observations from the sample of interest. Using the whole sample, however, never produces contradictory results.[15] As income is likely to be a key variable, we create another sample including all the adults of our survey whose individual income belongs to the restricted set of rosca members' income, removing the richest and poorest 5% of rosca members. The same conclusions apply to this case. We ran similar estimations for the sample of

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[13]We use a binary transformation of our continuous outcome.

[14]Ichino *et al.* (2008) mention that the stability of the point estimates, rather than the significance of the estimations, is the criterion by which a sensitivity analysis should be assessed.

[15]Taking the whole sample, the results are confirmed and are of larger magnitude with 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', that is, focusing on the observations such that $0.33 < \widehat{\Pr}(W = 1 \mid X) < 0.67$.

TABLE 3

Matching estimations of average effect of rosca participation

	Matching†	Biweight kernel‡	LLR§	NNM¶
Ratio of frivolous expenses	−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

Notes: Standard errors within parentheses: ***significant at 1%, **at 5% and *at 10% levels.
†Bias-corrected matching estimator (Abadie and Imbens) – Stata command: nnmatch.
‡Biweight kernel based on propensity score (Leuven and Sianesi, 2003) – Stata command: psmatch2.
§Local linear regression (LLR) with biweight kernel and propensity score – psmatch2.
¶Nearest neighbour (NNM) with random draw, replacement and propensity score (Becker and Ichino, 2002) – pscore.

individuals with a partner which corroborate the results presented in Table 3. Whichever the estimator and sample used, our results prove robust.

As displayed in Table 3, the 'total money uses' variable (1,000 CFA) appears not to differ significantly between members and non-members. That being so, we can directly compare the different ratios between members and non-members and attribute the ratio differences to rosca participation. These estimations highlight 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%.[16] This means that rosca members spend on average 13.3–24.4% less on 'temptation goods', which we assume their long-term self would prefer not to buy.[17] As to the share of individual savings in total money uses, our results clearly show 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 inclined to believe that roscas actually help agents discipline themselves to save.

Regarding the ratio of given transfers, if rosca members were to use their participation as a means to evade requests from friends and relatives, the estimated ratio difference would be negative. As the only weakly significant estimated effect exhibits a positive sign, this possibility seems to have to be discarded. Admittedly, these estimates prove difficult to reconcile with the 'protection from relatives' hypothesis, which we discuss next at greater length. However, they support 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. But considering

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[16]This difference is mainly driven by men who exhibit a higher share of frivolous expenses. However, this effect, though smaller, also appears to be present and significant in the female subsample. These checks tend to show that the reasons for joining roscas are the same for women and men.

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

that the share of given transfers tends to increase with rosca participation, this mechanical justification does not seem to work here.

VI.   Other motives for participation

Quick financing of the purchase of durable goods

As argued by Besley, Coate and Loury (1993), roscas enable their members to make indivisible payments 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 those roscas that have a non-predetermined order leads all members to improve over autarkic saving in expectation. Once the entire cycle order is known, the last pot recipient is *ex post* worse off, provided that the savings rate imposed by the rosca is not optimal for her. Observations collected in Benin do not seem to support the fact that most individuals join roscas for this reason. For 50% of the 183 roscas of our dataset the entire order is known before the cycle begins, prior to any contribution. In such cases, when the cycle starts there is no uncertainty as to the timing of the pot reception. Thus as the cycle starts, the median cycle length being 11.54 months, the last recipient could decide to opt out, *ex ante* knowing to be at a disadvantage. Backwards induction would then predict the breakdown of the rosca.[18]

Another piece of evidence rendering the Besley *et al.* (1993) reasoning ill-suited to the Beninese case is that only 24% of the rosca members in our sample declared that, given the choice, they would rather receive the pot at the beginning of the cycle. Meanwhile, the majority of rosca members (60%) preferred the end. For those in favour of an early reception of the pot, we do not rule out the Besley, Coate and Loury rationale but it appears that this motive is more of an exception.

While the quick financing rationale does not seem to be supported by our data, and is far from being the most cited motive for joining a rosca, our evidence points to the pot being used to make indivisible expenses. All rosca members were questioned about what they did or how they intended to use the pot during the present cycle. Nearly all of them mentioned making an indivisible expense: 49% reported investing in their small business (buying stocks of provisions for stores, motorcycle repairs for taxis, equipment for fishing, etc.), 18% planned renovating or building a house, 11% reported plot purchasing, 7% paid for school tuitions, 5% planned to reimburse a personal debt and 14% to acquire a durable good (TV set, mobile phone, etc.).

Insurance

Roscas can act as a substitute for insurance, and this could be another motive for joining such an association. However, this interpretation is mainly valid for the case of bidding roscas 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. They can only provide insurance to a small extent. Nevertheless, a

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[18]In our sample, 93% of all roscas change the order after each cycle is completed. However, this does not alter our argument. Interestingly, analyses reveal that there is no significant difference between a representative member of a rosca with or without uncertainty with respect to the order.

certain degree of flexibility can be offered 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 order were permitted. Moreover, 44% of all roscas allow two members to change the sequence without notifying the rosca's governing body.

Roscas can also provide insurance by offering loans to their members, as 20% of all roscas do. For the majority of those associations (94%), a loan can only be offered to a member who has not yet received the pot; the latter acting as collateral.

Half of the decision roscas set the reception order by considering the needs of individual members. This insurance aspect is enhanced for roscas based on meeting-to-meeting decisions. As for roscas whose order is determined before the cycle begins, the insurance they can provide is limited to foreseeable shocks.

Even though roscas can incorporate some insurance aspects in their functioning, once the pot is received and a shock occurs, there is little (if anything) available. Beninese roscas are therefore an imperfect substitute for insurance.[19] Moreover, surveyed individuals tend to resort to informal indemnity funds, specifically designed to provide insurance services (LeMay-Boucher, 2008).

Alternative explanations

From the intra-household decision framework depicted in section II, one can imagine that roscas are merely a tool to conceal money from one's partner and help spouses reduce their contribution to the provision of household public goods. This rationale is not supported, however, since the variables 'couple', 'female' and 'female share of the household income' are never significant in our regressions. Moreover, only 15% of the members who are part of a couple (23/157) admit that their spouse is not aware of their rosca membership, while 29% and 54% declare that the amount contributed and the time of pot reception, respectively, are unknown to their partner. Although roscas can be a means to support money-related secrecy between partners, these figures do not suggest it is a widespread motive for joining a rosca.[20]

In our sample, 20% of the members mentioned that they joined a rosca to protect their savings. This can indicate two things that cannot be disentangled. On one hand, members wish to avoid social pressure (financial help being requested on a regular basis from family, friends and neighbours) and potential requests from their spouses. As to the former, one might argue that by joining a rosca one opts for a socially accepted alibi to safeguard one's savings against all types of social pressure. However, our matching estimates tend to grant less weight to this motive. Regarding requests from the spouse, the household budget structure and secrecy within the couple are such that these kinds of claims are greatly reduced. On the other hand, it can also imply protection against risks of theft, fire or other catastrophies which were also brought up during informal interviews. To reduce these risks and preserve cash funds against such adversities, people would prefer not to save at home but rather secure their savings in a rosca. Far from being the most important

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[19]Contrary to our field observations, Calomiris and Rajaraman (1998) note a prevalence of bidding roscas in India and stress their insurance role.

[20]When asked: 'What is the fundamental reason why you joined a rosca?', not one of the 222 members provided us with an answer to that effect.

answer explaining members' participation, the fact that one of five members emphasizes protection gives credit to this alternative rationale. Moreover, savings protection is a motive for participation which also satisfies our second hypothesis. Indeed, an individual facing a fixed probability of theft and an increasing demand for income from relatives, can be strictly better off by joining a rosca at higher levels of income (Anderson and Baland, 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.

VII. Conclusion

Our empirical evidence shows that rosca participation is not a gender issue in Cotonou. Owing to secrecy and the household budget structure, each spouse retains control over his/her spendings and therefore, individually decides to join a rosca.

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. 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 findings.

Although we cannot formally prove the commitment hypothesis, our matching results of lower superfluous expenses and higher savings rates for rosca participants suggest that self-control problems are widespread, and that people living in the poor districts covered by our survey value savings commitment mechanisms such as roscas.

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