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Now or Later? The Allocation of the Pot and the Insurance Motive in Roscas

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Abstract — We propose a new rationale for the rotating savings and credit associations (roscas) is the Sub-Saharan African (SSA) context. We start from the observation that roscas in SSA use a pre-determined order to allocate the pot and that members often prefer to take the last turn. We argue that, when exchanges of turns are allowed during a cycle, a late turn allows to request the pot when an urgent need arises. Survey data indicate that insurance needs are critical in determining the preferred position of rosca members. We develop a theoretical model to formalize the argument and show that the preference for the last position requires that the probability of a shock is neither too low nor too high. We test this prediction in a lab-in-the-field experiment and confirm that the preference for being last is non-monotonic in the risk of negative shocks.

Key words — Roscas, Insurance, Risk.

***JEL* codes** — D03, D14.

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1 Introduction

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

Despite the gradual expansion of financial markets, rotating saving and credit associations (henceforth roscas) remain one of the most prevalent forms of informal financial institutions in developing countries (see e.g. Gugerty, 2007). In a roscas, a group of people gather for a series of meetings. At each meeting every member contributes money to a common pot which is given to one of them. The member receiving the pot is excluded from receiving the pot in future meetings but keeps contributing. The process is repeated until each member has received the pot. At this point the rosca either disbands or starts a new cycle. There is considerable variation among roscas with respect to the number of members, the frequency of meetings, the contribution and the process through which the pot is allocated. In random roscas the pot is allocated by a random draw; in bidding roscas the allocation is based on a bidding process and in fixed order roscas the order is determined prior to the launch of a cycle.

Thus far, the literature stresses the role of market failures to explain the existence and popularity of roscas. In their seminal paper, Besley et al. (1993) show that, in the absence of a credit market, roscas allow most members to finance a fixed investment or purchase an indivisible good sooner than when saving in autarky. Another reason to join a rosca is to force oneself to accumulate savings: present-biased individuals may use roscas and their regular meetings as a commitment device (Ambec and Treich, 2007; Gugerty, 2007; see also Anderson and Baland, 2002 for a related argument in the context of intra-household bargaining). A third motive for joining a rosca is insurance, which has been investigated in the context of bidding roscas (Calomiris and Rajaraman, 1998; Klonner, 2003). In such roscas, the pot is auctioned off and the bidding process allocates it to the member in greatest need.

In this paper we investigate the potential insurance function of non-bidding roscas in which the order for receiving the pot is pre-determined at the beginning of the cycle. In Sub-Saharan Africa, the order of most roscas is fixed and repeated over several cycles (Anderson et al., 2009). Interestingly, as discussed in the next section, a large number of their members express a preference for the last position. This observation contradicts the early investment motive and is hard to reconcile with the self-commitment motive.[2] It can however be explained by an insurance motive. Indeed, even when the order of allocation is pre-determined, most roscas do allow exchanges of position. Typically, when facing an emergency, a late receiver may ask for an exchange in order to receive the pot earlier. In such a flexible setting, the preference for the last position can thus be rationalized as an insurance strategy. This argument has already been put forward in the anthropological literature which, very early, underlined the flexible nature of roscas (Geertz, 1962, Ardener, 1964). In particular, ex-post changes in the allocation of the pot to accommodate individual contingencies have been documented in various settings (see for instance Fernando, 1986, for Sri Lanka, Begeshaw, 1978, for Ethiopia, Bouman, 1977, in Zambia, Lelart, 1989, in Benin or van den Brink, Rogier and Chavas, 1997 in Cameroon).

In this paper, we develop a theoretical model to analyze the insurance role of roscas in the absence of a capital market. We first investigate the possibility of a profitable exchange of position under idiosyncratic risks. In particular, early receivers may accept to exchange one's position with a later receiver hit by a negative shock. This exchange allows the former to receive the pot later and cope with possible future shocks. We then explore the conditions under which members can, ex ante, prefer a late position. We show that such a preference arises only for moderate risks. In very risky situations and given the possibility of exchange, all members would prefer to be first to maximize their chances of receiving the pot when hit by a negative shock. Conversely, under very low risk, members prefer to receive the pot earlier as in Besley et. al. (1993).

To assess the relevance of the insurance argument, we designed a lab-in-the-field experiment in Benin replicating a simple rosca environment. Players chose their position and, depending on the random occurrence of shocks, they were allowed to propose position exchanges. In this setting, we exogenously varied the probability of negative shocks to illustrate the non-monotonicity of the preference for the last position. All participants were also members of actual roscas and were systematically interviewed about their experience in roscas, their ability to cope with shocks and their preferred position. We show that

[2] As the incentives to contribute stem from the anticipation of receiving the pot in the future, the number of periods one has to contribute before receiving a new pot is critical. In a fixed order repeated rosca, this number of periods is the same for all members (Anderson et al., 2009). As a result one's position does not affect commitment incentives.

the last position tends to be preferred among members who are more vulnerable to risk, provided exchanges are allowed in the roscas to which they participate.

The remainder of this paper is organized as follows. Section 2 provides descriptive evidence of the actual practice of fixed order roscas in several settings. In section 3 we present the model. In section 4 we conduct our empirical analysis using both survey and experimental data. Section 5 concludes.

2 Descriptive Evidence

In Africa, random and fixed order roscas are much more common than bidding roscas, which represent less than 3% of the roscas analyzed by Dagnelie and Lemay-Boucher (2012) in Benin or Wittevrongel (2011) in Cameroon.[3] Bidding roscas are more prevalent throughout East and South Asia (Eeckhout and Munshi, 2010; Fang et al., 2015; Klonner, 2003). The literature stresses their insurance function as members compete by proposing higher prices in order to secure the pot when they most need it. By contrast, in random and fixed order roscas, the combination of an exogenously determined order for receiving the pot and a fixed contribution leaves no room for adjusting to individual contingencies. In such roscas, an early receipt of the pot is clearly preferable as it allows to enjoy its benefits sooner (Besley et al., 1993).

In practice however, it appears that people may exchange positions in case of an urgent need. This opens the possibility of an insurance role of non-bidding roscas, whereby late receivers have the opportunity to cope with shocks by requesting an exchange of position when shocks occur. When this flexibility exists, a trade-off appears between receiving the pot early and being placed later while keeping the possibility to request an exchange if needed.

In this perspective, it is not surprising that many members of non-bidding roscas prefer later positions. Various case studies suggest a strong preference for the last position. Thus, the share of members who express such a preference varies between 42% in South Africa (Aliber, 2001) and 85% in small-scale roscas in Ethiopia (Agegnehu, 2012; see also Wittevrongel, 2011 for Cameroon and Dagnelie and Lemay-Boucher, 2012 for Benin). This empirical regularity is not limited to Sub-Saharan Africa but also found among migrant populations in Belgium where 42% of the respondents prefer a late turn (Ndjendje Banday, 2011).

In a detailed survey we carried out in Cameroon which covered 503 roscas, 75% of the members reported being able to exchange position and receive the pot before their turn.

[3] In a fixed order rosca, the sequence followed to allocate the pot across the members is given and identical across cycles. In most random roscas, the sequence is decided by lottery at the beginning of each cycle.

These changes were typically granted to cope with emergencies, such as a health problem. When asked about their position preference, the respondents were equally split between the first and the last position.[4]

While preparing the experiment presented in Section 4, we carried out in-depth interviews with 13 members of six roscas in Burkina Faso in 2015.[5] These roscas allow changes of position during the course of the cycle. Typically, these exchanges have to be endorsed by the group. To be approved, they have to be justified by a negative shock and cannot involve any financial compensation (gifts or side-payments).

Exchanges appear common and members frequently turn to roscas in case of need: "[t]he order is determined at the beginning of the cycle. But, we can change the order at each meeting in case something unexpected happens. [...] For example, if a woman comes and says that her mother is ill and that she wants to return to the village but cannot go without money and therefore wishes to switch, we grant her that. [...] If there are several people, the one with the most serious problem benefits". This opportunity is an important motivation behind rosca participation: "My principal motive [to participate in the rosca] was to deal with the economic difficulties I may face." It is also an important factor behind the preference for a particular position: "For reasons of prudence, I prefer to take the last place. It has been my position every year and I will stick to it. You never know what happens". "There are many things to be taken into account.[...]. I always prefer the second last or last turn. If I take the first turn, I feel like a burden when something happens". By contrast, members who prefer to take an early turn do so for investment motives. "What I told you in the beginning is that I am a trader and it's only the first, second or at the limit the third place that is interesting for me. Beyond the third place, I'd rather prefer not to be part of the rosca."

3 Modelling Position Preference within Roscas

In the preceding section, we argued that roscas could, under some circumstances, help members to cope with temporary shocks and thereby play the role of an imperfect insurance device. In order to benefit from it, members should take a late position for receiving the pot so that, in case of shock, exchange with an early receiver is feasible. In this section, we provide a model to characterize the conditions under which, ex ante, members prefer a late position. We proceed in three steps. First, we describe the simplest rosca possible with only two members and show the superiority of the first position if no exchanges are possible. Second, we derive necessary and sufficient conditions for exchange. Finally, we

[4] A detailed description of the survey is provided in Baland et. al. (2016).

[5] Due to political turmoil in Burkina Faso, we changed our field of investigation to Benin.

characterize the preference for a late position.

3.1 Comparing Positions in the Rosca

Consider two individuals, 1 and 2, participating in a rosca over two periods. They each have an income Y and contribute an amount x to the rosca every period. At each period, they also face an individual shock s with a known probability p. These income shocks are independently distributed across periods and across individuals. Contributions in a given period are gathered to constitute the pot, $X = 2x$, which is given to one of the members given a pre-determined order. We further assume that individuals cannot save or borrow. The net income of each member in a given period can take four values: $(Y - x)$ if she contributes to the pot and faces no shocks, $(Y+2x-x = Y+x)$ if she receives the pot and faces no shocks, $(Y-x-s)$ if she contributes to the pot and faces a shock and $(Y+x-s)$ if she receives the pot and faces a shock.

Let us first consider a situation in which the members cannot change their positions. For notational simplicity, assume that member 1 is the first to receive the pot, while member 2, being second, receives it in the second period. Given a utility function $u(.)$ which is increasing and concave, and a discount factor $0 < \delta < 1$, the expected utility of member 1 is given by:

$$EU^1 = pu(Y + x - s) + (1 - p)u(Y + x) + \delta[pu(Y - x - s) + (1 - p)u(Y - x)] \quad (1)$$

while the expected utility of member 2 is given by:

$$EU^2 = pu(Y - x - s) + (1 - p)u(Y - x) + \delta[pu(Y + x - s) + (1 - p)u(Y + x)] \quad (2)$$

Since $\delta < 1$,member 1 has a higher expected utility than member 2: $EU^1 > EU^2$. Hence, the following proposition:

Proposition 1: Position preference in the absence of exchange *In the absence of exchange, being first is always preferred to being last in the rosca.*

3.2 The Profitable Exchange Condition

We now introduce the possibility of exchanging positions in the first period, once the shock is realized. Such an exchange is always profitable for member 2 if she received a shock in period 1. It can also be profitable for member 1 if he received no shock. Indeed, receiving the pot in the second period may help him to cope with an income shock in that period.

In all other situations, no profitable exchange is possible. Thus, if member 1 had a shock in the first period, he prefers to keep the pot, while if both members had no shock in the first period, member 2 prefers remaining second.

We first describe the conditions under which member 1 is willing to exchange the pot, in the absence of a shock in the first period. The expected gains from such an exchange is given by:

$$\begin{aligned} \triangle EU^1 &= EU^1_{Exch} - EU^1_{NoExch} \\ &= (u(Y-x) + \delta\left[pu(Y+x-s) + (1-p)u(Y+x)\right]) \\ &\quad - (u(Y+x) + \delta[pu(Y-x-s) + (1-p)u(Y-x)]) \end{aligned}$$

.

We therefore have:

Proposition 2: Profitable exchange condition *In the absence of a shock in period 1, member 1 prefers to receive the pot in period 2 iff*

$$\frac{u(Y+x-s) - u(Y-x-s)}{u(Y+x) - u(Y-x)} \geq \frac{1-\delta(1-p)}{\delta p} \tag{3}$$

The left hand side of the inequality represents the utility gain from receiving the pot at the time of a shock relative to receiving the pot in the absence of such shock. It can therefore be interpreted as a measure of the concavity of the utility function, and is always greater than one. If the utility function is of the CARA form, $u(c) = -e^{-\gamma c}$, with γ the coefficient of absolute risk aversion, this expression takes a very simple form since $\frac{u(Y+x-s)-u(Y-x-s)}{u(Y+x)-u(Y-x)} = e^{\gamma s}$. The expression on the right hand side depends on the parameters p, the probability of a shock, and δ, the discount factor. It is lower for high values of δ and p, both reflecting the higher gains of being insured in the future. In particular, when $\delta = 1$ and $p > 0$, the expression is equal to one and the inequality (3) always holds.

3.3 *Ex-ante* Position Preference within a Rosca

Let us assume that condition 3 is satisfied, so that in the case where member 2 is hit by a shock while member 1 is not, the latter always prefer to exchange position. We now examine the conditions under which this possibility affects the position preferred by the members, ex ante. In order to do this, we need to compare the expected utilities of both players across the two periods, allowing for exchange when it is mutually profitable.

The expected utility of Player I is given by:

$$\begin{aligned}EU^1_{Exch} &= (1-p)^2(u(Y+x)+\delta(pu(Y-x-s)+(1-p)u(Y-x)) \\ &+(1-p)p(u(Y-x)+\delta(pu(Y+x-s)+(1-p)u(Y+x)) \\ &+p^2(u(Y+x-s)+\delta(pu(Y-x-s)+(1-p)u(Y-x)) \\ &+p(1-p)(u(Y+x-s)+\delta(pu(Y-x-s)+(1-p)u(Y-x))\end{aligned} \tag{4}$$

in which we allow for position exchange in period 1 when member 2 is hit by a shock and member 1 is not. The expected utility of member 2 is given by:

$$\begin{aligned}EU^2_{Exch} &= (1-p)^2(u(Y-x)+\delta(pu(Y+x-s)+(1-p)u(Y+x)) \\ &+(1-p)p(u(Y+x-s)+\delta(pu(Y-x-s)+(1-p)u(Y-x)) \\ &+p^2(u(Y-x-s)+\delta(pu(Y+x-s)+(1-p)u(Y+x)) \\ &+p(1-p)(u(Y-x)+\delta(pu(Y+x-s)+(1-p)u(Y+x))\end{aligned} \tag{5}$$

Comparing these two expressions, one obtains after some manipulations:

$$\begin{aligned}&EU^2_{Exch} > EU^1_{Exch} \\ \Longleftrightarrow &\frac{u(Y+x-s)-u(Y-x-s)}{u(Y+x)-u(Y-x)}\left(\frac{p}{1-p}\right)\left(2\delta p^2-2\delta p-p+\delta\right) \\ &+\left(2\delta p^2-2\delta p-(1-p)+\delta\right)>0\end{aligned} \tag{6}$$

A closer examination of this condition leads to the following proposition:

Proposition 3: Ex ante position preference *Risk-averse members prefer being last in the rosca for intermediate values of the probability of a shock. For low and high values of p, members strictly prefer being first.*

More formally, $EU^2_{Exch} < EU^1_{Exch}$ *if* $p > \frac{1}{2}$. *Moreover, if* $\delta < 1, \exists \bar{p} : \forall p \epsilon [0, \bar{p}], EU^2_{Exch} < EU^1_{Exch}$.

Proof: Let us examine more closely the expression left hand side of inequality (6):

$$\frac{u(Y+x-s)-u(Y-x-s)}{u(Y+x)-u(Y-x)}\left(\frac{p}{1-p}\right)\left(2\delta p^2-2\delta p-p+\delta\right)+\left(2\delta p^2-2\delta p-(1-p)+\delta\right) \tag{7}$$

First, because of concavity, we know that $\frac{u(Y+x-s)-u(Y-x-s)}{u(Y+x)-u(Y-x)} > 1$. Moreover, for all possible values of p, expression (7) is always negative for low enough values of δ and is strictly increasing in δ. Consider the most favorable case under which $\delta = 1$. Replacing δ by this value in the expression above and assuming $0 < p < 1$, we obtain:

$$\frac{u(Y+x-s)-u(Y-x-s)}{u(Y+x)-u(Y-x)}\left(\frac{p}{1-p}\right)\left(2p^2-3p+1\right)+\left(2p^2-p\right)=$$
$$\frac{p}{1-p}\left(\frac{u(Y+x-s)-u(Y-x-s)}{u(Y+x)-u(Y-x)}\left(2p^2-3p+1\right)+\left(-2p^2+3p-1\right)\right)$$

This last expression is positive if and only if $2p^2 - 3p + 1 > 0$ which holds if and only if $0 < p < 1/2$. It is therefore negative if $p > 1/2$. Given the monotonicity in δ, we thus have: $EU^2_{Exch} < EU^1_{Exch}$ if $p > 1/2$.

Next, we show that, when condition (6) holds, the profitable exchange condition (3) is necessarily satisfied. First note that if condition (6) holds, $p < 1/2$, implying that $\left(2\delta p^2 - 2\delta p - p + \delta\right) > \left(2\delta p^2 - 2\delta p - (1-p) + \delta\right)$. As a result, the condition can only be satisfied if $\left(2\delta p^2 - 2\delta p - p + \delta\right) > 0$. We now proceed by contradiction and suppose that condition (3) is violated: $\frac{u(Y+x-s)-u(Y-x-s)}{u(Y+x)-u(Y-x)} < \frac{1-\delta(1-p)}{\delta p}$. Replacing $\frac{u(Y+x-s)-u(Y-x-s)}{u(Y+x)-u(Y-x)}$ by $\frac{1-\delta(1-p)}{\delta p}$ in (7), one obtains

$$\frac{1-\delta(1-p)}{\delta p}\left(\frac{p}{1-p}\right)\left(2\delta p^2-2\delta p-p+\delta\right)+\left(2\delta p^2-2\delta p-(1-p)+\delta\right)=$$
$$\frac{1}{\delta(1-p)}\left((1-\delta(1-p))\left(2\delta p^2-2\delta p-p+\delta\right)+(1-p)\,\delta\left(2\delta p^2-2\delta p-p+\delta-1+2p\right)\right)=$$
$$\frac{1}{\delta(1-p)}\left(\left(2\delta p^2-2\delta p-p+\delta\right)+(1-p)\,\delta\,(-1+2p)\right)=$$
$$\frac{1}{\delta(1-p)}\left(-p+p\delta\right)<0$$

As a result, (6) cannot hold if condition (3) is not satisfied.

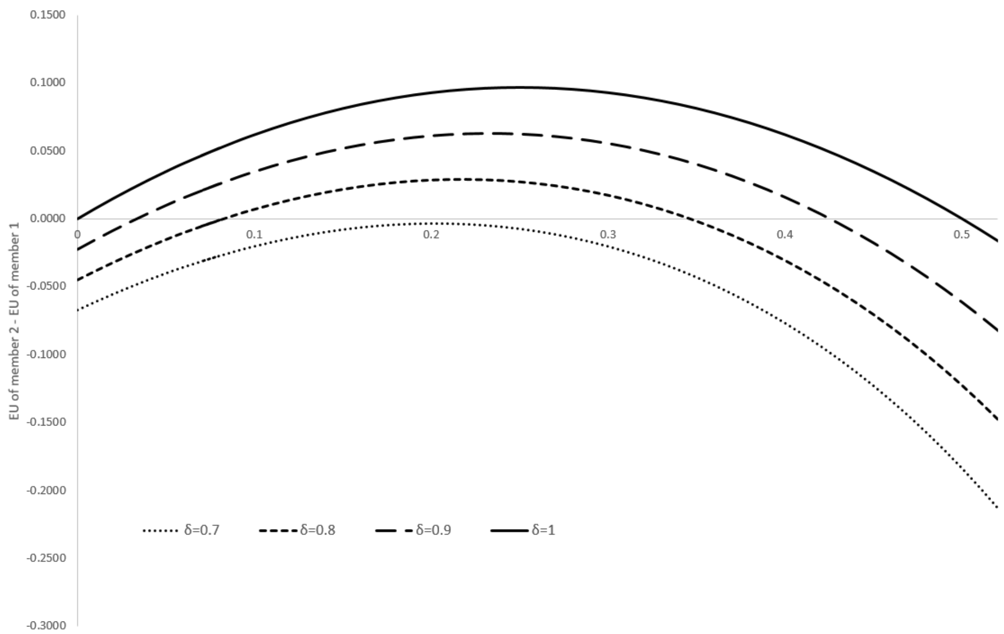
Finally, if $p = 0$, expression (7) is negative if $\delta < 1$. By continuity in p, $\exists\,\bar{p}$: $\forall p \epsilon \left[0, \bar{p}\right], EU^2_{Exch} < EU^1_{Exch}$. QED

Members prefer being last provided the risk of a shock is neither too high, nor too low. If it is too low, a profitable exchange is not feasible anyway, as the insurance value of receiving the pot in the second period is too low compared to the gain in utility from receiving the pot in the first period. If it is too high and, in particular, for all values of p greater than 1/2, being second is never preferred. This is because the first member is likely to be hit by a shock in the first period when he gets the pot and, if he is not hit by a shock, he is likely to be proposed an exchange by the other member (and be insured in the second period).[6]

[6]The intuition behind this result is the following. Suppose $\delta = 1$. For any member there are four

Using a CARA utility function, we can represent the range of values for p for which being second in the rosca is preferred. Figure 1 shows the difference in expected utility from being last as compared to being first, for different values of p and for various δ. In particular, the graph illustrates that, when there is no discount, being second is desirable for any $p \leq 0.5$. For $\delta < 1$, being second is preferred on a tighter range of probabilities of shocks. Finally, as expected, if the individual heavily discounts the future, the second position may never be desirable.[7]

Figure 1: The advantage of being second ($EU^2_{Exch} - EU^1_{Exch}$) as function of p, for various δ



possible states of world: no shock in either periods {no shock, no shock}, a shock in both period {shock, shock}, a shock in period 1 but not in period 2 {shock, no shock} and a shock in period 2 but not in period 1 {no shock, shock}. Being first or last in the rosca leads to exactly the same expected utilities in the first two states of the world ({shock, shock} and {no shock, no shock}). Similarly, experiencing {shock, no shock} for member 1 is equivalent to experiencing {no shock, shock} for member 2 as in both cases they obtain the pot precisely when they need it. We are thus left with comparing being first and last when one is hit by a shock *only* in the period in which he was *not* supposed to get the pot. In that case, the member gets the pot when needed provided an exchange takes place. This occurs with probability $1 - p$ for member 2 (member 1 is willing to exchange if she is not hit by a shock) and with probability p for member 1 (member 2 was willing to exchange if she was hit by a shock in period 1). Thus if $1 - p > p$ or $p < 1/2$, the situation of member 2 is more favorable.

[7] Analyzing position preference in a larger rosca is more complex because of the multiplicity of situations. It is clear, however, that if $p > 1/2$, members would still prefer to be first. This is because, for the first member, exchanging position becomes easier when the number of members increases (the probability that anybody is hit by a shock increases), in contrast, for members with a late position, it becomes more difficult to obtain an exchange when needed as several other members may want to exchange.

4 An Application to Benin

4.1 Survey Evidence

To test the predictions of our model, we designed an experimental game and conducted an original survey in eight neighbourhoods of the metropolitan area Cotonou-Calavi in Benin in May-June 2018. Across the eight locations, we conducted 40 experimental sessions with a total of 294 participants. At the end of each session, the participants were administered a survey. In addition to standard information on their socio-economics status, we collected systematic information on the roscas to which they participate(d).[8]

All the participants have been members of roscas and 64% are currently engaged in at least one rosca (with an average of 1.2 rosca). 42% of the participants express a strict preference for being the last to receive the pot. Among these, 45% mention that this position allows for more flexibility such as exchange in case of need. This is in spite of the fact that many members mentioned the risk of failing contributors or the risk of early receivers "running with the pot".[9]

Position exchanges occurred in 57% of the roscas and 21% of the respondents were directly involved. Such exchanges are typically motivated by unexpected events such as health problems, funerals or urgent repairs of durables. Whenever asked for an exchange, 95% of the participants accepted. When refusing, a major motive was that they were themselves in a difficult situation. Finally we inquired about their access to sources of funds, including savings and credit. 27% of the respondents declared being severely cash constrained as they have no savings available for emergency and no access to loan through banks or microfinance institutions. An additional 14% can be classified as moderately cash constrained, as they have some but not enough savings to deal with emergencies.

The survey allows us to investigate the determinants of position preference. According to our theoretical analysis, the last position can be preferred provided the rosca allows for exchanges of position and members face serious cash constraints. Overall, in our sample, such a preference is expressed by 58% of the respondents in this situation (as against 38% for the members who are moderately or not cash constrained). To explore this relation more systematically, we estimate linear probability models for the preference for the last position, as a function of the possibility to change position, the presence of cash constraint and their interaction. As discussed above, we use two measures of cash constraint. Members are "severely constrained" if they have no savings and no access to credit and "constrained" if they do not have enough savings. We also control for

[8] Table 4 in appendix reports the descriptive statistics of all variables used in the analysis.

[9] Problems in roscas were reported by 45% of the respondents and strategic default appears as the most prominent issue (see also Anderson et al., 2009).

sex, household size, income quartile, whether the respondent is in charge of most of the household expenses ("main breadwinner"), ethnicity, education, age and age square and enumerator fixed effects. Standard errors are clustered at the game session level. Results are reported in Table 1.

Table 1: Stated preference for last position in ROSCA

	(1) Prefers Last	(2) Prefers Last	(3) Prefers Last	(4) Prefers Last
gender (man=1)	0.060	0.064	0.058	0.057
	(0.077)	(0.076)	(0.076)	(0.075)
household size	-0.012	-0.011	-0.014	-0.014
	(0.012)	(0.012)	(0.012)	(0.012)
position change	-0.009	-0.121	-0.010	-0.080
	(0.050)	(0.072)	(0.051)	(0.064)
cash constraint	0.149*	-0.011		
	(0.076)	(0.103)		
change*cash constraint		0.281**		
		(0.123)		
severe cash constraint			0.148*	0.005
			(0.082)	(0.122)
change*severe constraint				0.247*
				(0.145)
first income quartile	0.223*	0.261**	0.245**	0.265**
	(0.121)	(0.125)	(0.119)	(0.123)
second income quartile	0.019	0.025	0.047	0.041
	(0.108)	(0.105)	(0.103)	(0.101)
third income quartile	0.106	0.111	0.120	0.124
	(0.092)	(0.096)	(0.090)	(0.093)
main breadwinner	0.130*	0.145*	0.136*	0.150**
	(0.075)	(0.074)	(0.074)	(0.073)
constant	0.680	0.655	0.694	0.724*
	(0.423)	(0.420)	(0.420)	(0.422)
N	295	295	295	295

Standard errors (in parentheses) are clustered at the game session level.
All regressions control for enumerator fixed effects, ethnicity, education, age and age squared.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Comparing columns 1 and 2 shows that, in line with our theoretical framework, cash constraints matter for position preference, but only when change of position is allowed. While cash constrained individuals are 15 percentage points more likely to prefer to be last, the coefficient varies from 28 to -1 percentage points depending on whether change is allowed or not. Similar results obtain when we use the stricter definition of cash constraint (columns 3 and 4). Poor individuals (first income quartile) and those in charge of household expenses express a substantially stronger preference for the last position. This preference does not vary with gender and household size.

The survey does not allow us to test the predictions of the model concerning the role of varying exposure to shocks. To this end, we designed an experimental rosca game that explicitly varies the probability of shocks. At each round of the game, players are required to choose a position while being exposed to different probabilities of shocks.

4.2 Experimental Evidence

The game was designed to replicate the actual functioning of a rosca. In the game, the rosca includes two members – the subject and a virtual person. The rosca lasts for two periods or weeks. Each week the subject is given a fixed income, has to pay her contribution to the rosca and faces a negative shock with a given probability. In addition, she may receive the pot, depending on her initial position and a possible exchange. The size of the shock is small enough to be covered by the pot amount but too large to be covered by the income net of rosca contribution. When a shock occurs but the subject does not have the pot, she is financially penalized by a net deduction on the total amount obtained over the two-week round. In the game, this deduction was formulated as the interest charged by a virtual moneylender called for to cover the shock. Saving is not allowed as money cannot be transferred to the second week. Subjects played for a total of eleven two-week rounds with varying probabilities of shocks. To determine the occurrence of a shock, the subject draws a ball out of a bag containing green (no shock) and red (shock) balls. The subjects directly recorded all their decisions on a tablet computer with the help of an original application.[10]

At the beginning of each round, the participant is first informed about the probability of shocks (the number of balls of each color is announced) before being asked to privately report her preferred position in the rosca (week 1 or 2). The application then assigns her an initial position for the round, to allow for conflicting preferences with the other (virtual) player. In practice, the preference expressed is sometimes overruled to force enough variation in the roles played by the subject. Thereafter, the subject is invited to draw a ball from the bag to determine the occurrence of a shock in week 1. She is then given the opportunity to propose a change of position to the virtual player who may accept the proposition. The application then simulates a possible exchange and announces the final position of the player. Contributions are paid and the pot given to the relevant player. On the second week a new draw of the shock takes place and no new decision is made. At the end of the round, the application computes the total payoff obtained by the

[10]The application can be visualized on http://renatehartwig.com/projects/insurre

player. This pay-off includes a 10% interest on the net gains of the first week (to simulate the discounting of the second period) and the financial penalties imposed if the player experienced a shock on the week in which he did not receive the pot.

In practice, the weekly income was set at 8000 FCFA, the contribution at 6000 FCFA so that the pot is equal to 12000 FCFA. The size of the shock is also equal to 8000 FCFA and the financial penalties are set at 2000 FCFA.[11] Most sessions involved three different probabilities of shocks equal to 0.15, 0.3 and 0.45 (in varying order across sessions). In addition, for a limited number of sessions (five out of 40), a wider range of probabilities (0.1, 0.3 and 0.6) was imposed. Thus, each subject was exposed to three different probabilities across the eleven rounds played. The game was incentivized as subjects received the payoffs they obtained in one randomly selected round. The average amount received is equivalent to 17% of the reported average monthly income for the participants. The experiment protocol is detailed in Appendix A2.

Our main interest lies in the relation between the expressed preference for the second position in the rosca and the probability of a shock.[12] In a first step however, we verify that, when demanding a position exchange, the players responded to the incentives set by the game. In theory, an exchange should be proposed whenever the player due to receive the pot in week 2 has a shock in week 1. In all other cases, demands for exchange are less likely. In Table 2 below, we investigate the determinants of the demand for exchange, as a function of the position assigned and the occurrence of a shock. A linear probability model with round fixed effect is estimated. Column 1 reports the results with no additional control, column 2 includes individual controls and column 3 individual fixed effects. Individual controls are those used in Table 1 above. Standard errors are clustered at the session level. The results are remarkably stable across specifications. Players assigned the last position are 18 percentage points more likely to request an exchange when experiencing a shock, confirming that they responded, at least partly, to economic incentives.

Regarding position preference, our theory predicts that the preference for the last position is non-monotonic and the highest for intermediate probabilities of a shock. Figure 2 plots the share of players who choose the last position as a function of the probability they were exposed to, along with the confidence intervals around these shares. The relation between the probability of a shock and the preference for the last position follows an

[11] The exchange rate at the time of the survey was 1.52 euros per 1000 FCFA.

[12] As expected, condition (6) indicates that risk aversion is another major determinant of the preferred position. Unfortunately, survey based measures of risk aversion are notably unreliable and often inconsistent. Moreover this dimension is hard to manipulate experimentally. Our various attempts to elicit risk attitudes did not allow us to construct a robust measure of risk aversion and we therefore decided not to include this dimension in our analysis.

Table 2: Exchange demand

	(1) exchange demand = 1	(2) exchange demand = 1	(3) exchange demand = 1
shock week 1	0.063**	0.065**	0.049*
	(0.029)	(0.029)	(0.028)
assigned last position	-0.010	-0.009	-0.017
	(0.022)	(0.022)	(0.022)
shock week 1 * assigned last	0.178***	0.173***	0.188***
	(0.046)	(0.044)	(0.042)
constant	0.220***	0.024	0.224***
	(0.025)	(0.151)	(0.022)
round fixed effects	yes	yes	yes
individual controls	no	yes	no
individual fixed effects	no	no	yes
N	3243	3243	3243

Standard errors (in parentheses) are clustered at the game session level.
Individual controls include ethnicity, education, age, age squared, income quartiles, main breadwinner and cash constraint.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

inverted U-shape: the share of players choosing to be second is highest (equal to 47 percent) when the probability is equal to 0.3. The confidence intervals around the extreme probabilities are much wider, as only five sessions involved these levels of probabilities.

Turning to a multivariate framework, Table 3 reports the results of linear probability models where the dependent variable is the preference for the last position expressed at the beginning of the round. The main variables of interest are the varying probabilities of a shock. The first four columns report the coefficients obtained for the probabilities defined as categorical variables. We include our usual individual controls in the first two columns and individual fixed effects in the last two columns. Columns 1 and 3 report the estimates for all sessions while columns 2 and 4 exclude the five sessions for which more extreme values of the probabilities were implemented. In the last two columns we estimate a quadratic model for the probability level, with individual controls (column 5) or individual fixed effects (column 6). Standard errors are clustered at the session level. The results fall perfectly in line with the predictions formulated in Proposition 3 above. The preference for the last position is significantly lower for high and low probabilities, and highest for intermediate ones. Taking the probability 0.15 as the base category, players are 5 to 6 percentage points more likely to ask to be last when the probability is 0.3 but 10 percentage points less likely when the probability nears one half at 0.45. The coefficients, while negative, are less stable for the more extreme values. Column 1 suggests that players are 13 to 14 percentage points less likely to prefer to be last when the probabilities are 0.1 or 0.6. The quadratic estimates support these findings, with an estimated turning point at a probability of 0.27 (column 5).

Figure 2: Preference for last position and probability of a shock

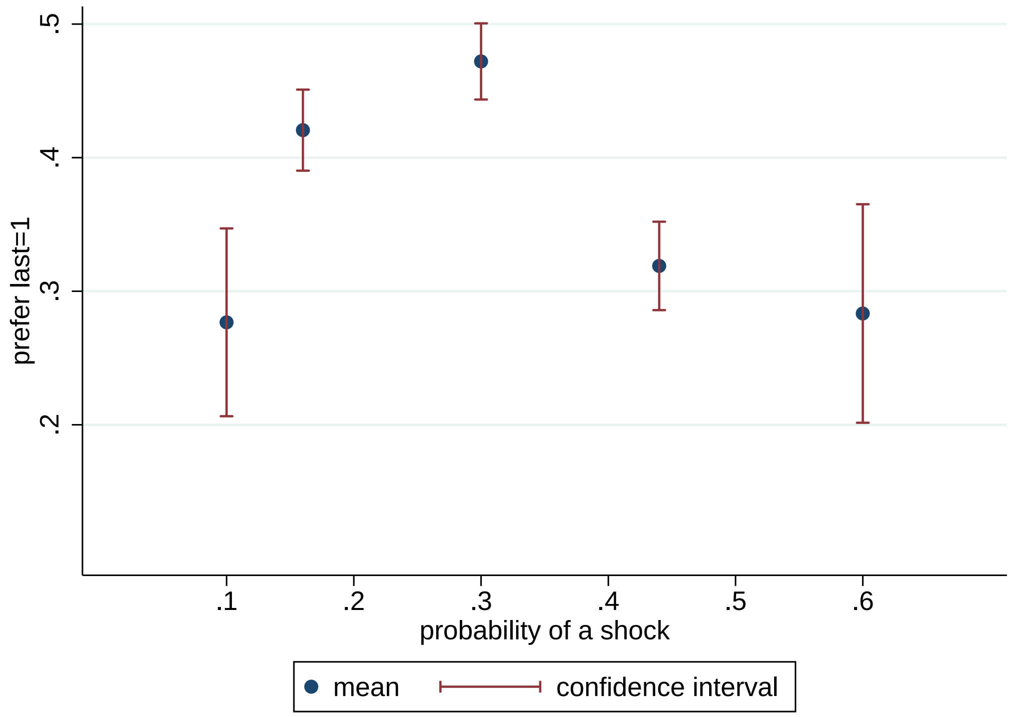


Table 3: Preference for last position and probability of shock

	(1) prefers last	(2) prefers last	(3) prefers last	(4) prefers last	(5) prefers last	(6) prefers last
probability = 0.1	-0.140*		-0.050			
	(0.076)		(0.043)			
probability = 0.15	omitted category	omitted category	omitted category	omitted category	omitted category	omitted category
probability = 0.3	0.052**	0.064***	0.064***	0.064***		
	(0.020)	(0.019)	(0.016)	(0.016)		
probability = 0.45	-0.101***	-0.101***	-0.101***	-0.101***		
	(0.026)	(0.026)	(0.017)	(0.017)		
probability = 0.6	-0.133*		-0.047			
	(0.074)		(0.046)			
probability					1.385**	1.216***
					(0.527)	(0.266)
probability*probability					-2.540***	-2.270***
					(0.868)	(0.415)
constant	0.240	0.227	0.408***	0.421***	0.079	0.278***
	(0.173)	(0.198)	(0.012)	(0.011)	(0.174)	(0.038)
individual controls	yes	yes	no	no	yes	no
individual fixed effects	no	no	yes	yes	no	yes
N	3243	2804	3243	2804	3243	3243

Standard errors (in parentheses) are clustered at the game session level.
Columns 2 and 4 exclude the 5 sessions where the wider range of probabilities was imposed (01., 0.3 and 0.6).
Individual controls include ethnicity, education, age, age squared, income quartiles, main breadwinner and cash constraint.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5 Conclusion

The starting point of our investigation is the observation that some members of fixed order roscas prefer not to take the pot early, thereby foregoing potential investment opportunities. In this paper we argue that such a behavior can be motivated by insurance under idiosyncratic risk. This is because, even if the order of receiving the pot is pre-determined, exchanges of position are allowed in case of urgent need, and late receivers can better make use of this opportunity. We provide descriptive evidence about the insurance motive in African roscas and discuss the conditions under which this motive may dominate the investment motive. Survey data indicate that insurance needs are critical in determining the preferred position of rosca members. We develop a theoretical model to formalize the argument and show that the preference for the last position requires that the probability of a shock is neither too low nor too high. We test this prediction in a lab-in-the-field experiment and confirm that the preference for being last is non-monotonic in the risk of negative shocks.

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Appendix

A1: Descriptive Statistics

Table 4: Descriptive statistics survey and experiments

	Mean	Sd	N
Survey sample			
age	34.332	10.852	295
gender (man=1)	0.542	0.499	295
household size	4.858	2.541	295
ethnicity = Fon	0.549	0.498	295
ethnicity = Adja	0.197	0.398	295
ethnicity = other	0.254	0.436	295
did not finish high school	0.407	0.492	295
income quartile = 1	0.271	0.445	295
income quartile = 2	0.244	0.430	295
income quartile = 3	0.292	0.455	295
income quartile = 4	0.193	0.395	295
main breadwinner = 1	0.485	0.501	295
cash constraint =1	0.407	0.492	295
severe cash constraint =1	0.268	0.444	295
prefer last position = 1	0.424	0.495	295
position change = 1	0.569	0.496	295
Game sample			
prefers last position = 1	0.403	0.491	3243
assigned last position = 1	0.375	0.484	3243
shock week 1 = 1	0.272	0.445	3243
exchange demand = 1	0.241	0.428	3243
probability = 0.1	0.049	0.216	3243
probability = 0.15	0.315	0.464	3243
probability = 0.3	0.364	0.481	3243
probability = 0.45	0.236	0.424	3243
probability = 0.6	0.037	0.189	3243

A2: Experiment Protocol

(Translated - All session were conducted in French.)

1. Introduction

(Experimenter introduces himself and presents the project)

My name is ... and with my colleagues ... I am very pleased to welcome you to this meeting.
We are economics researchers at the University of Namur in Belgium, and we are conducting a study on savings behaviour. For this study, we interview a number of participants. The individual information collected as part of this study is used solely for scientific research and will not be disclosed. All information that you share with us remains anonymous. At this point, I would like to thank you for your participation and for taking the time to answer our questions.

To better understand how savings decisions are made in roscas, we will ask you to play a game in which you are a member of a virtual rosca. We will pay you at the end of the session, based on the money you have earned in one round of that game. We will choose the round we pay at random, at the end of the interview by pulling a ball out of a bag. We pay you for two reasons: First, because you took the time to participate in this study. Second, we would also like you to make the decisions you take seriously, as you would for any other decision in your life. Regardless of the amount you win, we will give you a participation fee of 3,000 FCFA which will be added to the money you earn during the game to cover your travel expenses.

The game we present to you is not a test. There is no correct answer. You make your choices based on your personal preferences. What we want to know is what choices you make when face with different options. Again, the tasks give you the chance to earn real money, so think carefully about the choices you want to make. *(Experimenter to check if there are questions and the content of the study and the payment process are well understood)* Are there any questions?

2. Explanation of the game

I will now introduce you to the rosca and the choices you need to make. In this rosca, you will interact with a virtual person. This person is linked to you now through the computer. This other person will also make choices, like you. You can follow the instructions on the screen in front of you if you click on the "Instructions" button on your tablet.

You and the other person form a mini-rosca with two participants. The rosca runs for two weeks, week 1 and week 2. Contributions are always paid and no one can leave the rosca before the end. You will first indicate when you prefer to receive the common pot, at the first meeting (week 1) or at the second meeting (week 2). The other person will also say when she would prefer to receive the pot. In case you both want to receive the pot at the same time, the computer randomly decides the order, much like the president of a rosca who would toss a coin.

In the game, you receive an income of 8,000 FCFA each week. From this, you pay your contribution to the rosca. The contribution is 6,000 FCFA per week. Hence, the amount of money you receive when you get the pot is 12,000 CFA (6,000 x 2). But, as in real life, problems arise that cost money. For example, a family member asks for your financial support. So, if a family member calls upon you during during the weeks of the rosca, you will have to pay to help him cope with the situation. In the game, the family will ask for a support of 8,000 FCFA. To find out if your family is asking for help, you will draw a ball from a bag every week:

(Experimenter show the bag with red and green balls)

If you pick a red ball, your family asks for help and you give them 8,000 CFA. If you pick a green ball, you are not faced with a request.In the event that you can not fund your family's demand, because you have not received the pot this week, you will need to borrow money to meet the demand. You will have to go to an informal money lender who is expensive and charges an interest of 2,000 FCFA. In the rosca, once you know if you need to help your family or not, you can ask to change position. Hence, if the other person agrees, you can change places. You may have already experienced this in roscas where people agree to leave the pot to another person to help the other facing a problem. So, here too, you are free to change positions with the other player if you both agree.

(Two experimenters show the procedure in a role play)

To summarize, in this game you first choose if you want to be first or second. Then the computer decides depending on the request of your counterpart. You receive your salary; you pay your contribution to the rosca; and you draw a ball from the bag to see if you will face a request or not. Depending on this you can request to exchange your position with the other. If you do not receive the pot and you are facing a family demand, you have to borrow. After all these decisions are made, we calculate the pay-off for the week. A very important point: You can not use the money you earned in the first week. We will invest this money for you and you will have the opportunity to earn a tenth more (10%) of that amount at the end.

We then move to the second week. You again have an income of 8,000 FCFA and draw a ball from the bag to see if you face a family demand or not. Note that you can change places only once in week 1. In week 2, it is no longer possible to change places. After you have made your decision, the task ends and we calculate the pay-off for the second week and also the total gain you earned during the rosca cycle.

We repeat this decision set with you and the other person 11 times. The balls in the bag from which you will draw change from time to time. *(Experimenter to check if there are questions and everything is well understood) (Experimenter to show the booklet, to explain the options and the gain)* We have prepared a brochure in front of you that describes all possible scenarios and payments. You can refer to this brochure at any time during the game. *(Experimenter again check if the participant understood the task) (Experimenter show test questions and let the participants play the demonstration game)* If there are no more questions, we will start. *(Experimenter to show the cycle to play (from 1 to 11) and must show the participant the balls in the bag that determine the probability of a shock).* I just showed you the bag with the balls. Please now make your choice when you prefer to receive the pot? Please pick a ball from the bag, to know if you are going to face a request from the family. *(Repetition week 2 and for each of the 11 cycles)*

3. End

This is the end of our session. We will now determine the amount you will receive based on the decision you made during the game, as I explained to you at the beginning of our meeting. We will pay you the prize money you received in the corresponding round in the game. For that we will call you in the room in a few minutes one by one to pay you.
I would like to thank you again for your time and your answers.