THE ECONOMICS OF ROTATING SAVINGS AND *COLLATERAL* ASSOCIATIONS

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This paper modifies the mechanism of the Rotating Savings and Credit Association (*ROSCA*), and provides a possible theoretical interpretation of a mutual-guarantee association that here we call Rotating Savings and *Collateral* Association (*ROSCoA*). Through a very simple case of moral hazard, the paper first shows that each *ROSCoA* member has the opportunity, in expected terms, to become an entrepreneur just with a contribution equal to the *n*th fraction of the individual collateral asked by a bank. Besides, the paper shows under what conditions a potential entrepreneur may prefer to join either a *ROSCA* or a *ROSCoA*.

Keywords: collateral, moral hazard, mutual credit

JEL Classification numbers: D81, D82, H53

1 INTRODUCTION

This paper modifies the mechanism of the Rotating Savings and Credit Association[1] (*ROSCA*), and provides a possible theoretical interpretation of a mutual-guarantee association that here we call Rotating Savings and *Collateral* Association (*ROSCoA*). This work is motivated by the fact that these associations, despite their importance, have not received much attention in the existing theoretical literature.

In this paper, there are two potential entrepreneurs with similar projects that can decide to form either a *ROSCA* or a *ROSCoA*. In a *ROSCA*, the individuals pay, each period, a regular sum to collect and receive, in turn, a pot (here, the investment needed to start up a firm). In a *ROSCoA*, instead,

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[1] See, for one of the first rigorous theoretical descriptions, Besley et al. (1993).

the individuals collect the collateral needed by an outside lender to finance, in turn, each member's project. In the present paper, creditors face a moral-hazard problem as the outcome of each project depends on the level of unobservable effort exerted by each entrepreneur. So, our paper can be related to the works on peer groups and inside financing such as Chiteji (2002) and Anderson et al. (2009), or outside financing such as Armendariz-Gollier (2000) and Roy Chowdhury (2005). In this type of literature, the main issue is the possibility for the group to receive credit by means of the additional guarantee of joint liability or peer monitoring. The main emphasis of our paper, instead, is on the incentive mechanisms needed to solve, individually, the hazard problem.

The model first shows that, at the end of a 2-period cycle, while in a *ROSCA* each member has the opportunity to run a firm (in expected terms) with a contribution equal to half of the individual *investment*, in a *ROSCoA* the contribution is equal to half of the individual *collateral* asked by a bank. That is, the same collateral collected by members at the beginning of the *ROSCoA* cycle can be used, in theory, to finance all projects. Besides, the model compares the results achieved by the agents and shows that: first, the very poor can only choose to form a *ROSCoA*; second, when agents have enough resources *i*) they always prefer to join a *ROSCA* when the banking sector is in monopoly, while they are equally well off either in a *ROSCA* or in a *ROSCoA* when banks are perfectly competitive; *ii*) they prefer to join a *ROSCA* (*ROSCoA*) if the degree of risk aversion is relatively low (high) in monopoly, while they are always better off in a *ROSCoA* in perfect competition.

As a result, the paper has also two main empirical predictions: *a*) when potential entrepreneurs have a very low endowment, they can only form a *ROSCoA* and ask for a bank loan. This seems consistent with the microfinance practices and, in part, supported by the empirical literature (e.g., Levenson-Besley, 1996 and Handa-Kirton, 1999) that argues how *ROSCA* participation, in some cases, increases with income (i.e., richer poor are more likely to join a *ROSCA*); *b*) in countries with a high (low) bank concentration index, there should be more (less) *ROSCAs* than *ROSCoAs*. The latter result is a prediction since *ROSCAs* are informal organizations and so not an easy subject for a rigorous empirical survey. However, although this should not be intended as empirical evidence, we know from the literature that *ROSCAs* are generally more common in developing regions where, according to Beck et al. (2006)[2], the bank concentration index is often very large. To cite some examples[3] of countries having experienced cases of *ROSCAs*, the concentration index is 0.62 in Ghana, 0.72 in Cameroon, 0.72 in Kenya, 0.83 in Etiopia, 0.96 in Malawi, 1 in Papua Nova Guinea, 1 in Jamaica. On the other hand, *ROSCoAs* are more common[4] in Europe and Eastern Asia where the bank concentration index is in some cases relatively low. For example, the index is 0.28 in Taiwan, 0.35 in Italy, 0.45 in Japan, 0.47 in Thailand, 0.58 in Indonesia, 0.58 in France, 0.65 in China, 0.71 in Germany. The high index for China and Germany may reflect the fact that the reduction in the variance of outcomes is particularly significant for the members of local *ROSCoAs*.

Section 2 introduces the main features and assumptions of the model. Section 3 shows what happens if two individuals decide to form a *ROSCA*. Section 4 derives the equilibrium financial contracts in the case of a *ROSCoA*. Section 5 compares the two types of associations. Section 6 concludes.

2 THE ENVIRONMENT

Consider a 2-period village economy. There are 2 identical would-be entrepreneurs[5] and each one has access to a project requiring a fixed

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[2] And from the up-to-date file made available online by the authors.

[3] See Aryeetey et al. (1997), Handa-Kirton (1999) and Low (1995).

[4] See Columba et al. (2010) and Beck et al. (2010).

[5] The analysis could be easily extended to more than 2 entrepreneurs.

investment of L. The final outcome of each project depends on the effort, high or low, that the entrepreneur decides to apply. Specifically, under low effort, the firm succeeds with probability p_b and yields a return R_b, whereas with probability $1 - p_b$ it goes bankrupt and ends up with nothing. Under high effort, the firm succeeds with probability $p_a > p_b$ and yields a return $R_a < R_b$, whereas with probability $1 - p_a$ it fails.

Assume that the entrepreneurial process is efficient only if high effort is exerted, that is if

$$p_b R_b < L < p_a R_a . \qquad (A1)$$

Thus, the low-effort outcome is not only a mean-reducing spread of the high-effort one, as in de Meza-Webb (1987), but here the two projects have also different returns in case of success[6].

Agents have the same initial wealth $w < L$, so we assume that they decide to form (if possible) either a *ROSCA* or a *ROSCoA* where they perfectly share each-period profit (although other forms of rent distribution could be considered). To simplify, consider risk neutrality (to be relaxed in subsection 5.1), no discounting and a safe rate normalized to 0. With no discounting, the analysis is similar for each member and each period.

3 THE *ROSCA*

[6] This assumption is mainly used to rule out the low-effort strategy.

In a *ROSCA*, each period the two members make a contribution of $L/2$ and one of them, in a predetermined order, receives the pot. As the start-up investment is fixed, only agents with $w \geq L/2$ can form a *ROSCA*.[7]

Each firm's expected gross profit at the end of the first period is

$$u_1 = w + (p_a R_a - L)/2 \quad . \tag{1}$$

The participation constraint for *ROSCA* members is trivially satisfied under ($A1$). Moreover, the effort exerted is always high because the expected product is related to the fixed investment, and not to the actual individual contribution. Indeed, the incentive constraint, $(1/2)[p_a(R_a - L) - p_b(R_b - L)] \geq 0$, reduces to $p_a R_a \geq p_b R_b$ that always holds for ($A1$).

At the end of the *ROSCA* cycle, the final expected payoff for each firm is

$$u_2 = w + p_a R_a - L \, . \tag{2}$$

As a result, joining a *ROSCA* the entrepreneurs have the opportunity to run a firm with a ex-ante individual contribution equal to $L/2$. Agents are assumed to invest at the safe rate (normalized to 0) the possible difference $w - L/2$.

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[7] It is recognized that these associations lack a mechanism to prevent the first- and last-ranked recipient to defect leaving the organization (see, for example, Anderson et al., 2009). The first, indeed, after receiving the sum has no interest in continuing the payments (especially in the case of a single cycle). The last-period beneficiary does not draw any benefit from being involved as she can privately set aside the money without exposing herself to the risk of non payment by the others. In the present paper, we do not consider the first-ranked issue. Besides, here the last ranked cannot accumulate the whole investment sum since agents have no endowment in the second period.

4 THE *ROSCoA*

If agents decide to form a *ROSCoA*, they will collect, initially, the individual collateral needed to receive a loan from an outside bank. Since the effort applied by each borrower is unobservable and not contractible, the bank faces a classic moral-hazard problem. As in Ghatak (2000), though in an adverse-selection setting, assume that the final output produced is imperfectly observable in the sense that the bank can only verify whether the project is successful or not, but cannot verify the exact amount produced. So, the final outcome cannot be related with certainty ex post to the borrower's action (e.g., the firm could in theory conceal or invest elsewhere some of the final product). In this case, the optimal form of financing is the debt contract.

Assume that lenders are endowed with the level of capital needed to finance the two investment projects.

Subsection 4.1 analyzes the case of a single moneylender and subsection 4.2 the case of perfectly competitive banks.

4.1 Single Lender

A monopolistic lender/bank tries to design the financial contracts in order to extract all possible rent from each borrower. As a benchmark, subsection 4.1.1 analyzes a one-period relationship between the bank and an individual firm not belonging to the *ROSCoA* association. Then, subsection 4.1.2 analyzes the relationship between the bank and *ROSCoA* members.

4.1.1 Benchmark: *Individual Liability Lending*

A one-period financial contract specifies the loan advanced by the bank, L; the amount that the firm has to repay if the return is positive, D; the collateral transferred in case of failure, C.

The individual firm's gross expected payoff under the contract is

$$u(D,C)=\begin{cases} w+p_a(R_a-D)-(1-p_a)C & \text{if high effort is applied or} \\ w+p_b(R_b-D)-(1-p_b)C & \text{if low effort is applied.} \end{cases}$$

The firm chooses high effort only if the incentive compatibility constraint is satisfied, i.e. iff

$$D \le D' + C, \qquad (IC)$$

where $D' = (p_a R_a - p_b R_b)/(p_a - p_b)$.

The participation constraint is

$$u(D,C) \ge w. \qquad (PC)$$

The equilibrium profits will depend on whether the firm is encouraged to apply low or high effort.

Under low effort, the bank would reach at most $\pi = p_b R_b - L$, so it will never induce this strategy[8]. As a result, the choice of the bank is restricted to the contract promoting the efficient solution.

Under high effort, $D = D' + C$ and the equilibrium profits will depend on the size of the endowment.

If $w < p_a(R_a - D')$, where $p_a(R_a - D')$ is the level of collateral such that the (*PC*) is binding, the equilibrium collateral is $C = w$. The firm receives a gross expected profits of

[8] This does not necessarily imply that it is never beneficial for the firm to choose the low-effort strategy. The borrower, indeed, takes into account the difference between its expected product and the repayment sum derived from the financial contract, and not the difference between the expected product and the loan received from outside.

$$u(D,C) = w + p_a(R_a - D') \quad . \tag{3}$$

The bank obtains an expected payoff equal to

$$\pi(D,C) = p_a D + (1 - p_a)C - L = p_a D' + w - L \quad . \tag{4}$$

In the following analysis, it will be helpful to assume that

$$L - p_a D' > 0 \quad . \tag{A2}$$

Under ($A2$), the equilibrium payoff of the bank is equal to 0 when $C = L - p_a D' = C^{PC}$, so the firm can receive a loan only if $w \in [C^{PC}, L)$. Note that for $C = C^{PC}$, the equilibrium payoff for the firm is

$$u(D,C) = w + p_a R_a - L \quad , \tag{3'}$$

that is, the first-best profit. The bank, instead, receives

$$\pi(D,C) = 0 \quad . \tag{4'}$$

Therefore, when $w < p_a(R_a - D')$, the entrepreneur obtains something above the outside option and the monopolistic bank is not able to extract all the rent.

If $w \geq p_a(R_a - D')$, the equilibrium collateral is $C = p_a(R_a - D')$. The entrepreneur receives

$$u(D,C) = w, \tag{5}$$

and the bank gets

$$\pi(D,C) = p_a R_a - L. \tag{6}$$

Consequently, if the collateral is large enough, all surplus is extracted by the bank as in a full-information setting. Note that, in this case, the firm is able to retain from the contract *exactly* the endowment it had before the financial transaction.

To restrict the analysis, in the remainder of this section, assume that the monopolistic bank decides to grant a loan only if it can achieve the highest possible payoff. Hence, the bank will always require a collateral[9]

$$C \geq p_a(R_a - D') = C^M \tag{A3}$$

.[10]

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[9] This is a reasonable assumption if we imagine (as in Varghese, 2005) that the bank has nationwide branches and is able to obtain the profit $p_a R_a - L$ outside the village economy.

[10] It is always $p_a(R_a - D') > 0$ as this reduces to $R_b > R_a$.

Note that the bank is not strictly interested in a collateral $C > p_a(R_a - D')$

as, in any case, it would obtain the payoff (6).

The equilibrium repayment in case of success is $D = D' + C = D^M$.

4.1.2 *Bank–ROSCoA Relationship*

If agents decide to form a *ROSCoA*, anticipating the behaviour of the bank under (*A*3), at the beginning of the cycle they will make a money contribution of $C^M/2$ to collect the collateral pot[11]. So, to receive a loan, each endowment must be such that $w \geq C^M/2$. This subsection shows that the *same* collateral collected at the beginning of the first period can be used to secure the second-period loan.

Under the first-period contract, a *ROSCoA* member receives an expected profit equal to

$$u_1(D,C) = \begin{cases} w + p_a(R_a - D) - (1 - p_a)C^M/2 & \text{for high effort, or} \\ w + p_b(R_b - D) - (1 - p_b)C^M/2 & \text{for low effort.} \end{cases}$$

The current firm's incentive constraint is

$$D \leq D' + C^M/2 \,. \qquad (IC^{ROSCoA})$$

[11] The firm could strategically choose to hide some of its endowment to get a share of the contractual rent. This choice is analyzed in more detail in Reito (2011).

This implies that, to reach the repayment sum D^M required by the monopolistic bank, the other member acts as a guarantor with the additional fraction $C^M/2$.

The first-period participation constraints of the firm and of the other *ROSCoA* member are thus the same and equal to

$$u_1(D,C) \geq w. \qquad (PC^{ROSCoA})$$

The (PC^{ROSCoA}) requires that the equilibrium expected payoff under the contract must be at least equal to the sum received by saving the amount w at the safe rate. Hence, at equilibrium, each member's expected gross profit is

$$u_1(D,C) = w. \qquad (7)$$

Bank's net expected profit is

$$\pi_1(D,C) = p_a R_a - L. \qquad (8)$$

As in subsection 4.1.1, after the first transaction, the two members of the association are able to retain from the contract *exactly* the endowment they had at the beginning of the first period. Accordingly, in expected terms, the first-period collateral fraction $C^M/2$ can also be used to secure the second-period loan. The reason is that, although a monopolistic bank is able to extract all the rent, the participation constraint of both members must be in any case satisfied. Agents are again assumed to save also the possible remaining difference $w - C^M / 2$.

The final payoff of each *ROSCoA* member is

$$u_2(D, C) = w. \quad (9)$$

A somewhat extreme implication is that, in theory, even members with $w = C^M / 2$ (individually insufficient to ask for a loan) are able to become entrepreneurs.

4.2 Perfectly Competitive Lenders

In a competitive credit market, the financial contract must satisfy the incentive constraint for the current firm, the participation constraints of both members and the zero-profit condition for each bank,

$$\pi(D, C) = p_a D + (1 - p_a) C - L = 0 \quad . \quad (0\pi C)$$

For (*A*1), the choice of the bank is again restricted to promoting the high-effort strategy. In this model setup, there is not an unequivocal definition of competitive equilibrium. Indeed, as each firm's incentive constraint is $D \le D' + C/2$, there can be infinite equilibrium combinations of C and D satisfying the (0πC) and maximizing the expected payoff of the current-period firm. However, what we need here is that, with perfectly competitive banks, the firm will always achieve the first-best payoff whatever combination is derived through competition. For example, if we substitute $D = D' + C$ (i.e. taking into account the other member's share) into (0πC), we obtain

$$C^{PC} = L - p_a D',$$

which is always positive under (*A*2).

After the first-period contract, each *ROSCoA* member receives

$$u_1(D,C) = w + (p_a R_a - L)/2, \tag{10}$$

and the bank

$$\pi_1(D,C) = 0. \tag{11}$$

The final payoff for each firm is

$$u_2(D,C) = w + p_a R_a - L. \tag{12}$$

Once more, agents will save the difference $w - C^{PC}/2$, if any.

5 COMPARISON BETWEEN *ROSCAs* AND *ROSCoAs*

The first result of the paper is the following

Proposition 1:

In expected terms, each member has the opportunity to become entrepreneur

1) in a ROSCA with a contribution equal to $L/2$ *;*

2) in a ROSCoA with a contribution equal respectively to $C^M/2$ *in a monopolistic credit market, and to* $C^{PC}/2$ *in a competitive credit market.*

Proposition 1 implies that members can run a firm with a lower[12] exogenous flow of savings in a *ROSCoA* with respect to a *ROSCA*. The fraction of the collateral needed is not individually sufficient to ask for a loan so, under individual liability lending, agents with $w = C^M/2$ or $w = C^{PC}/2$ would never be able to get finance. Another implication of proposition 1 is the

Lemma 1:

1) The maximum ex-post contribution if all projects fail is equal respectively to C^M *in monopoly or* C^{PC} *in perfect competition;*

2) At a ROSCoA equilibrium, it is always $C^{PC} < C^M < L$.

Proof:

It is $C^M > C^{PC}$ as that reduces to $p_a R_a > L$. It is also $L > C^M$ as that reduces to $p_a p_b R_a + p_a L > p_a p_b R_b + p_b L$ that is always true since $p_a L > p_a p_b R_b$ and $p_a p_b R_a > p_b L$. ■

Clearly, the choice of a mutual-credit association is to some extent affected by the individual contribution. Indeed, very poor agents may be forced to form one of the two associations without the possibility to choose. If, instead, agents are rich enough, they will be more interested in their expected payoff rather than in the contribution to become entrepreneurs.

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[12] In real life, it is possible in some cases to observe a financial contract with a collateral requirement larger than the loan investment. So, in the terms of this model, we may have an ex-ante (and thus ex-post) collateral contribution $C/2 > L$ (even if it does not seem very likely that a share of the collateral can be larger than the entire loan size).

The following proposition summarizes the discussion made in section 4 and compares the results achieved by the two potential entrepreneurs.

Proposition 2:

1) In a monopolistic credit market, risk-neutral potential entrepreneurs with

a) $w \in [0, C^M / 2)$ *, cannot form neither a ROSCA nor a ROSCoA;*

b) $w \in [C^M / 2, L / 2)$ *, can only form a ROSCoA;*

c) $w \in [L / 2, L)$ *, by comparing (2) and (9), choose to form a ROSCA.*

2) In a competitive credit market, risk-neutral potential entrepreneurs with

a) $w \in [0, C^{PC} / 2)$ *, cannot form neither a ROSCA nor a ROSCoA;*

b) $w \in [C^{PC} / 2, L / 2)$ *, can only form a ROSCoA;*

c) $w \in [L / 2, L)$ *, by comparing (2) and (12), are equally well off either in a ROSCoA*

or in a ROSCA[13].

The comparison between the two associations is depicted in fig. 1. The switch line is the locus of contracts such that the firm is indifferent between high and low effort. For the following lemma, the switch line must be located above the 45° line.

Lemma 2:

Either in the monopolistic or in the perfect competition case, if a ROSCoA equilibrium exists, it is always $D \geq C$.

Proof:

The proof is straightforward. Consider perfect competition and members with $w < L$. In this case, the repayment sum must be strictly larger than L in

[13] In this case, we can say that members choose a *ROSCoA* with some given positive probability.

order to satisfy the (0πC). This would also be true under a monopolistic bank. ■

Note that, with risk neutrality, the switch line is always located above the 45° line. Indeed, both under monopoly and perfect competition, it is $D > C$ since $D = D' + C$ and $D' > 0$. This means that if $w \geq C^M / 2$ in monopoly or $w \geq C^{PC} / 2$ in perfect competition, an equilibrium always exists.

[Fig. 1 HERE]

In fig. 1, a *ROSCA* member reaches the indifference line max u. We can thus imagine that this firm receives the hypothetical financial contract $(D,C) = (L/2, L/2)$ at point *R*.

In a monopolistic credit market, a *ROSCoA* member receives the contract *M* and an expected profit equal to 0. In a competitive credit market, a *ROSCoA* member receives the contract *PC* and maximizes its expected profit.

This analysis, based on risk neutrality, fails to explain why, in some countries with a competitive banking sector, potential entrepreneurs seem to prefer to form a *ROSCoA* and not a *ROSCA* (e.g., in Italy, France, Japan). It is neither able to explain why in countries with a high banking concentration index there is a strong presence of *ROSCoAs* (e.g. in Germany and China). These facts are discussed in the following subsection, which introduces risk aversion on the borrowers' side.

5.1 Risk-Averse Members[14]

[14] This subsection is based on Stiglitz-Weiss (1992).

Assume now that potential entrepreneurs are strictly risk averse, i.e. $u'(\cdot) > 0$ and $u''(\cdot) < 0$, and that there is decreasing absolute risk aversion. Lenders are again considered risk neutral.

Under the financial contract, the expected utility of a potential entrepreneur is

$$E[u(\cdot)]_j = \begin{cases} w + p_a u(x_a^S) + (1-p_a)u(x^f) & \text{for high effort, or} \\ w + p_b u(x_b^S) + (1-p_b)u(x^f) & \text{for low effort.} \end{cases}$$

where $j = a,b$ and where x_a^S and x_b^S are the end-of-period profits in case of success, while x^f is the profit in case of failure. Under risk aversion, we cannot derive the exact collateral values without specifying the utility function. So, we will mainly use the graphical representation and denote by C^M the collateral such that members receive an expected utility equal to 0, and by C^{PC} the collateral such that each bank's (0πC) holds. The switch curve is defined as the locus where $p_a u(x_a^S) + (1-p_a)u(x^f) = p_b u(x_b^S) + (1-p_b)u(x^f)$. The switch curve has a positive slope as

$$\left.\frac{dD}{dC}\right|_{E[u]_a = E[u]_b} = \frac{(p_a - p_b)u'(x^f)}{p_a u'(x_a^S) - p_b u'(x_b^S)} > 0 \qquad (13)$$

Each firm's indifference curve is always steeper than the bank's indifference line. Indeed, it is $[(1-p_a)u'(x^f)/p_a u'(x_a^S)] > [(1-p_a)/p_a]$ as $u(x_a^S) > u(x^f)$ and $u''(\cdot) < 0$.

In the case of a *ROSCA*, $x_a^S = (R_a - L)/2$ and $x^f = -L/2$. Again, it is as members received the contract $(D,C) = (L/2, L/2)$. In the case of a *ROSCoA*, $x_a^S = (R_a - D)/2$ and $x^f = -C/2$.

Lemma 2 can also be applied under risk aversion so, if a *ROSCoA* equilibrium exists, the financial contract must located above the 45° line[15]. However, in this case, we cannot be sure that the switch curve is entirely located above the 45° line. For example, rich individuals may have a very low degree of risk aversion and a flat switch curve (Stiglitz-Weiss, 1992). To rule out this case we assume that, at the contract $(L/2, L/2)$, it is

$$E[u(L/2, L/2)]_a \geq E[u(L/2, L/2)]_b \quad . \tag{A4}$$

Under (*A*4), *ROSCA* members always exert high effort so, for (13), there is at least a portion of the switch curve above the 45° line. In other terms, this means that we only focus on poor potential entrepreneurs with a rather steep switch curve.

Consider fig. 2a and 2b that represent two possible equilibria respectively for a relatively high and low degree of risk aversion (where the switch curves is considered above the 45° line). If the effort applied was observable, the optimal contract would be represented by point *A* in fig. 2a and 2b. In this case, the bank would reach the first-best profit. With asymmetric information, instead, the bank must pay a risk premium to the risk-averse firm (both figures do not consider the indifference curves above the switch curve since the low-effort strategy is inefficient).

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[15] If a *ROSCA* equilibrium exists, the switch curve can also be tangent or cross the 45° line at point $(D,C) = (L/2, L/2)$.

[Fig. 2a and 2b HERE]

In the monopolistic case, the comparison between the associations and the results achieved by members are summarized in the

Proposition 3:

Under (A4), in a monopolistic credit market,

1) if $E[u(L/2, L/2)]_a > 0$*, risk-averse potential entrepreneurs with*

a) $w \in [0, C^M/2)$*, cannot form neither a ROSCA nor a ROSCoA;*

b) $w \in [C^M/2, L/2)$*, can only form a ROSCoA;*

c) $w \in [L/2, L)$*, choose to form a ROSCA.*

2) if $E[u(L/2, L/2)]_a \leq 0$*, risk-averse potential entrepreneurs with*

a) $w \in [0, C^M/2)$*, cannot form neither a ROSCA nor a ROSCoA;*

b) $w \in [C^M/2, L/2)$*, can only form a ROSCoA;*

c) $w \in [L/2, L)$*, choose to form a ROSCoA*[16].

Proof:

See fig. 3 where $E[u(L/2, L/2)]_a > E[u(L/2, L/2)]_b$. In this case, there is a portion of the (0πC) line above the 45° line, between point $(L/2, L/2)$ and the switch curve (point *X*). For (13), the switch curve is increasing at the point where it intersects the (0πC) line. So, all contracts between *R* and *Y* in fig. 3 are possible (monopolistic or competitive) equilibrium contracts.

Case 1–*c*: fig. 2a. If $E[u(L/2, L/2)]_a > 0$, *ROSCoA* members would receive contract M where $E[u(M)]_a = 0$. So, the *ROSCA* equilibrium is at *R*.

[16] If $E[u(L/2, L/2)]_a = 0$, members choose a *ROSCoA* with some given positive probability.

Case 2–*c*: fig. 2b . If $E[u(L/2, L/2)]_a \le 0$, the monopolistic *ROSCoA* equilibrium is at *M* where $E[u(M)]_a = 0$.

■

[Fig. 3 HERE]

In the competitive credit market, had we perfect information, the contract would be represented by point *A* in fig. 4. The *ROSCoA* member would maximize its profit while the bank would break even. With asymmetric information, the equilibrium contract is point *PC* which gives a lower expected utility than *A*, but higher with respect to point *R*. Note that the payoff of a member in a *ROSCoA* is always larger than that in a *ROSCA* (that is, *PC* is always to the left of *R*, or equal when the switch curve is tangent or cross the 45° line).

[Fig. 4 HERE]

As a result, we can state the following

Proposition 4:

Under (A4), in a competitive credit market, if an equilibrium exists, risk-averse potential entrepreneurs always (weakly) prefer a ROSCoA.

Note finally that, since the indifference curves are negative sloped, the implications of proposition 1 hold both at the monopolistic and at the competitive equilibrium.

6 CONCLUSION

The aim of this paper is to provide a theoretical description of a mutual-guarantee association that here, in a rotating scheme, we call *ROSCoA*. In a model with two potential entrepreneurs we show that each of the two *ROSCoA* members has the opportunity, in expected terms, to become an entrepreneur just with a contribution equal to half of the individual collateral asked by a bank (with n members, with the n-th fraction of the collateral). Besides, the paper shows that: first, if (risk averse) agents are very poor, they can only choose to form a *ROSCoA*; second, when agents have enough resources *i*) they always prefer to join a *ROSCA* when the banking sector is in monopoly, while they are equally well off either in a *ROSCA* or in a *ROSCoA* when banks are perfectly competitive; *ii*) they prefer to join a *ROSCA* (*ROSCoA*) if the degree of risk aversion is relatively low (high) in monopoly, while they are always better off in a *ROSCoA* in perfect competition.

The fact that the ex-post contribution of a *ROSCoA* member is always lower (or at most equal if all projects fail) than the individual collateral required by a bank, can clearly have relevant consequences. For example, it could be possible to incorporate the *ROSCoAs* in a model of growth to investigate whether the possibility of financing more projects with the same collateral can have interesting macroeconomic implications.

Other implications would emerge if we introduced in the analysis strong social norms and transaction costs among the participants. Unlike *ROSCAs*, the participation to a *ROSCoA* is not based on the *intuitu personae*. That is, the share of collateral may be freely transferred to any other external potential entrepreneur. The reason is that the whole fixed investment is always born by the bank. The link between participants to a *ROSCA*, instead, is based on a share of the investment that is lost in any case. Therefore, in a *ROSCA*, the transfer of the right to participate would always be more expensive.

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