Competition and Altruism in Microcredit Markets*

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Abstract

We analyze the effects of entry in a previously monopolistic microcredit market characterized by asymmetric information and where institutions can offer only one type of contract. We consider different behavioral assumptions by the Incumbent and study their influence on the equilibrium. We show that competition leads to contract differentiation but can make borrowers worse off. Moreover, the screening process creates a previously unexplored source of rationing. We show then that if the incumbent institution is altruistic, rationing is reduced and that this can positively affect the competitor's profit.

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1 Introduction

Microfinance is considered as one of the most promising instruments to reduce poverty and promote economic development in many areas of the world. Its potential is based on the idea that poor people have an unexplored amount of entrepreneurial skills that ought to be considered in any

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sustainable development plan. Microcredit was designed to help the poor to help themselves.

Although the invention of microcredit and the first experiments in the field were certainly motivated by social and humanitarian motives, there seems to be more than just philanthropy behind some Micro Finance Institutions (MFI) today. Indeed, many important MFIs are (or claim to be) profit maximizing.

The good performances of some of these MFIs, together with the strong emotional impact on public opinion, have attracted a large number of financial institutions, banks, NGOs and donors to this emerging market. The result is that in some areas, characterized by an earlier spread of microcredit, the market is getting saturated.

Consequently, many institutions have now to deal with the effects of competition. In countries like Bangladesh and Bolivia the increase of credit supply is already affecting the incentives for repayment, the fidelity of clients, the quality of the pool of borrowers. This is all the more important that these are considered as key factors to explain the success of microcredit.

Increased differentiation has been one of the first visible consequences of the increase in the number of competitors, although, as many practitioners state, there is still a considerable overlapping of geographic areas and customers' pool.

1.1 Standardizing to Compete

Microcredit has some features making it special with respect to standard credit markets. These characteristics ought to be taken into account to understand the consequences of increasing competition.

Lending money is, in general, not costless. Capital is expensive, and so are the enforcement of repayments, the accountancy systems and even the storing of money. A large part of these costs is independent of the loan's size. For instance, the wage for a bookkeeper is the same no matter how small the loan is.

This makes microcredit relatively more expensive than standard credit, leaving MFIs with a smaller profit margin. For this reason many MFIs struggle for financial sustainability even though they use repayment incentives whose effectiveness has been widely tested. Reducing the managerial cost is essential for the profitability of a microcredit program.

One of the highest costs for an MFI is labor. Microcredit is based on a strict personal relation between MFIs' employees and borrowers. They need to meet regularly, collect the periodic repayments and control the quality of the investment.

Nonetheless some MFIs prefer to hire less specialized personnel. This allows them to pay lower wages, reducing the operational costs. But it also reduces the average quality of the firm's human capital. To reconcile this trade-off, simplification of all the procedures is needed: microfinance contracts need to be as standardized as possible. Some big and viable MFIs highlight this strategy as the main factor of their success. For instance, ASA, in Bangladesh define its organization as the *Ford Motor Model of Microfinance*, stressing via this analogy how important for them is to offer an extremely standardized contract. The *Grameen Bank*, also operating in Bangladesh and probably the most celebrated Microfinance Institution in the world, offers loans with a unique interest rate, namely 16%, and this is certainly a special feature for a bank managing a portofolio of several millions of clients. In other words, there is evidence that MFIs operating in competive markets offer extremely few contract types, and often only one.

The most convincing explanation of this phenomenon comes from the fact that lending money to the poor is possible only via the design and implementation of mechanisms able to tackle issues as moral hazard, absence of collateral, adverse selection, gender specificity and so on. These mechanisms are complex, often delicate. Moreover the choice and the implementation of such mechanisms have important consequences for the organization of the firms, both in terms of management and infrastructure. Since the contracts offered by each MFI are an essential part of these mechanisms, inevitably the choice of a particular interest rate has a strong commitment power (at least in the short run) and makes it particularly difficult to offer various contract types.

We model a microcredit market with these characteristics. Our goal is to understand the effects of competition on credit supply, borrowers' welfare and MFIs' profit. To capture the special features of the market, we impose restrictions on the strategy set for the competing MFIs that sensibly constrains their behavior, making it more difficult for them to face the financial risks. More precisely we assume throughout the paper that MFIs operate in a market with different types of borrowers, but can only offer one type of contract. This captures the idea that MFIs cannot offer the same variety of products that a standard bank would.

We first use a simple sequential game, with two firms (Incumbent and Entrant) and two types of borrowers (Safe and Risky). We first assume that both firms are profit maximizing. This framework fits a mature microcredit market (like Bangladesh or Bolivia), where the market is dominated by few and large institutions, often with an official Bank legal status.

Then, we consider the case where the Incumbent is altruistic. An altruistic institution maximizes the borrowers' profit under a non-bankruptcy constraint. This approach better describes a younger microcredit market. In most countries, microcredit has been pioneered by NGOs programs with a clearly stated social aim. Some of them have then transformed into profit maximizing institutions, but others have kept their status unchanged and have started cohabiting and competing with profit maximizing entrants.

If a monopolistic MFI can offer one contract only, screening is not possible. But if more than one MFI is in the market, then there might be incentives to differentiate the contracts as much as possible. We show that these incentives exist and that they lead to equilibria in which competitors offer incentive compatible contracts that enable a perfect screening of the borrowers' type.

As usual in these equilibria, the Risky borrowers enjoy an information rent and the Safe ones are rationed. Yet, rationing is not merely a consequence of adverse selection as in Stiglitz and Weiss (1981). The information rent is decreasing in the level of rationing, and both are determined by the Incumbent's choice. Therefore, when the Incumbent sets his optimal contract she indirectly influences the Entrant's profit. Clearly if the Incumbent wants the Entrant to engage in a screening strategy, she has to guarantee her a high enough profit. For this reason, the level of rationing turns out to depend on the Entrant's outside option.

This form of cooperative screening has some costs, but it is in many cases more profitable than direct competition from the firms point of view. The presence of a second MFI introduces some competitive pressure (with a negative effect on expected profits), but because it makes screening possible, it allows MFIs to offer more targeted (and therefore more profitable) contracts. From the borrowers' point of view, competition can be bad: we show that the borrower welfare can be lower than under monopoly.

Our model also relates to one of the most controversial debates in the microfinance literature, concerning the long run strategic behavior that MFIs should adopt in order to enlarge the microfinance outreach. One side of this debate claims that microfinance should abandon the NGOs non-profit behavior and turn into a profit seeking business, independent of any form of subsidy. The argument is that profit maximizing behavior leads to more rigorous financial management. This, in turn, attracts more investors and enlarges the market capacity. More poor people can then be served in a profitable way, leading to a clear welfare gain.

But other researchers and practitioners fear that such a behavior might end up damaging the poor. In their view, microfinance is helpful only if it allows poor borrowers to accumulate capital to be reinvested in their small business. An MFI too focused on profit maximization could, in an oligopolistic market, be able to extract most of the rent, reducing the beneficial effect of access to credit. This phenomenon seems relevant since in some countries many standard banks are currently scaling down part of their business to enter the microfinance market.

Our model shows that this threat is realistic. In particular we find that in equilibrium a profit maximizing MFI is able to extract the entire surplus from at least one borrower type.

By contrast, if the Incumbent is altruistic, *all* the borrowers have positive rent and credit rationing is lower in equilibrium. More surprisingly this is possible while letting the profit maximizing Entrant earn a strictly positive profit that is, under certain conditions, even higher than the profit she would earn when the Incumbent maximizes her profit.

In other words, the presence of an altruistic firm in the market makes not only all the borrowers better off, both in terms of rationing and rent, but it could even be an incentive to attract entrants in the market. The intuition behind this result is that the Incumbent's altruism reduces the amount of rationing necessary to screen the borrowers, and in equilibrium the Entrant can benefit from serving a larger number of clients.

Other papers have examined the issue of increasing competition in microcredit Markets. McIntosh and Wydick [10] present a model in which MFIs maximize the number of served borrowers and cross-subsidize the non-profitable borrowers using the profits earned by serving the profitable ones. They show that as competition increases, the profits from profitable borrowers shrink, so that more poor borrowers are excluded from credit. Their result is based on the assumptions that poor borrowers are less profitable than richer ones, and that MFIs can offer a different contract for each borrower. We will assume, instead, that all borrowers give ex-ante the same expected profit although they differ in their level of risk.

McIntosh, de Janvry and Sadoulet (2005) present an empirical analysis of the highly competitive microcredit market in Uganda. Studying the location decision of the MFIs, they find a strong tendency towards the creation of clusters of institutions, even though the presence of a competitor in the market increases the level of defaults. Our model provides a possible explanation for this phenomenon.

The story our paper builds on is probably closest to the work of Navajas, Conning and Gonzales-Vega (2003), although the tools we use are extremely different. They describe the Bolivian microcredit market and its evolution from monopoly to duopolistic competition. They stress that the two main institutions in the market (Bancosol and Caja Los Andes) have specialized in different market niches: they offer different contracts based on different mechanisms that attract different types of borrowers. This pattern seems to be common in microcredit markets. Our paper draws on this observation.

The paper is organized as follows: In section 2 we define the main features of the market presenting a simple model in which only one MFI is active. In sections 3 we introduce the model with sequential entry and we show how and when differentiation takes place, taking into account different behavioral assumptions for the Incumbent. In section 4 we conclude.

2 The Single MFI Model

We introduce the model starting with the simplest case possible. We examine the maximization problem of a monopolistic MFI under two different behavioral assumptions. First we assume that the MFI maximizes its expected profit; next we consider an altruistic MFI maximizing the borrowers' expected utility. We show that an altruistic institution always prefers to serve both types of borrowers, whereas a profit maximizing MFI chooses between serving both or serving the Risky only.

2.1 One Profit Maximizer MFI

Consider a market with only one MFI and a unit measure of borrowers requesting a loan to finance a new business. The size of the loan is, for simplicity, set to one. There is a fraction β of safe borrowers (characterized by a return R_s and a probability of success p_s), and a fraction $1-\beta$ of risky borrowers (with return R_r and probability of success p_r). The monopolistic MFI has limited lending capacity given by $\alpha \in [0,1)$, so that it can serve at most a measure α of borrowers. We assume that $\alpha > \max\{\beta, 1-\beta\}$, implying that $\alpha \geq 1/2$. The MFI is able to serve at least all the borrowers of a given type. Finally let $x \in [0,1]$ denote the fraction of the demand the MFI is willing to serve (or, in other words, the probability for each borrower to obtain the scarce funds).

We assume that $p_i R_i = m > 1$ and that $p_s > p_r$. Hence $R_s < R_r$. This ensures that both types have the same expected return, and thus that a priori a money lender does not prefer one type to the other. We also assume that $p_r R_s \geq 1$. This ensures that even in case of mismatch between contract and borrower type, lending is viable. The MFI offers only one contract $C = (x, D)$, in which she specifies the repayment D, inclusive of principal and interests, and the probability x for a borrower to be served.

The borrowers' type is private information. Finally, as a tie-breaking rule, we assume that even when the contract leaves the borrowers with no rent, they still prefer borrowing to not borrowing.

The MFI's problem is to find the optimal values for D and x. Clearly, whenever $D > R_s$, only risky borrowers apply for funds. It is then optimal to set $D = R_r$ and $x = 1$: only Risky borrowers apply and their applications are all accepted. That gives the MFI profit:

$$\Pi_{Risky} = (1 - \beta)(m - 1) \tag{1}$$

If, instead, $D \leq R_s$, then both types request credit. So when the MFI wants to serve both types, she optimally sets $D = R_s$. Given the MFI's capacity constraints, she can only serve a fraction of the borrowers applying for credit. She has therefore to set $x = \alpha$, that gives her profit:

$$\Pi_{Both} = \alpha(\beta(m - 1) + (1 - \beta)(p_r R_s - 1)) \tag{2}$$

Note that the MFI cannot choose to serve only safe borrowers. When $D \leq R_s$ the risky borrowers also apply for credit and there is no way to screen them. Whether the MFI prefers serving one or both types, depends on the parameters of the model.

We can restate the problem in a more formal way by introducing some notation that will prove useful in the rest of the paper. Define the demand function $B : \mathbb{R}_+ \to [0, 1]$ denoting the number of borrowers *willing* to apply at given value of repayment D. Clearly, in this simple case we have:

$$B(D) = \begin{cases} 1 & \text{if} \quad D \leq R_s \\ (1 - \beta) & \text{if} \quad R_s < D \leq R_r \\ 0 & \text{if} \quad D > R_r \end{cases}$$

As showed above, the choice of D affects the composition of the applicants pool and, therefore, the average probability of repayment. The latter can be described by a function $P : [0, R_r] \to [0, 1]$ that assigns to each repayment D the average probability of repayment. Under our assumptions this function is defined as:

$$P(D) = \begin{cases} p_r & \text{if} \quad D > R_s \\ \beta p_s + (1 - \beta)p_r & \text{if} \quad D \leq R_s \end{cases}$$

Using these definitions, the maximization problem faced by a monopolistic, profit maximizing MFI can be written as:

$$\max_{x,D} \Pi = xB(D)[P(D)D - 1] \tag{3}$$

subject to:

$$xB(D) \leq \alpha$$

The objective function is not continuous in D. Indeed the demand function has a jump in the point $D = R_s$ so that a small increase of D can significantly alter the average probability of repayment and the overall profit of the MFI. The constraint is binding whenever the MFI prefers to serve both types.

2.2 One Altruistic MFI

We now consider the assumption that the monopolistic MFI is *altruistic*. An altruistic MFI maximizes the sum of the utilities of the borrowers it serves. The maximization is subject to a non-bankruptcy constraint.

Using the notation introduced above, the maximization problem faced by an altruistic MFI in a monopolistic market can be written as:

$$\max_{x,D} BW := xB(D)[m - P(D)D] \tag{4}$$

subject to:

$$xB(D)[P(D)D - 1] \geq 0 \qquad NBC$$
$$xB(D) \leq \alpha$$

The first constraint is a non-bankruptcy constraint, ensuring the financial viability of the contract. The second is the capacity constraint.

As before, there are two options available for the monopolist: serving both types of customers or serving only the Risky ones. Due to its altruism, the altruistic MFI always prefers to serve both types of borrowers. To see that, suppose first that the monopolist serves only the Risky types. In that case the NBC can be rewritten as $(1-\beta)(p_r D - 1) = 0$. This is binding when $D = 1/p_r$. But, by assumption, $1/p_r < R_s$. Such a repayment would attract both types. Thus if the MFI wants to serve the Risky borrowers only, she has to set $D = R_s + \epsilon$, with $\epsilon \in \mathbb{R}_+$ arbitrarily small. Substituting it in the objective function we get $BW_r = (1-\beta)p_r(R_r - R_s - \epsilon) = (1-\beta)(m - p_r R_s) - \epsilon$.

If, instead, the monopolists serves both types, she optimally sets $D = D_b = \frac{1}{\beta p_s + (1-\beta)p_r}$. Substituting it in the objective function we get $BW_b = \alpha(m-1)$.

Since by assumption $\alpha > \max\{\beta, 1-\beta\}$ and $p_r R_s \geq 1$, BW_b is strictly larger than BW_r, so that serving the Risky borrowers only is a strictly dominated strategy

Intuitively, giving the Safe borrowers access to credit can only increase the rent of the Risky ones, while excluding them is not feasible. The MFI has then an unambiguous incentive to serve both types.

In the next section, we present a model with sequential entry. We will show how the credible threat of entry by another MFI in the market changes the behavior of both a profit maximizing and an altruistic MFI.

3 Sequential Entry

Consider a microcredit market initially served by a single MFI (the Incumbent), and suppose that a second one (the Entrant) is considering entering the market in the following period.

We maintain the assumption that each MFI can offer one contract only. The timing is the following: at time $t = 1$ the Incumbent sets his contract. The Entrant observes the market and the Incumbent's strategy and at time $t = 2$ she decides whether to enter the market or not. At time $t = 3$, the borrowers observe both contracts and choose their favorite. Due to rationing or to capacity constraints, at the end of this stage some borrowers might be denied the loan they have applied for. In that case at time $t = 4$, they choose their second best contract (if they have one). As before a contract is a pair $C = (x, D)$, where x is the probability of obtaining the scarce funds (or, the fraction of the demand the MFI is willing to serve) and D is the required reimbursement. We denote by $C^I = (x^I, D^I)$, the contract offered by the Incumbent and with $C^E = (x^E, D^E)$, the contract offered by the Entrant. We assume that the Entrant maximizes expected profit.

The choice of a particular contract determines the pool of borrowers served. In this respect their choice results in a commitment: once a contract (and the underlying mechanism) is chosen, it cannot be changed in the short run. This assumption seems quite plausible. Part of the successes of microfinance is due to the design of innovative mechanisms able to deal with issues as moral hazard, absence of collateral, adverse selection, gender specificity and so on. These mechanisms are tailor-made to address the unique features of the socio-economic environment of the borrowers, and can therefore be substantially different across MFIs[1].

[1]For instance, it is extremely common to observe in the same market MFIs adopting only group lending and others using only individual lending.

The differences in mechanisms are reflected in the management and organization of the MFIs. A clear evidence of that is that extremely few MFIs use more than one mechanism. Hence, once a mechanism is designed and implemented, it is reasonable to think that an MFI has to stick to it at least in the short run.

As usual, we solve the model considering first the Entrant's optimal reaction for any given choice by the Incumbent, and we then proceed by backward induction to specify the optimal choice by the Incumbent.

Note that now the players have more choices available compared to the situation described in the previous section: there they could only decide whether to serve the risky or both types. Now, instead, they can in principle make any choice: should they choose to serve only safe borrowers, the presence of the competitor can help them screen out one type from the other.

The borrowers compare the contracts offered by both the Incumbent and the Entrant and decide the MFI to apply for credit to. Borrowers are primarily concerned by the monetary outcome of the contract, so the demand faced by each MFI depends on C^I and C^E. Similar to the previous section we can then define a function $B^i(\cdot,\cdot) : \mathbb{R}^2_+ \times [0,1]^2 \rightarrow [0,1]$ that assigns to each combination of contracts the mass of borrowers preferring MFI i. We can partition the space of contracts into four cases:

1. Full separation: $x^i p_s(R_s - D^i) > x^j p_s(R_s - D^j)$ and $x^j p_r(R_r - D^j) \geq x^i p_r(R_r - D^i)$, for $i, j \in I, E$: in this case the Safe borrowers prefer the contract offered by firm i, whereas the Risky ones prefer the contract offered by j. Thus, β borrowers apply for credit to MFI i ($B^i(C^i, C^j) = \beta$), and $1-\beta$ to MFI j ($B^j(C^i, C^j) = 1-\beta$). If these conditions are fulfilled the MFIs can screen the borrowers.

2. Full coverage by both: $D^i \leq R_s$; $D^j \leq R_s$; $x^i p_s(R_s - D^i) > x^j p_s(R_s - D^j)$ and $x^i p_r(R_r - D^i) > x^j p_r(R_r - D^j)$: in this case all the borrowers prefer the contract offered by MFI i. Thus $B^i(C^I, C^E) = 1$ but, because of the capacity constraint, MFI i can at most serve the first α applicants. The remaining $1-\alpha$ (the residual demand of both types) is served by j, so that $B^j(C^I, C^E)$ is bounded below by $1-\alpha$. [2]

3. Partial separation: $D^i \leq R_s$; $R_s \leq D^j \leq R_r$; $x^i p_s(R_s - D^i) > x^j p_s(R_s - D^j)$ and $x^i p_r(R_r - D^i) \geq x^j p_r(R_r - D^j)$: also in this case $B^i(C^i, C^j) = 1$, so that MFI i can serve up to α borrowers. But MFI

[2] The actual residual demand depends on the mass of borrowers served by the competitor. MFIs can in principle decide not to use their whole capacity (setting $x < 1$). But given the capacity constraint, the residual demand measures *at least* $1-\alpha$.

j is only able to attract the residual demand of the Risky borrowers, so that $B^j(C^i, C^j)$ is bounded below by $(1-\alpha)(1-\beta)$.

4. Exclusion: $R_s \leq D^i \leq R_r$; $R_s \leq D^j \leq R_r$ and $x^i p_r(R_r - D^i) \geq x^j p_r(R_r - D^j)$: in this case both MFIs can attract only the Risky borrowers, who in turn prefer the contract offered by i. We have then $B^i(C^i, C^j) = 1-\beta$ and $B^j(C^i, C^j) = 0$.

As a tie-breaking rule we assume that if a borrower is indifferent between two *different* contracts, he chooses the one that has been designed for his type. Moreover if both MFIs offer the same contract, they share the demand equally.[3] As before, we can also define a function $P(\cdot,\cdot) : \mathbb{R}^2_+ \times [0,1]^2 \rightarrow [0,1]$, assigning to each combination of contracts the probability of repayment. It takes value p_r, p_s or $p_b := \beta p_s + (1-\beta)p_r$ when the MFI serves respectively the Risky, the Safe or Both types of borrowers.

3.1 The Entrant Strategy

As mentioned above, at time $t = 2$ the Entrant chooses her contract upon the observation of the Incumbent's choice. She has then three different possibilities: (i) Offer a targeted contract; (ii) Target the residual demand of the chosen sector(s); (iii) Offer a non-specialized contract, suited to attract both types. As we will see, the first option is only feasible if the Incumbent has set a contract that allows screening. The Entrant faces the following maximization problem:

$$\max_{x^E, D^E} \Pi^E = x^E B(C^I, C^E)\Big[P(C^I, C^E)D^E - 1\Big]$$

subject to:

$$x^E B(C^I, C^E) \leq \alpha$$

The Entrant's strategy set is given by the set of all possible contracts (x, D) such that $x \in [0,1]$ and $D \geq 1$. But the strategy set can be divided in three subsets, each of them identifying a possible *intention*: serving the Risky, the Safe or Both borrower types. In other words, the choice of a contract determines the group to target to, but also the strategic behavior to adopt with respect to the competitor: a particular contract (x_i, D_i) determines whether there will be direct competition (both MFIs targeting the

[3]This taxonomy is exhaustive since if the Safe borrowers are indifferent between the contracts, then also the Risky are.

same pool of borrowers), perfect product differentiation (each MFI specializing on a particular group) or monopolistic behavior on the residual demand (the MFI exploits the capacity constraint of the competitor).

As a first observation, notice that direct price competition for the same type of borrowers is only possible when both MFIs serve the Risky borrowers or when both serve both types.[4] We show that these strategies are never played in equilibrium.

Since by assumption $1 > \alpha \geq \max\{\beta, (1-\beta)\}$, whatever the Incumbent strategy is, the Entrant can always target the residual demand $(1 - x^I B^I(C^I, C^E))$, and impose on it a monopolist price. For the sequel, it is useful to calculate the profit the Entrant can earn serving the residual demand of the Risky types, when the Incumbent faces a demand $B^I(C^I, C^E) = 1$, i.e. serves both markets. The Entrant can set $D^E = R_r$, extracting the whole surplus from the residual Risky borrowers and earning:

$$\Pi^E_{ResR} = (1-\alpha)(1-\beta)(m-1). \tag{5}$$

In the same way we can define the profit the Entrant can earn serving the residual demand of both types. She can set $D^E = R_s$, extracting all the Safe borrower's surplus and leaving the Risky ones a rent. She earns:

$$\Pi^E_{ResB} = (1-\alpha)[\beta(m-1) + (1-\beta)(p_r R_s - 1)] \tag{6}$$

Whether Π^E_{ResR} or Π^E_{ResB} is bigger depends on the particular values of the parameters. If $\beta < \frac{m - p_r R_s}{2m - p_r R_s - 1}$ the Entrant prefers to serve the residual demand of the Risky type.

Perfect screening of the borrowers is only possible when competitors coordinate. If an MFI chooses to specialize in the Risky sector, the screening is easily done by setting a contract with $D > R_s$, so that no Safe borrower is willing to apply. But serving only the Safe borrowers is not so easy. A suitable contract for the Safe type, requires a lower value of D, and that surely attracts also the Risky borrowers.

In our model, as in a more standard screening problem, MFIs can ration some borrowers in order to make screening possible. By properly adjusting the value of x, they can reduce the expected profitability of the contract designed for the safe borrowers. At the same time, the risky ones receive an information rent. The idea is quite standard, but we apply it in a particular way: in our model the optimal contracts are the result of a competitive

[4] If both MFIs choose the Safe sector, screening is impossible, and they both end up serving both types.

process between two different MFIs, each offering one single contract. We prove the existence of equilibria in which the MFIs find it profitable to design screening contracts in order to make this differentiation possible.

Screening Strategies: Since the Entrant's contract is chosen after the observation of the Incumbent's choice, under some conditions the Incumbent can induce the Entrant to serve one particular market niche and engage in a screening strategy. She can do it by offering a particular contract that makes it optimal for the Entrant to target the other type. We explain the mechanism in the next two lemmas.

Lemma 1. *If the Incumbent chooses a contract such that* $x^I \leq \hat{x}_s(D^I)$ *where* $\hat{x}_s(D^I)$ *is defined as:*

$$\begin{array}{rcl} \min\left\{1, \dfrac{\alpha(m-1)}{m - p_r D^I}\right\} & \textit{if} & \Pi^E_{ResR} \geq \max\{\Pi^E_{ResB}, \Pi^E_{Both}\} \\ \min\left\{1, \dfrac{(1-\beta)(m-1) - \Pi^E_{ResB}}{(1-\beta)p_r(R_r - D^I)}\right\} & \textit{if} & \Pi^E_{ResB} \geq \max\{\Pi^E_{ResR}, \Pi^E_{Both}\} \\ \min\left\{1, \dfrac{(1-\beta)(m-1) - \Pi^E_{Both}}{(1-\beta)p_r(R_r - D^I)}\right\} & \textit{if} & \Pi^E_{Both} \geq \max\{\Pi^E_{ResR}, \Pi^E_{ResB}\} \end{array}$$

then the Entrant's optimal reaction is to offer a contract $(x^E = 1; D^E_r = R_r - \frac{x^I_s}{x_r}(R_r - D^I_s))$*, so that screening takes place with the Incumbent serving the Safe borrowers and the Entrant serving the Risky.*

Proof. See Appendix A □

Intuitively, this lemma states that if the Incumbent wants to serve only the safe borrowers, she must exclude some of them. The number of excluded borrowers depends on the prevailing Entrant's outside option (when the Incumbent is profit maximizing, the relevant outside option is the profit of serving both types. The other options matter when the Incumbent is altruistic). In fact, the Entrant's profit (from serving only the Risky) is lowered by the informational rent that her customers must be given, and this rent is in turn decreasing in the level of rationing chosen by the Incumbent. In other words, the higher is the number of excluded Safe borrowers, the higher is the Entrant's profit. The Incumbent must then exclude a high enough number of customers ($\hat{x}_s(D^I)$) in order to make the Entrant's profit higher than the other options.

What happens when the relevant threshold $\hat{x}_s \notin [0,1)$? If $\hat{x}_s > 1$, the constraints presented in Proposition 1 are not binding, and screening is possible for any $x_s^I < 1$. This happens when the outside options are extremely low (see Figure 2).

The Incumbent behaves the way explained above whenever serving the Safe market niche is her most profitable strategy. Clearly, this is not necessarily the case. Nonetheless, the Incumbent can, in a similar way, decide to specialize in the Risky market niche, inducing the Entrant to specialize in the Safe one and to make screening possible. In order to do it, she has to reduce adequately the required repayment for the Risky borrowers. The mechanism is detailed in the next proposition.

Lemma 2. *If the Incumbent offers a contract (x^I, D^I) characterized by:*

$$R_s < D_r^I \leq \hat{D}^I(x^I) := R_r - \frac{1}{x_r^I}\tilde{x}^E(R_r - D_s^I) \tag{7}$$

where

$$\tilde{x}^E := \max\left\{\alpha(1 + \frac{(1-\beta)(p_r R_s - 1)}{\beta(m-1)}), \frac{(1-\beta)(m-1)}{\beta(m-1) + (1-\beta)(m - p_r R_s)}\right\}$$

then the Entrant's optimal reaction is to offer a contract $(x^E = \tilde{x}^E; D^E = R_s)$, so that screening takes place with the Incumbent serving the Risky borrowers and the Entrant serving the Safe ones.

Proof. See Appendix A. □

Also in this case, to have screening, Risky borrowers must be given better conditions via a reduction of the repayment D_r. At the same time some of the Safe borrowers must be rationed. One of the important implications of the lemmas above is that, in a microfinance market, if specialization is an equilibrium, then it must be an equilibrium with *credit rationing*. This rationing is due to the combined effect of adverse selection and oligopolistic competition. Different than in Stiglitz and Weiss (1981), where rationing is *only* a consequence of the presence of 'bad' types in the market, in our model the value of x_s is determined by the outside option of the competitor.

In Lemma 1, the Incumbent rations the safe borrowers in order to make the screening strategy optimal for the Entrant. In Lemma 2, the Incumbent has to increase the information rent offered to the Risky borrowers in order to reduce rationing of the Safe ones and increase the Entrant's profit. This is an explanation for rationing in markets with a limited availability of contract types and oligopolistic competition that, to our knowledge has not been explored before.

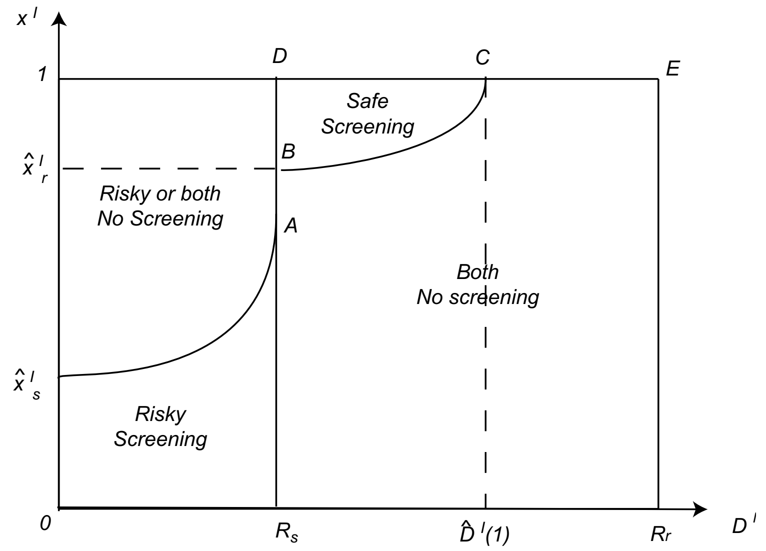

Figure 1: Entrant strategies as a function of the Incumbent strategies

Non-screening Strategies: When the conditions stated in Lemmas 1 and 2 are not fulfilled screening is not possible. As illustrated in Figure 1, there are two cases to consider.

In the first case Incumbent sets a contract with $D^I \leq R_s$, but $x^I \geq \hat{x}_s^I$ (region $\hat{x}_s^I AD1$). By choosing such a contract the Incumbent indicates that her preferred strategy is to serve both types. The Entrant can then either undercut the Incumbent's price, or she can simply decide to serve the residual demand. More precisely, the Entrant knows that by serving the residual demand she can earn:

$$\Pi_{Res} = \max\{\Pi^E_{ResR}; \Pi^E_{ResB}\}. \tag{8}$$

Alternatively she can earn:

$$\Pi_{Undct} = \alpha[\beta(p_s D^I - 1) + (1 - \beta)(p_r D^I - 1)] \tag{9}$$

(where $x^E = \alpha$). The choice clearly depends on the value D^I set by the Incumbent.

In the second case, the Incumbent sets a contract lying in the region $R_s R_r ECB$, that is a contract that only suits the Risky borrowers but does not fulfill the condition of Lemma 2. The Entrant has three possible strategies: (a) Serve the residual demand of the Risky borrowers (earning Π^E_{ResR})[5]. (b) Undercut the Incumbent's price. (c) Offer a contract with $x^E = \alpha$ and $D^E = R_s$. In this last case she serves a fraction α of both borrowers type, making profit:

$$\Pi^E_{RB} = \alpha\{\beta(m-1) + (1-\beta)(p_r R_s - 1)\} \tag{10}$$

and leaving the Incumbent with the residual demand on the risky borrowers.

In the next subsection we will show that undercutting is never part of the equilibrium.

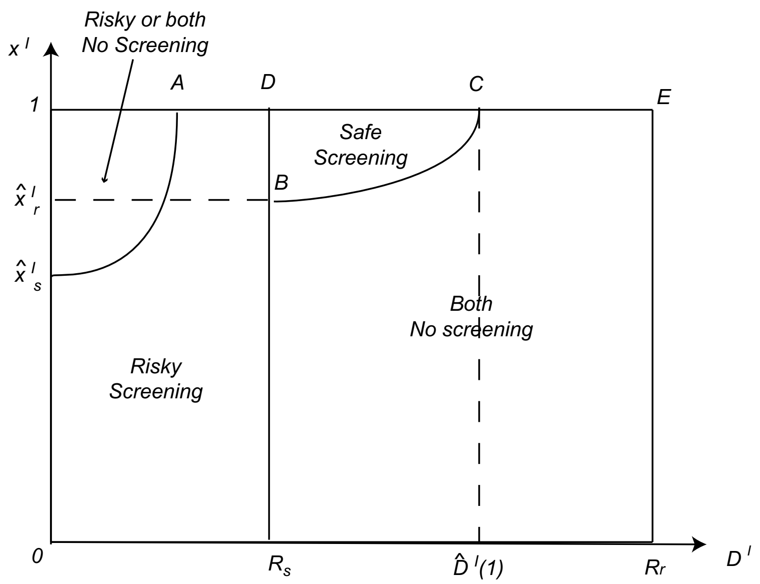

Figure 2: Entrant Strategies as a function of the Incumbent strategies: the case $\hat{x}_s \notin [0, 1)$

3.2 The Incumbent Strategy

We examine now the Incumbent's behavior taking into account the Entrant's reaction examined above. In order to better describe the special features of microfinance markets, we will consider three different behavioral assumptions for the Incumbent. This will help us not only to understand better a

[5]As we will show later, this option is only relevant when the Incumbent is altruistic

highly heterogeneous phenomenon, but also to provide some general policy advices obtained via the comparison of the effects on welfare of different conducts.

3.2.1 The Profit maximizing Incumbent (PM Model)

We start by assuming that the Incumbent MFI is *profit maximizing*, just like the Entrant. One could argue whether this assumption is the appropriate one for the market we want to examine. Indeed, although profit maximization is probably the most natural behavior for any financial institution, it is not necessarily the most appealing to describe a microfinance institution. Microfinance owes most of his fame to the role it is supposed to play in fostering economic growth in developing countries. As a consequence, at least at first, it has attracted more socially motivated players (NGOs, international institutions, national banks) than business oriented institutions.

Nonetheless, the biggest and more influential MFIs do claim that they are able to make significant profits, and consider this ability as the result of a careful and business oriented management. The remarkable implication is that if microfinance showed to be effective in poverty reduction, then this result would be attainable in a costless or even profitable way.

This *win-to-win* promise has generated on the one hand a huge (and probably naive) wave of enthusiasm by a number of NGOs that glimpse in it the ultimate solution to their financial problems, and on the other hand quite some skepticism by a number or researchers and bureaucrats. Indeed the profitability of some MFIs seems to be quite sensible to the definition itself of profit, since in some cases unorthodox accountancy methods are used.

Anyway the advocates of a pure profit maximizing behavior seems to be the most numerous and the most influential, so that more and more MFIs are trying to put in practice their preaches. In order to get a better theoretical understanding of the problems involved in this debate, we now examine a model describing this scenario, in which the Incumbent behaves as a profit maximizer.

Let $C^E(C^I)$ be the Entrant's reaction function to the Incumbent's strategy. The Incumbent faces this maximization problem:

$$\max_{x^I, D^I} \Pi^I = B(C^I, C^E(C^I))x^I \left[P(C^I, C^E(C^I))D^I - 1\right]$$

subject to:

$$x^I B(C^I, C^E(C^I)) \leq \alpha$$

The Incumbent, just like the Entrant, can choose whether to specialize in a particular sector or to accept both types of borrowers. In the first case she needs to induce the Entrant to offer an incentive compatible contract as showed in Lemma 1 and 2. In what follows we describe her optimal behavior for each possible case.

Suppose first that the Incumbent wants to be the only creditor for the Safe borrowers. In that case she needs to offer a contract satisfying the conditions in Lemma 1, inducing the Entrant to specialize in the Risky borrowers offering an incentive compatible contract. When the Incumbent is profit maximizing the Entrant's dominant outside option is to undercut the Incumbent's contract, so that the relevant value of $\hat{x}_s(D^I)$ is the last one in Lemma 1. Since $\hat{x}_s(D^I)$ is increasing in D^I, the Incumbent will choose D^I as big as possible, taking into account the constraints $D \leq R_s$ and $\hat{x}_s^I < 1$. This leads to $D^I = R_s$. If the constraint in Lemma 1 is not binding, then the Incumbent just minds the constraint $x^I < 1$ (see region $0R_sDA\hat{x}_s^I$ in Figure 2).

Under these conditions $B^I(C^I, C^E) = \beta$, giving the Incumbent the following expected profit:

$$\Pi_{sr}^I = \beta \hat{x}_s(R_s)(m-1). \tag{11}$$

Suppose instead that Incumbent wants to serve *all* the Risky borrowers. She can then either induce the Entrant to serve the Safe ones only and engage in a screening strategy or she can offer a non targeted contract.

In the first case the findings of Lemma 2 apply. The equation in condition (7) is increasing in x_r^I, so the Incumbent chooses $x_r = 1$, and $D_s^I = \hat{D}^I(1)$. This gives him the expected profit:

$$\Pi_{rs}^I = (1-\beta)\Big[p_r\Big[R_r - \alpha\Big(1 + \frac{1-\beta}{\beta}\frac{p_r R_s - 1}{m-1}\Big)(R_r - R_s)\Big] - 1\Big]$$

that can be rewritten as:

$$\Pi_{rs}^I = (1-\beta)(p_r \hat{D}^I - 1) \tag{12}$$

In the second case her profit is nil if the Incumbent chooses the Risky sector, too. Otherwise she earns $\Pi_{ResR} = (1-\alpha)(1-\beta)(m-1)$

The third option for the Incumbent is to choose not to specialize. The Incumbent knows that when she chooses such strategy, the Entrant reacts targeting either the Risky or Both borrowers. It follows that the unique Incumbent's concern is the danger of price competition by the Entrant: the Incumbent does not mind any screening issue (she wants to serve both types), but she does worry about the Entrant's possibility to undercut her contract. This reasoning implies the following simple result:

Lemma 3. *In any equilibrium with no screening in which the Incumbent serves both types, her profit is given by:*

$$\Pi_B^I = \max\{\Pi_{ResR}^E, \Pi_{ResB}^E\} \tag{13}$$

Proof. First notice that when the Incumbent chooses not to specialize, she has no incentives not to use her whole capacity. But she has to set a contract such that undercutting is uninteresting for the Entrant. This contract is defined by the couple (x_b^I, D_b^I) that makes the Entrant indifferent between serving the residual demand (at monopolist prices) and pricing just below the Incumbent's conditions. In other words the contract has to satisfy the condition:

$$\max\{\Pi_{ResR}^E, \Pi_{ResB}^E\} = \alpha[\beta(p_s D_b^I - 1) + (1-\beta)(p_r D_b^I - 1)]$$

The value of D_B^I is then obtained by solving the equation:

$$D_b^I = \frac{max\{\Pi_{ResR}^E, \Pi_{ResB}^E\} + \alpha}{\alpha[\beta p_s + (1-\beta)p_r]}$$

□

The Incumbent has then to compare equations (11), (12) and (13) in order to decide her optimal strategy. Not surprisingly the ranking depends on the values of the parameters. Still, some clear results are available. In order to prove them, some preliminary observations are needed. We examine all the Incumbent's profit as a function of β. The first result is that there exists a value for β such that the Incumbent is indifferent to all her strategies.

Lemma 4. *The Incumbent is indifferent between serving the Safe borrowers, the Risky ones or both types when*

$$\beta = \frac{m - p_r R_s}{2m - 1 - p_r R_s}$$

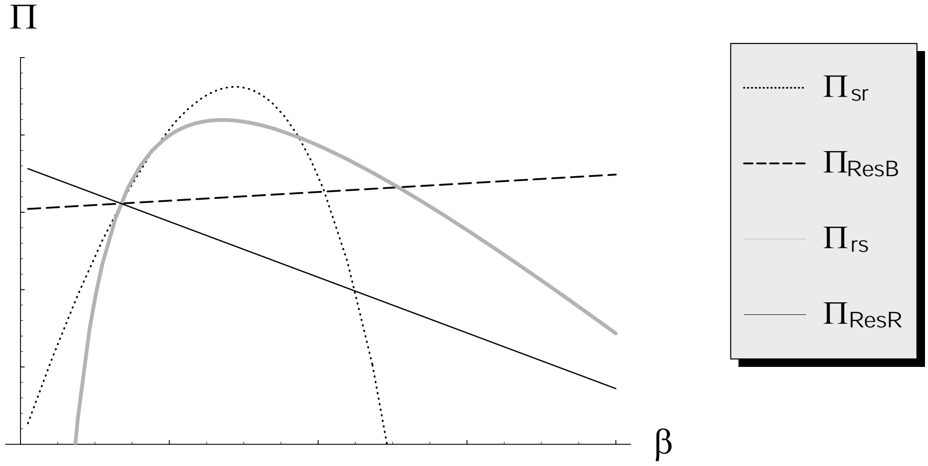

Figure 3: Incumbent Profit: Example 1.

Proof. It follows from simple algebra □

Consider again equations (11), (12) and (13) as functions of β. Note that Π_{ResR} and Π_{ResB} are linear in β, the former decreasing and the latter increasing, so that (13) is a weakly convex "v-shaped" function. The functions describing the profit the Incumbent can earn in a screening equilibrium have different properties that are summarized in the next Lemma.

Lemma 5. *The curves Π^I_{rs} and Π^I_{sr} are first increasing and then decreasing, always concave in β.*

Proof. See Appendix A □

In the next proposition we prove and characterize the existence of equilibria in which both MFIs offer an incentive compatible contract. More generally, four different types of equilibria are possible: two in which the contracts are such that no screening takes place (with one of the MFIs serving the residual demand), and two in which screening is implemented as explained above, depending on whether the Incumbent prefers to serve the Safe or the Risky. The screening strategies always prevail when the fractions of Safe and Risky borrowers are not too unequal.

Proposition 1. *For intermediate values of β, the Incumbent MFI always (weakly) prefers a screening strategy.*

Proof. One can easily check that the curves Π^I_{rs} and Π^I_{sr} cross equation (13) twice: once in the point $\beta = \frac{m-p_rR_s}{2m-1-p_rR_s}$ defined in Lemma 4 and a second time either to the left or to the right, depending on the values of the parameters. By Lemma 5 this implies that there always exist values of β such that the profit arising from a screening strategy is higher than the profit of a non-screening one. This always happens for intermediate values of β since, as proved in Lemma 4, Π^I_{rs} and Π^I_{sr} must cross at least once. □

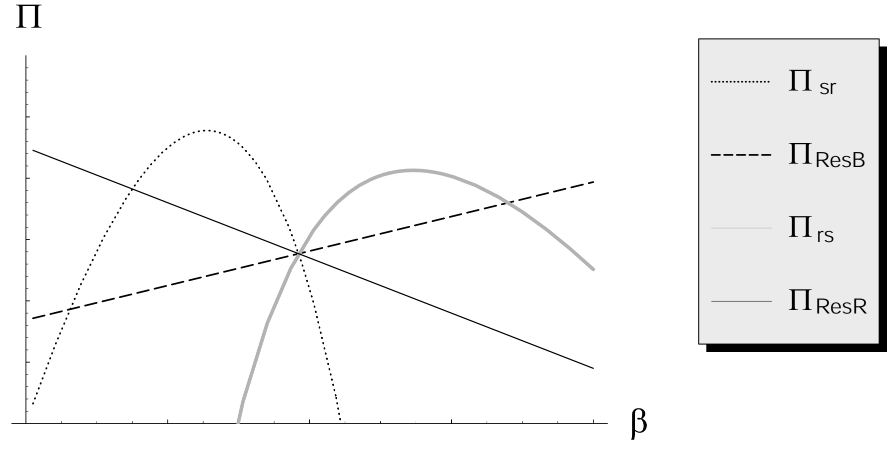

Figure 4: Incumbent Profit: Example 2.

The findings of Proposition 1 are described in Figures 3 and 4. The results show that in a microfinance market the special kind of product differentiation we described is not unlikely to happen. This is in line with the findings of Navajas et Al. (cfr. [12]).

We can now examine the results above in order to understand the consequences of competition in terms of profitability of the firms and borrower welfare. The first conclusion we can draw is that in terms of total welfare competition is always better than monopoly.

Proposition 2. *The total welfare is always higher under a competitive regime.*

Proof. See Appendix A □

The result is somewhat expected, but it must be stressed that it depends mostly on the fact that, since $\alpha \leq 1$ the presence of two MFIs ensures a higher outreach. Still, we claim that competition is not necessarily the best scenario for poor borrowers. Indeed, if we consider borrower welfare as a good proxy for poverty reduction, than the effects of increasing competition are ambiguous when one takes into account the bias given by the capacity constraint. Indeed, it is easy to show that competition can make borrowers worse off if compared to a monopoly with no capacity constraint.

Proposition 3. *If the parameters are such that a monopolist with no capacity constraint would serve both types, then in equilibria with screening the Risky borrowers enjoy less rent and the Safe ones are more rationed.*

Proof. See Appendix A □

The result is due to the fact that in equilibrium the MFI serving the Risky borrowers is able to extract from them a higher rent than what a monopolist could if he does not want to exclude the Safe. Clearly the reverse is true if a monopolist prefers serving the Risky borrowers only. In this case, clearly, competition can only have positive effects. This observation has important policy implications, since very often the capacity constraint of MFIs is determined by socially motivated investors or donors (like World Bank ecc.). If their goal is to maximize borrower welfare, then there are instances in which financing only one monopolist can be better than financing two competitive MFIs.

It is also worth noticing that the Entrant is always guaranteed the profit Π_{Both}. As a consequence, whenever the Incumbent specializes in the Risky sector, the Entrant earns the same profit she would earn if she were a monopolist. That provides a simple possible explanation for the puzzling behavior of MFIs described by McIntosh, de Janvry and Sadoulet (2005) [9], who report that MFIs prefer to locate where other MFI are already active despite the possible negative effect of competition.

3.2.2 The Altruistic Incumbent (AI Model)

We now turn to consider a different behavioral assumption concerning the Incumbent MFI. Microfinance has been invented for humanitarian reasons. It was thought as a possible poverty reducing tool, based on the idea that poor people have a relevant but unexplored amount of entrepreneurial skills that ought to be used: poor must be helped to help themselves.

This is probably the reason why microfinance markets are characterized by a quite heterogeneous population of institution, spanning from small volunteer based humanitarian projects to big international financial institution and banks. A critical analysis of the real motivations inducing international banks to downscale to microfinance is beyond the scope of this paper. Nonetheless, an economic theory on microfinance cannot put aside the fact that some important players in the game may not be merely profit maximizing.

Indeed, empirical evidence shows that in many cases the very first MFIs entering, or even creating the market were not profit-maximizing institutions. Their first, declared goal was to make their customers better off. It seems therefore appropriate to consider in our model also MFIs whose main focus is not profit but the quest for an efficient way to properly serve their clients without incurring substantial capital losses.

Some of these benevolent MFIs did a pretty good job, and their success attracted the attention of other institutions, with completely different goals and often profit maximizing behavior.

In this section we model a situation in which a socially motivated Incumbent is followed by a profit maximizing Entrant. Our goal is to understand how and if the presence of an "altruistic firm" influences the Entrant's strategy, the borrowers' welfare and the market equilibrium.

There are different possible ways to model an altruistic behavior. We consider two instances. First, we assume that the Incumbent's altruism leads to the maximization of the sum of his clients utility, subject to a non-bankruptcy constraint. We label this behavior as *Naive Altruism*, since the Incumbent takes into account only the direct effects his strategy has on his own clients. This behavior characterizes small project-based programs, endowed with less resources and technical knowledge.

Next we consider a different form of altruism that we label as *Smart Altruism.* This is the behavior of an MFI that takes into account also the effect her strategy has on the Entrant's clients. Therefore, a smart MFI maximizes the sum of the utilities of all the borrowers in the market. This second behavioral assumption fits a market in which the Incumbent MFI is state owned, or a central bank.

Naive Altruism: Consider first a *naive* altruist Incumbent. She solves the following problem:

$$\max_{D^I, x^I} B^I(C^I, C^E(C^I))x^I[m - P(C^I, C^E(C^I))D^I] \tag{14}$$

subject to:

$$B^I(C^I, C^E(C^I))x^I[P(C^I, C^E(C^I))D^I - 1] \geq 0 \qquad NBC$$
$$x^I B^I(C^I, C^E(C^I)) \leq \alpha$$

The Entrant's behavior is the same described in Section 3.1 and, as before, the altruistic Incumbent takes into account her reaction when she chooses her best strategy.

The solution of this problem is quite simple, and follows directly from the analysis of section 2.2. Suppose for a moment that the Incumbent MFI has complete information about borrower types, so that she has no problems screening them. Whatever her preferred sector is, she sets her contract so as to leave her customers the highest possible utility while taking into account the NBC. Then the maximal utility she can give to her customers without going bankrupt is $(1-\beta)(m-1)$ if she serves the Risky, $\beta(m-1)$ if she serves the Safe, and $\alpha(m-1)$ if she serves Both types. By assumption $\alpha > \max\{\beta, 1-\beta\}$, so a perfectly informed Incumbent *always* prefers to serve both types.

If the Incumbent's information is incomplete, she can still ensure his customers the payoff $\alpha(m-1)$ serving both types. This is simply done by setting $D^I = \frac{1}{\beta p_s + (1-\beta)p_r}$, that is the value that makes her NBC binding. There are no other screening issues to deal with. Moreover, the Entrant cannot undercut the Incumbent's offer, or she would make negative profits. On the other hand, the borrower welfare attainable serving only Risky or only Safe clients is surely smaller than $(1-\beta)(m-1)$ and $\beta(m-1)$ respectively, since to make screening possible some information rent has to be given to the Risky types, and some Safe borrowers are necessarily rationed. We can then conclude that targeting Both types is a strictly dominating strategy for a Naive Altruistic Incumbent.

This simple model shows that an MFI concerned only with her customers' welfare has no incentive whatsoever to engage in a screening strategy. Trying to differentiate her offer from that of the Entrant can only decrease her positive impact on borrowers. The Entrant's reaction is clearly to serve, depending on the values of the parameters, either the residual demand of the Risky types or the residual demand of Both types.

In general the benefits of such behavior for the market considered as a whole, are not necessarily higher than the benefits the same market would have if the Incumbent maximized his profit. Note, in fact, that when the Incumbent serves Both types, the Entrant can behave as a monopolist on the residual demand. This clearly reduces the welfare of the residual clients. But more importantly, for some values of the parameters, it also reduces the Entrant's profit, hampering the development of a competitive sector and reducing the outreach. [6].

In what follows we examine a slightly more sophisticated type of altruism, leading the MFI to consider the effects of her strategy on the welfare of the whole pool of borrowers. We will discuss the advantages and disadvantages of such an assumption, together with the implications in terms of policy.

Smart Altruism: The second possible type of altruism we consider consists in the maximization of the total borrower welfare. As sketched above, a smart altruistic MFI has to be concerned with the welfare of her clients *and* also with the welfare of the customers served by her competitor. A rational MFI is able to understand which consequences her strategy has on the Entrant's behavior and on her customers. As we will see, this different perspective can indeed lead to different types of equilibria, in which the MFIs specialize in different market niches.

A *smart* altruistic Incumbent faces this maximization problem:

$$\begin{aligned}\max_{D^I,x^I} & B^I(C^I, C^E(C^I))x^I[m - P(C^I, C^E(C^I))D^I] + \\ & B^E(C^E(C^I), D^I)x^E(C^I)[m - P(C^E(C^I), C^I)D^E(C^I)]\end{aligned} \tag{15}$$

subject to:

$$\begin{aligned}B^I(C^I, C^E(C^I))x^I[P(C^I, C^E(C^I))D^I - 1] \geq 0 \qquad NBC \\ x^I B(C^I, C^E(C^I)) \leq \alpha\end{aligned}$$

The next proposition shows how the Incumbent solves her maximization problem:

[6]We could speculate that this reduction has negative consequences in terms of total welfare, especially because lower profits might eventually discourage potential investors from entering the market. But in the model we have no such things as fixed entry cost, so that no formal arguments can be given. Still we can conjecture that the presence of entry costs would only make our result non valid for *some* values of the parameters, not adding any intuition. For specific values the Incumbent could blockade entry, and the analysis would be trivial. For some others, she would accommodate, and our results would apply

Proposition 4. *If the Incumbent behaves as a* ***Smart Altruistic*** *MFI, she optimally sets:*

1. $D^I = D_{min}$ *to serve the Safe borrowers,*
2. $D^I = 1/p_r$ *to serve the Risky ones,*
3. $D^I = 1/(\beta p_s + (1-\beta)p_r)$ *to serve both.*

where $D_{min} = 1/p_r$ *if* $\Pi_{ResR} > \Pi_{ResB}$*, and*

$$\frac{\alpha(\beta(m-1) + 2(1-\beta)(p_r R_s - 1)) - (1-\beta)(m-1) + \alpha(1-\beta)}{\alpha(1-\beta)}.$$

if $\Pi_{ResB} > \Pi_{ResR}$.

Proof. See Appendix A □

The Proposition above shows how an altruistic attitude by the Incumbent can influence the strategic behavior of the profit maximizing Entrant. First of all the Incumbent's altruism changes the Entrant's outside options. When the altruistic Incumbent serves the Safe borrowers, the Entrant cannot undercut anymore her contract, so that in Lemma 1 the relevant value of $\hat{x}_s(D^I)$ is either the first or the second one. When instead the altruistic Incumbent serves the Risky borrowers, the Entrant cannot earn anymore Π_{Both}, so that the only alternative to screening is serving the residual demand.

But in the latter case, the Incumbent's altruism has also a second effect on the Entrant's behavior. As we mentioned in the proof of Proposition 4, the reduction of the repayment demanded to the Risky borrowers is so important to make the contract designed for them interesting also for the Safe ones. This forces the Entrant to choose a cheaper contract in order to make screening possible. As a result, all the borrowers are better off.

When, instead, the Incumbent specializes in the Safe borrowers, she can only influence her own clients' welfare. The reason is that the level of rationing the Incumbent has to choose (i.e. the value of x_s^I) is determined only by the outside option the Entrant has with respect to engage in screening. And this option is independent of any behavioral choice. We have showed in Lemma 1 that the Entrant's outside options give the Incumbent a constraint that is stricter than the borrowers' incentive constraint. As a consequence, the Incumbent adapts his contract so as to give enough profit to the Entrant.

This phenomenon makes relatively less interesting for a Smart Altruistic Incumbent to specialize in the Safe borrowers. When such an MFI specializes in the Safe borrowers, to reduce the repayment, it has to ration more than a profit maximizer firm would do. All that, without inducing any counterbalancing reaction of the Entrant. This leads to the following result:

Proposition 5. *A Smart Altruistic Incumbent always prefers serving Both types of borrowers to serving Safe borrowers only.*

Proof. See Appendix A □

Whereas a Naive Altruistic Incumbent *always* finds the screening strategies less interesting than serving both types of borrowers, a Smart one would still in many cases rather opt for specialization. The result is described in the next proposition:

Proposition 6. *When $\Pi_{ResR} > \Pi_{ResB}$ a Smart Altruistic Incumbent prefers to serve the Risky borrowers rather than serving both types if and only if*

$$\beta \leq \frac{(1-\alpha)(m-1)}{p_s/p_r - 1} := \beta_{max}$$

When, instead, $\Pi_{ResB} > \Pi_{ResR}$ a Smart Altruistic Incumbent prefers to serve the Risky borrowers rather than serving both types if and only if

$$\beta \leq \frac{p_r(1-\alpha)(p_r R_s - 1)}{p_s - \alpha p_r - p_r(1-\alpha)(m - p_r R_s + 1)} := \beta_{max}$$

Proof. See Appendix A □

It is interesting to notice that when the altruistic Incumbent serves the Risky borrowers, in equilibrium rationing is bounded to be extremely low ($x_s^E = 1-\epsilon$). In the profit maximizing Incumbent case, when the Incumbent serves the Safe borrowers, the number of excluded borrowers can be much higher since $\hat{x}_s$ can take any value in the interval $[0, 1]$. This is due to the fact that in that case, the troublesome incentive constraint is the one ensuring that the Risky borrowers do not prefer the contract designed for the Safe. Now instead, since the Incumbent is altruistic, the Risky borrowers are already given the maximal possible rent, and this mitigate the necessity to ration the Safe ones.

This has some consequences in terms of policy. The presence in the market of an altruistic MFI has the obvious consequence of increasing the borrowers' welfare. But many have pointed out that it could also hamper the development of a competitive and open financial sector. A strongly socially motivated player could indeed discourage possible investors to enter the market, because of the extremely harsh price competition.

Under our assumptions, the presence of an altruistic MFI can instead have a positive impact also on the profit maximizing Entrant. This is the result of different counterbalancing forces. In a screening equilibrium of the AI model, the Entrant serving the Safe borrowers can reduce rationing to the minimum. This has clearly a positive effect on the Entrant's profits. On the other hand, the Incumbent's offer is so low that even the Safe borrowers must be offered an informational rent. And this clearly reduces the profit.

For a large range of the parameters, the former effect outweigh the latter, so that he Entrant is better off when the Incumbent is Altruistic. One example is given in Figure 5.

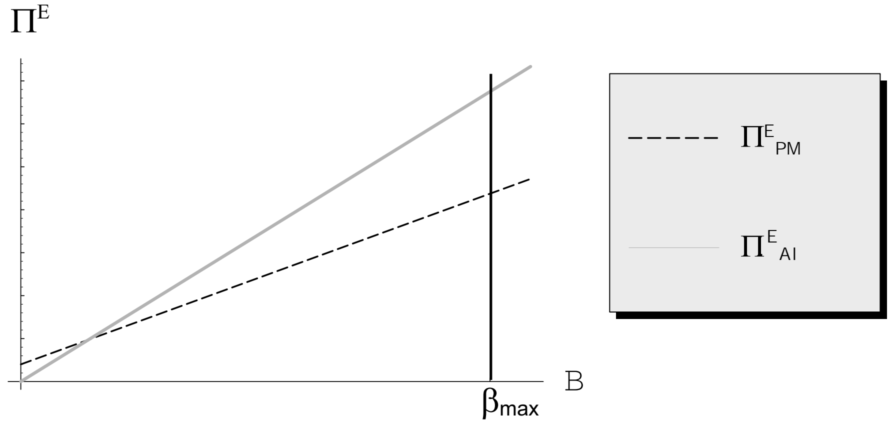

Figure 5: Entrant Profit: Comparison AI model and PM model

The figure shows the Entrant's profit as a function of β. The dashed line Π^E_{PM} represents the Entrant's profit in the PM model when a screening equilibrium prevails. The grey line labeled as Π^E_{AI} shows instead the Entrant's profit in the AI model when she serves the Safe borrowers and the Incumbent serves the Risky ones. For $\beta < \beta_{max}$ (that is in the interval in which the Altruistic Incumbent prefers to serve the Risky borrowers) Π^E_{AI} is bigger then Π^E_{PM} for β big enough. That shows that the negative effect due to harsh price competitions can be outweighed by the positive effect of less rationing.

The conditions needed to get this effect are quite general: α must be relatively small[7] and the pool of borrowers must be heterogeneous enough (that is $p_s - p_r$ must be large). Both conditions seems to be realistic, since most of the MFIs only have a limited capacity at their disposal, and important differences between groups of borrowers have repeatedly been reported.

4 Conclusions

Microfinance has attracted an important variety of actors, pursuing different objectives but nonetheless competing with each other to attract clients. Our model describes the interaction between these actors in a tractable framework that includes the features making microcredit markets special.

Our results show how important it is to take into account the different motives of MFIs. The interaction of competing MFIs leads to remarkably different equilibria when these different objectives are taken into account. Understanding the mechanism driving the results, and the implication it has on the potential competitors, is very important for those who, considering microcredit as a privileged tool to reduce poverty, are working to enlarge its outreach and promote its development.

Our model also highlights a possible source of exclusion of many borrowers from the market. We show that rationing is not only due to asymmetric information per se, but can also be a consequence of the need of MFIs to differentiate their products from those of the competitors.

Some of the results are sensitive to the values of the parameters (an empirical investigation would surely be beneficial), but our assumptions seem to be realistic for the type of market we are describing. Clearly our model hinges on the assumption that MFIs can only offer one contract. Although it may appear as a strong limitation, modeling explicitly a fixed cost per contract type, would not change much our result and would add in complexity.

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A Appendix 1

Proof of Lemma 1. Suppose the Incumbent is willing to serve the Safe borrowers only, and that she offers the contract described above. In order to attract the Safe borrowers she has to offer a contract characterized by $D_s^I \leq R_s$. Such an offer would attract also some Risky borrowers, and if the Incumbent is alone in the market she cannot avoid it. We show that by choosing $x_s^I \leq \hat{x}_s(D^I)$ she can induce the Entrant to offer a screening contract. The values of x^I we are looking for, are easily obtained computing the profits the Entrant would get serving the Risky customers only, that is when $B^E(C^I, C^E) = 1 - \beta$ His maximization problem in this case is given by:

$$\max_{x_r, D_r} \Pi_{rs}^E = (1-\beta)x_r(p_r D_r - 1)$$

In order to have $B^E(C^I, C^E) = 1 - \beta$, we need the following conditions to hold.

$$\begin{aligned} D^E &\leq R_r & & PC1 \\ D^I &\leq R_s & & PC2 \\ x^E p_r(R_r - D^E) &\geq x^I p_r(R_r - D^I) & & IC1 \\ x^I p_s(R_s - D^I) &\geq x^E p_s(R_s - D^E) & & IC2 \end{aligned}$$

Consider first the constraints $PC1$ and $IC1$. The IC1 is always binding since the left hand side is decreasing in D_r. Solving it for D_r we get:

$$D_r = R_r - \frac{x_s^I}{x_r}(R_r - D_s^I)$$

What about x_r? Substituting D_r in the profit function we get:

$$\Pi_{rs}^E = (1-\beta)x_r[p_r R_r - p_r \frac{x_s^I}{x_r}(R_r - D_s^I) - 1] = (1-\beta)(x_r p_r R_r - p_r x_s^I(R_r - D_s^I) - x_r)$$

that is clearly maximized for $x_r = 1$ given that $p_r R_r = m > 1$. According to these constraints the Entrant reaction when the Incumbent prefers to serve the Safe borrowers is:

$$\begin{cases} x_r = 1 \\ D_r = R_r - \frac{x_s^I}{x_r}(R_r - D_s^I) \end{cases} \tag{16}$$

leading to this expected profit:

$$\Pi_{rs}^E = (1-\beta)[(m-1) - p_r x_s^I(R_r - D_s^I)] \tag{17}$$

This profit must be compared with the Entrant's outside options. She can:

1. Choose the Risky sector, but only serve the residual demand of the Risky. It is then optimal to set $D^E = R_r$ and $x^E = 1$, that gives profit $(1 - x^I)(1 - \beta)(m - 1)$.

2. Choose to serve the residual demand of Both types. This leads to profit $(1-x^I)[\beta(m-1)+(1-\beta)(p_rR_s-1)]$.
3. Choose the Safe sector and undercut the Incumbent's contract. This can be done by simply setting $x^E=1$ and $D^E=D^I$. When the Incumbent is profit maximizing, this gives the Entrant a profit $\Pi_{Both}=\alpha[\beta(m-1)+(1-\beta)(p_rR_s-1)]$.

Depending on the values of the parameters and on the assumptions about the Incumbent's behavior, one of these three options dominates the others. When Π_{ResR} is the most appealing option, then we need this condition to hold for the Entrant to engage in screening:

$$(1-\beta)[(m-1)-p_rx_s^I(R_r-D_s^I)]>(1-\alpha)(1-\beta)(m-1) \tag{18}$$

Note that the right hand side is pre-multiplied by $(1-\alpha)$ and not by $1-x_s^I$. If we had $1-x_s^I$ the inequality would be trivially satisfied and the Incumbent would set x_s^I as high as possible and surely higher than α. So in case of deviation the capacity constraint would surely bind. Solving the inequality for x_s^I we find the threshold:

$$\hat{x}_s:=\frac{\alpha(m-1)}{m-p_rD_s^I} \tag{19}$$

Note that $\hat{x}_s$ is not necessarily less or equal to one[8].

When Π^E_{ResB} is the relevant option, this condition is needed:

$$(1-\beta)[(m-1)-p_rx_s^I(R_r-D_s^I)]>(1-\alpha)[\beta(m-1)+(1-\beta)(p_rR_s-1)] \tag{21}$$

and solving for x_s^I we get:

$$\hat{x}_s:=\frac{(1-\beta)(m-1)-(1-\alpha)[\beta(m-1)+(1-\beta)(p_rR_s-1)]}{(1-\beta)p_r(R_r-D_s^I)} \tag{22}$$

Also in this case, $\hat{x}_s$ might not be in the interval $[0,1)$.

Finally, when Π_{Both} is the dominant option, we need this condition to hold for the Entrant to engage in screening:

$$(1-\beta)[(m-1)-p_rx_s^I(R_r-D_s^I)]>\alpha[\beta(m-1)+(1-\beta)(p_rR_s-1)] \tag{23}$$

Solving the inequality for x_s^I we find the threshold:

$$\hat{x}_s:=\frac{(1-\beta)(m-1)-\alpha[\beta(m-1)+(1-\beta)(p_rR_s-1)]}{(1-\beta)p_r(R_r-D_s^I)} \tag{24}$$

[8]For $\hat{x}_s^I$ to be in the proper interval we need:

$$\alpha<\frac{m-p_rR_s}{m-1} \tag{20}$$

We still have to show that these values of $\hat{x}_s^I$ make screening possible. One condition need to be verified: given the optimal reaction of the Entrant, the value $\hat{x}_s$ must satisfy the other incentive constraint (IC2). Note first that the contract offered by the Entrant is by construction such that a Risky borrowers prefers it to a contract designed for the safe ones. But we also have to check that the safe borrowers do not prefer a contract designed for the Risky ones. Replacing $x_r^E = 1$ and $D_r^E = R_r - \frac{x_s^I}{x_r}(R_r - D_s^I)$ in the IC2 we get:

$$x_s(R_s - D_s) \geq [R_s - R_r + x_s(R_r - D_s)] \Rightarrow x_s(R_s - R_r) \geq R_s - R_r$$

that is trivially satisfied for any $x_s \in [0, 1)$. The Incumbent knows that, whatever his choice of x_s and D_s is, the Entrant will react in such a way to make his incentive constraint binding. So, in order to make screening possible he just needs to set his optimal value for D_s and then choose x_s in such a way to make $D_r^E > D_s^I$. Using equation (16) we see that:

$$D_r = R_r - x_s^I(R_r - D_s^I) > D_s \Leftrightarrow x_s < 1.$$

So the constraints given by equations (21) and (18) will bind whenever they give values in the interval $[0, 1)$. □

Proof of Lemma 2. Suppose the Incumbent specializes in the Risky sector. In order to avoid direct competition she has to induce the Entrant to serve the Safe sector offering an incentive compatible contract. In this case the Entrant solves this maximization problem:

$$\max_{x_s^E, D_s^E} \Pi_{sr}^E = \beta x^E(p_s D^E - 1)$$

But to have $B^E(C^I, C^E) = \beta$, the following conditions must be fulfilled:

$$\begin{aligned} D_s^E &\leq R_s && PC1 \\ D_r^I &\leq R_r && PC2 \\ x_s^E p_s(R_s - D_s^E) &\geq x_r^I p_s(R_s - D_r^I) && IC1 \\ x_r^I p_r(R_r - D_r^I) &\geq x_s^E p_r(R_r - D_s^E) && IC2 \end{aligned}$$

Consider first the IC1. Note that, under our assumptions, a profit maximizing Incumbent has no reasons to offer $D_r^I \leq R_s$. So, in this case the RHS of the IC is surely negative. Therefore the PC binds and the IC becomes irrelevant. The Entrant can set $D_s^E = R_s$. What about x^E? The Entrant knows that the Incumbent has no means to avoid some of the Risky borrowers to ask for the cheaper contract designed for the Safe ones. The only thing she could do is to offer the same contract as the Entrant, but in that case they would have to share equally the same market. So, to have screening, the Entrant must "help" the Incumbent to keep his customers.

This has clear positive effects for the Incumbent, and, as we will prove, it is also profitable for the Entrant since it reduces the riskiness of his pool of customers and increases the expected profit.

The Entrant knows that the Incumbent's contract must fulfill IC2 in order to attract only risky borrowers. Solving it for x^E we find the condition

$$x^E \leq \frac{x_r^I(R_r - D_r^I)}{R_r - D_s^E} \tag{25}$$

So, to have screening some of the safe borrowers must be denied access to credit. Notice that if $D_r^I = R_r$, (25) is true only for $x^E = 0$. So, to allow screening the Incumbent must offer a contract with $D_r^I < R_r$. The expected Entrant's profits are:

$$\Pi_{sr}^E = \beta x_s^E(m-1) \tag{26}$$

How can the Incumbent induce such a cooperative behavior? We have to consider the Entrant's outside options. She can:

1. Choose the Risky sector, undercutting the Incumbent.
2. Choose the Safe sector and offer a non incentive compatible contract, setting $D^E = R_s$ and $x^E = \alpha$, earning

$$\Pi_{br}^E = \alpha(\beta(m-1) + (1-\beta)(p_r R_s - 1))$$

The Incumbent is left with the residual demand of the Risky.

Consider first the the second option. In this case, for the Incumbent to prefer serving the Safe types, we need $\Pi_{sr}^E \geq \Pi_{br}^E$. In formulas:

$$\beta x_s^E(m-1) \geq \alpha(\beta(m-1) + (1-\beta)(p_r R_s - 1)) \Longrightarrow x_s^E \geq \alpha(1 + \frac{(1-\beta)(p_r R_s - 1)}{\beta(m-1)})$$

Now replacing x_s^E with (25) we get:

$$D_r^I \leq R_r - \frac{\alpha}{x_r^I}\Big[1 + \frac{(1-\beta)(p_r R_s - 1)}{\beta(m-1)}\Big](R_r - R_s) := \hat{D}^I$$

This value is surely smaller than R_r. The incumbent profit would then be:

$$\Pi_{rs}^I = (1-\beta)(p_r \hat{D}^I - 1)$$

Notice that Π_{rs}^I can be greater than Π_{br}^E. In this case the relevant outside option would be the other one, i.e. to undercut the Incumbent and target the Risky borrowers. Then, to induce screening the Incumbent must set D such that:

$$\beta x_s^E(m-1) \geq (1-\beta)[(m-1) - p_r x_s^E(R_r - R_s)] \Longrightarrow$$
$$x_s^E \geq \frac{(1-\beta)(m-1)}{\beta(m-1) + (1-\beta)(m - p_r R_s)}.$$

Replacing for the incentive constraint we get:

$$D_r^I \leq R_r - \frac{1}{x_r^I}\Big[\frac{(1-\beta)(m-1)}{\beta(m-1)+(1-\beta)(m-p_rR_s)}\Big](R_r-R_s) := \hat{D}^I$$

If we define

$$\tilde{x}^E := \max\left\{\alpha(1+\frac{(1-\beta)(p_rR_s-1)}{\beta(m-1)}), \frac{(1-\beta)(m-1)}{\beta(m-1)+(1-\beta)(m-p_rR_s)}\right\}$$

then the Incumbent must set $\hat{D}^I(\tilde{x}^E)$ to induce the Entrant to offer an incentive compatible contract.

□

Proof of Lemma 5. Consider first Π_{sr}^I (see equation (11)). Then we have:

$$\frac{\partial \Pi_{sr}^I}{\partial \beta} = \frac{(m-1)^2+(m-1)\alpha(m-p_rR_s)}{m-p_rR_s} - \frac{\alpha(m-1)^2}{(m-p_rR_s)(1-\beta)^2}$$

The derivative is positive for $\beta < 1 - \frac{\alpha(m-1)}{\sqrt{\alpha(m-1)(m\alpha-1+p_r(R_r-R_s\alpha))}}$ and negative otherwise. The second derivative is given by:

$$\frac{\partial^2 \Pi_{sr}^I}{\partial \beta^2} = \frac{2\alpha(m-1)^2}{p_r(R_r-R_s)(\beta-1)^3}$$

that is always negative since $\beta < 1$.

Consider now Π_{rs}^I (see equation (12)). We have:

$$\frac{\partial \Pi_{rs}^I}{\partial \beta} = \frac{\alpha(m-p_rR_s)(p_rR_s-1)+\beta^2[\alpha(m-p_rR_s)^2-(m-1)^2]}{\beta^2(m-1)}$$

The derivative is positive for $\beta < \frac{\sqrt{\alpha(m-p_rRs)(p_rR_s-1)}}{\sqrt{\alpha(m-p_rR_s)^2-(m-1)^2}}$ and negative otherwise. The second derivative is given by:

$$\frac{\partial^2 \Pi_{rs}^I}{\partial \beta^2} = -\frac{2\alpha(m-p_rR_s)(p_rR_s-1)}{\beta^3(m-1)}$$

that is also always negative. □

Proof of Proposition 2. Suppose first that the parameters are such that the Incumbent prefers to engage in a screening strategy serving the Safe borrowers. In that case the safe borrowers get zero rent, whereas the Risky ones enjoy a positive rent given by $(1-\beta)p_r\hat{x}_s(R_s)(R_r-R_s)$. On the firms' side, the Incumbent earns

$\Pi^I_{sr} = \beta\hat{x}_s(R_s)(m-1)$ and the Entrant earns $\Pi^E_{sr} = (1-\beta)[(m-1)-p_r\hat{x}_s(R_s)(R_r - R_s)]$. Summing up and simplifying we get:

$$W_{sr} = \beta\hat{x}_s(R_s)(m-1) + (1-\beta)(m-1)$$

When the Incumbent is profit maximizer, $\hat{x}_s(R_s) = \frac{(1-\beta)(m-1)-\Pi_{Both}}{(1-\beta)p_r(R_r-D^I)}$. This value is in the interval $[0,1]$ iff $\Pi_{Risky} > \Pi_{Both}$. That means that if the incumbent were a monopolist he would serve only the risky borrowers setting $D^I = R_r$, so that all the borrowers would get zero rent. Thus, total welfare would correspond to the monopolist profit Π_{Risky}, that is clearly smaller than W_{sr}.

Suppose now that the parameters are such that the Incumbent prefers to engage in a screening strategy serving the Risky borrowers. Also in this case the Safe borrowers get zero rent, but the Risky ones get $(1-\beta)p_r[\alpha(1+\frac{(1-\beta)(p_rR_s-1)}{\beta(m-1)})(R_r - R_s))]$. On the firms' side, Incumbent earns $\Pi^I_{rs} = (1-\beta)(p_r\hat{D}^I - 1)$ and Entrant $\Pi^E_{rs} = \Pi_{Both} = \beta\alpha(1+\frac{(1-\beta)(p_rR_s-1)}{\beta(m-1)})(m-1)$. Summing up and simplifying we get:

$$W_{rs} = \Pi_{Both} + (1-\beta)(m-1)$$

This equilibrium is possible when the parameters are such that a monopolist would decide to serve both types of borrowers. Under this circumstance, only the Risky borrowers enjoy a positive rent, so that the total welfare would be:

$$W = \Pi_{Both} + \alpha(1-\beta)p_r(R_r - R_s)$$

that is clearly smaller than W_{rs}. □

Proof of Proposition 3. Suppose that a monopolist, endowed with a capacity $\alpha = 1$, is willing to serve both types. He optimally sets $D = R_s$. Then the Safe borrowers get no rent, whereas the Risky ones enjoy a rent $(1-\beta)p_r(R_r - R_s)$.

In a screening equilibrium, if the Risky borrowers are served by the Incumbent, they earn $(1-\beta)p_rx_s(R_r - R_s))]$. Since $x_s \in [0,1]$, the Risky borrower welfare is strictly lower in a competitive regime. The Safe borrowers get zero rent under both regimes, but they are rationed more under competition since $x^E\beta < \alpha$. □

Proof of Proposition 4. We have to show that, regardless her intention of serving Risky, Safe or Both borrowers, the Incumbent always chooses a contract that makes her profit nil.

1. Suppose first that the Incumbent wants to serve only the Safe sector, and that she wants to induce the Entrant to engage in a screening strategy. As showed in Lemma 1 this is done by offering $x_s \leq \hat{x}_s$. We have to consider the effects of her choice on the Safe borrowers she serves and on the Risky

borrowers the Entrant serves.
Consider first the Safe borrowers. In all the cases analyzed in Proposition 1, $\hat{x}_s$ is increasing in D^I. So, for an altruistic MFI there is a trade-off between offering the borrowers a "cheaper" contract and rationing them more. To find the optimal solution we just need to substitute for $\hat{x}_s$ in the objective function, that in this case reduces to $\beta x_s p_s(R_s - D_s)$. In the relevant interval this equation is decreasing and concave in D_s. The NBC becomes $\beta x_s(p_s D_s - 1) \geq 0$. The MFI would therefore like to choose the lowest possible value of D_s, that is the value that makes her profit equal to zero. This is given by $D_s^I = 1/p_s$.
The outside option for the Entrant is to serve the residual demand. Analyzing equations (19) and (22), we easily see that for $D_s^I = 1/p_s$, the corresponding value of x_s becomes smaller than α. But if $x_s < \alpha$ than the residual demand is not given anymore by $1-\alpha$, but by $1-x_s$. So the outside options change. Solving the analogous of equations (18) and (21) we see that the first is impossible, and that the second is only satisfied for $x_s > 1$. So the Incumbent can decrease the value of D_s^I at the best up to the point in which the corresponding $\hat{x}_s$ is equal to α. This is given by $D_s^I = 1/pr$ when $\Pi_{ResR} > \Pi_{ResB}$, and by

$$D_s^I = \frac{\alpha(\beta(m-1) + 2(1-\beta)(p_r R_s - 1)) - (1-\beta)(m-1) + \alpha(1-\beta)}{\alpha(1-\beta)}.$$

when $\Pi_{ResB} > \Pi_{ResR}$. The Entrant reacts offering $D^E = R_r - \alpha(R_r - D_s^I)$. So the Incumbent's altruism has limited beneficial effects on the Risky borrowers served by the Entrant.

2. Suppose now that the Incumbent chooses to serve the Risky sector and consider first the direct effect of a reduction of D^I. To maximize the Risky borrower's utility, the Incumbent wants to set x^I as high as possible, namely equal to one, and D^I as low as possible. But the value of D^I that makes the NBC binding is $1/p_r$. Now, as a consequence of our assumptions $1/p_r \leq R_s$, so that the findings of Lemma 2 do not apply to this case: the Entrant's outside option we used in Lemma 2 (i.e. serve both types with $D^E = R_s$) is not feasible if the Incumbent sets $D^I = 1/p_r$. With such a contract the Entrant could only attract the residual demand.
Is it still possible to screen the borrowers while leaving the Risky borrowers the maximum rent possible? We know that the Incumbent's contract must satisfy this condition in order to satisfy the Risky borrowers' incentive constraints:
$$D_r^I \leq R_r - x_s^E(R_r - D_s^E). \tag{27}$$
Moreover, to satisfy the Safe borrowers' incentive constraint the contracts must be such that:
$$x^E p_s(R_s - D^E) \geq p_s(R_s - \frac{1}{pr}) \Longrightarrow D^E \leq \frac{m}{p_s} - \frac{m}{x^E p_s} + \frac{1}{p_r x^E}. \tag{28}$$

Plugging this value in the Entrant's objective function we easily see that it is increasing in x^E, so the Entrant would like to set $x^E = 1$. In that case the inequality in (28) would reduce to $D_s \leq \frac{1}{p_r}$. The Incumbent can therefore offer a contract with $D^I = \frac{1}{p_r} + \epsilon$ with $\epsilon \in \mathbb{R}_+$ arbitrarily small. By doing that she can attract all the Risky borrowers if the Entrant offers $D_s^E = \frac{1}{p_r}$. Substituting for that value in 28 and rearranging, we get $x_s^E = \frac{R_s - 1/p_r - \epsilon}{R_s - 1/p_r}$, so that $x^E \cong 1$ and both constraints are satisfied with equality. This shows that the Incumbent's altruism has a positive effect also on the Entrant's clients. It is easy to check that the Entrant's profit is positive ($\Pi_{rs}^E \cong \beta(\frac{p_s}{p_r} - 1)$) and, for relevant values of the parameters, higher than the profit she would get serving the residual demand.

3. Suppose, finally, that the Incumbent wants to serve Both types of borrowers. In that case, nothing changes with respect to the monopolist case since there are no screening issues and the Incumbent's altruism has no effect on the Entrant's customers. To maximize the borrowers' utility the Incumbent sets D^I as low as possible, so that the NBC binds, and x^I as high as possible, so that also the capacity constraint binds. We have therefore:

$$D_b = \frac{1}{\beta p_s + (1-\beta)p_r}$$

□

Proof of Proposition 5. We define an upper bound for the total borrower welfare when Incumbent serves the Safe borrowers inducing the Entrant to serve the Risky ones:

$$\bar{BW}_{sr} = \beta \hat{x}_s(m-1) + (1-\beta)(m - p_r D_r^E) \tag{29}$$

It is obtained by assuming that the Incumbent can serve the Safe borrowers setting $D_s^I = 1/p_r$. We can compare it with the borrowers' welfare when the Incumbent serves both types, that is given by:

$$BW_b = \begin{cases} \alpha(m-1) \quad \text{if} & \Pi_{ResR} > \Pi_{ResB} \\ \alpha(m-1) + (1-\alpha)(1-\beta)p_r(R_r - R_s) \quad \text{if} & \Pi_{ResB} > \Pi_{ResR} \end{cases} \tag{30}$$

We have therefore two cases to examine. Consider first the case where the Entrant prefers to serve the residual demand of the Risky borrower. We can replace the values of $\hat{x}_s$ (first formula in Lemma 1) and D_r^E in equation (29). After some tedious computations the formula simplifies to:

$$BW_{sr} = \alpha(m-1)\Big[-\frac{\beta}{m - p_r/p_s} + \beta\frac{p_r}{p_s}\frac{1}{m - p_r/p_s} + 1\Big]$$

For BW_{sr} to be bigger than BW_b we need the term in squared bracket to be bigger than one. This happens if and only if

$$m - \frac{p_r}{p_s} + \beta\Big(\frac{p_r}{p_s} - 1\Big) > m - \frac{p_r}{p_s} \Longrightarrow \frac{p_r}{p_s} > 1$$

that is impossible since by assumption $p_r < p_s$.

Consider now the case where the Entrant prefers to serve the residual demand of Both types. As above, we replace the values of $\hat{x}_s$ (second formula in Lemma 1) and D_r^E in equation (29). The result is a curve strictly decreasing and concave in β. For small values of β we can have $BW_{sr} > BW_b$. But we can show that in the relevant range of the parameters, the inequality is inverted. Note that $\Pi_{ResB} > \Pi_{ResR}$ when $\beta \geq \frac{m-p_r R_s}{2m-p_r R_s-1} := \breve{\beta}$. Substituting this threshold in (29) we get:

$$BW_{sr}(\breve{\beta}) = \frac{(m-1)[2mp_s - p_r - p_r m]}{(p_s m - p_r)(2m - p_r R_s - 1)}\alpha(m-1)$$

We just need to prove that the first multiplier is smaller than one. After some algebra the condition reduces to:

$$R_r\left(2 - \frac{p_s}{p_r}\right) < R_s$$

Replacing $R_r = \frac{p_s}{p_r} R_s$ in the formula above we get:

$$2\frac{p_s}{p_r} - \left(\frac{p_s}{p_r}\right)^2 - 1 < 0 \Longrightarrow \left(\frac{p_s}{p_r} - 1\right)^2 > 0$$

that is clearly always satisfied. Given the monotonicity and the concavity of BW_{sr}, this is enough to prove that when $\Pi_{ResB} > \Pi_{ResR}$, the smart altruistic Incumbent always prefers serving both types. □

Proof of Proposition 6. When the Incumbent serves the Risky borrowers only, setting $D_r = 1/p_r$ and $x_r = 1$, the Entrant reacts setting $x_s = 1 - \epsilon$ and $D_s = 1/p_r - \epsilon$, that is any repayment smaller than the one imposed by the Incumbent. To make our comparisons easier we can compute the total welfare the borrowers would get if $\epsilon = 0$. Let us call this approximation $\overline{BW}_{rs}$. It is very easy to verify that:

$$\overline{BW}_{rs} = \beta(m - \frac{p_s}{p_r}) + (1-\beta)(m-1) \tag{31}$$

that can be rewritten as a function of β:

$$\overline{BW}_{rs}(\beta) = (m-1) + \beta(1 - \frac{p_s}{p_r}) \tag{32}$$

This is a downward sloped affine function, whose intercept $(m-1)$ is bigger than the intercept of the function:

$$BW_b = \begin{cases} \alpha(m-1) \quad \text{if} & \Pi_{ResR} > \Pi_{ResB} \\ \alpha(m-1) + (1-\alpha)(1-\beta)p_r(R_r - R_s) \quad \text{if} & \Pi_{ResB} > \Pi_{ResR} \end{cases}$$

The line $\overline{BW}_{rs}(\beta)$ intersects BW_b from above when β is equal to the thresholds defined above. $\square$