Competition and Altruism in Microcredit Markets

Paolo Casini
ECARES, Université Libre de Bruxelles and Università G. d'Annunzio

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ECARES
ULB - CP 114
50, F.D. Roosevelt Ave., B-1050 Brussels BELGIUM
www.ecares.org

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Paolo Casini†

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Abstract

We analyze the effects of entry in a previously monopolistic microcredit market characterized by asymmetric information and by institutions that offer only one type of contract. We consider different behavioral assumptions concerning the Incumbent and study their influence on equilibrium predictions. 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 that if the incumbent institution is altruistic, rationing is reduced and that this can positively affect the competitor's profit.

Keywords: Microfinance, Competition, Altruism, Differentiation, Credit Rationing
JEL Classification: G21, L13, L31, O16

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 taken into account in any sustainable development plan. Microcredit was designed to help the poor to help themselves.

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†ECARES (Université Libre de Bruxelles) and Università "G. d'Annunzio", Chieti. E-mail: pcasini@ulb.ac.be

Microfinance is a variegated phenomenon. NGOs, banks, international organizations and various other forms of financial institutions are crowding into the markets to supply the poor with affordable credit. Despite being active in the same markets, these institutions are motivated by different objectives, spanning from poverty reduction to profit maximization, passing through different definitions of financial sustainability. The effects of the competitive interaction of this variety of players on poverty reduction is still unclear from both a theoretical and empirical perspective. Since Micro Finance Institutions (MFIs) are often motivated by goals different than profit maximization, there is no clear reason to believe that more competition necessarily lead to lower prices. Indeed, empirical evidence shows that interest rates are not significantly decreasing even in markets in which competition is very harsh.[1] On top of all this, financial sustainability and lending technologies impose tight constraints on governance and management, so that asymmetric information cannot be addressed with standard tools like, for instance, a menu of contracts. For these reasons, applying the existing theories on competition (and, more specifically, on competition in credit markets) to Microcredit is not straightforward.

In our paper we take explicitly into account some idiosyncrasies of Microcredit markets. Our goal is to understand the effects of competition on credit supply, borrower welfare and MFI profit. To capture the idea that MFIs cannot offer the same variety of products that a standard bank would, we assume that MFIs, although operating in a market with different types of borrowers, can only offer one type of contract. We show how equilibrium predictions respond to different assumptions on MFIs objectives, and we prove that altruistic behavior can be beneficial for both borrowers and competing MFIs.

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 MFIs today. Indeed, some of the most important between them are (or claim to be) profit maximizing.

The good performances of some 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. 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 and the

[1] See, for instance, Kaffu and Mutesasira (2003)

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 overlap of geographic areas and customers' pools.

Lending money is not costless. Capital is expensive, and so are enforcement of repayments, accountancy systems and even 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. Hence, workforce is essential.

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 defines its organization as the *Ford Motor Model of Microfinance*, stressing via this analogy how important it is for them 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 widely studied mechanisms such as group lending, dynamic incentives, regular repayment schedules etc. These tools allow MFIs to tackle issues such as moral hazard, absence of collateral, adverse selection, gender specificity and so on. But the implementation of these mechanisms is complex, often delicate. Moreover the choice of such mechanisms has 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.

Our paper models a microcredit market with these characteristics. We use a simple sequential game, with two firms (Incumbent and Entrant) and two types of borrowers (Safe and Risky).[2] We first assume that both firms are profit maximizing. This framework fits a mature microcredit market (like Bangladesh or Bolivia), 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 borrower profit under a non-bankruptcy constraint. We define two types of altruism that we label as *naive* and *smart*. The difference between them is given by the way the Incumbent MFI takes into account the reaction of the Entrant. This approach better describes a younger microcredit market and is empirically very relevant. Indeed, 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 allow for perfect screening of the borrower types.

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 informational rent is decreasing in the level of rationing. In our model, both are determined by the Incumbent's choice. Via this mechanism, when setting her contract the Incumbent indirectly influences the Entrant's profit. Thus, 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.

[2]The sequential structure of the game is very helpful to ease exposition but is not essential, since all the results are valid also in a simultaneous setting. See Casini (2008) [3].

From the MFIs' point of view, this form of cooperative screening has some costs, but is in many cases more profitable than direct competition. The presence of a second MFI introduces some competitive pressure (with a negative effect on expected profits), but since it makes screening possible, it allows MFIs to offer more targeted (and therefore more profitable) contracts. As a consequence, from the borrowers' point of view, competition is not necessarily welfare enhancing: we show that under some conditions the borrower welfare is lower under competition 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. On top of that, the demand for credit is believed to be quite inelastic. This would allow to increase interest rates with limited consequences on the outreach.

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. Moreover, there is experimental evidence that the demand for credit is actually elastic (See Karlan and Zinman (2007) [9]).

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 can also result into an incentive for profit maximizing firms to enter the market. This is due to the fact that the Incumbent's altruism reduces the amount of rationing necessary to screen the borrowers, so that 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 [12] present a model in which MFIs maximize the number of borrowers served 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.

Our paper is closely related to the work of Navajas, Conning and Gonzales-Vega (2003). 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 simple case of a monopoly. We examine the maximization problem of a monopolistic MFI under two different behavioral assumptions. First we assume that the MFI maximizes her expected profit; next we consider an altruistic MFI maximizing the borrower 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 α of the borrowers applying for credit. 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 $B : \mathbb{R}_+ \rightarrow [0, 1]$. It denote 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 applicant pool and, therefore, the average probability of repayment. The latter can be described by a function $P : [0, R_r] \rightarrow [0, 1]$ that assigns to each repayment D the average probability of repayment. Under our assumptions this function is defined as:

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

Finally, let $X(C, \alpha) := \min\{xB(D), \alpha\}$ denotes the mass of borrowers served by the MFI. Using these definitions, the maximization problem faced by a monopolistic, profit maximizing MFI can be written as:

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

The objective function is not continuous in D. This is due to the fact that 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 subject to a non-bankruptcy constraint.

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

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

subject to:

$$X(C,\alpha)[P(D)D - 1] \geq 0 \qquad NBC$$

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. It is easy to observe that, due to its altruism, an altruistic MFI always prefers the first option.

Observation 1. *An altruistic MFI in monopoly always prefers to serve both types of borrowers.*

To see this, 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 anticipated entry of 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.

We retain the assumption that each MFI can only offer one contract. 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. 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. As argued in the Introduction, 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.[3]

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.

We do not model explicitly any of these mechanisms, but we think the contracts as being a fundamental part of them. This approach is correct as long as we can consider the repayment (or in other words the interest rate) as the main strategic variable of the market. Despite the importance of the underlying mechanisms, there is clear evidence that borrowers actually consider the interest rate as a fundamental parameter to base their decision on.[4]

As usual, we solve the model considering first the Entrant's optimal reaction for any given choice by the Incumbent, and 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

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

[4] See, for instance, Karlan and Zinman (2007) [9]

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 on the MFI at which they want to apply for credit. 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 $1-\alpha$. [5]

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 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 $B^j(C^i, C^j) = 0$.

We assume that if both MFIs offer the same contract, they share the

[5] 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* $1-\alpha$.

demand equally.[6] As before, we can also define a function $P(\cdot,\cdot) : \mathbb{R}_+^2 \times [0,1]^2 \to [0,1]$, 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 contract that attracts *all* the borrowers of a specific type; (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:

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

where $X^E(C^E, C^I, \alpha) := \min\{x^E B(C^I, C^E), \alpha\}$ denotes the mass of borrowers served by the Entrant

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 same pool of borrowers as in case 2 and 4 of the taxonomy), full separation (each MFI specializing on a particular group as in case 2) or monopolistic behavior on the residual demand (the MFI exploits the capacity constraint of the competitor as in case 3).

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 monopoly price. For the sequel, it is useful to calculate the profit the Entrant earns 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 optimally sets $D^E = R_r$, extracting

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

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 earns serving the residual demand of both types. She sets $D^E = R_s$, 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 can be given an informational rent. This idea is quite standard, but we apply it in a particular way: in our model the optimal contracts are the result of a competitive interaction between two different MFIs, each offering one single contract. In what follows, 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 contract that makes it optimal for the Entrant to target only one type of borrowers. We explain the mechanism in the next two lemmas.

Lemma 1. *If the Incumbent chooses a contract such that $D^I \leq R_s$ and*

$x^I \leq \hat{x}_s(D^I) < 1$ *where* $\hat{x}_s(D^I)$ *is defined as:*

$$\begin{array}{ccc} \dfrac{\alpha(m-1)}{m-p_rD^I} & \text{if} & \Pi_{ResR} \geq \max\{\Pi_{ResB}, \Pi_{Both}\} \\ \dfrac{(1-\beta)(m-1)-\Pi_{ResB}}{(1-\beta)p_r(R_r-D^I)} & \text{if} & \Pi_{ResB} \geq \max\{\Pi_{ResR}, \Pi_{Both}\} \\ \dfrac{(1-\beta)(m-1)-\Pi_{Both}}{(1-\beta)p_r(R_r-D^I)} & \text{if} & \Pi_{Both} \geq \max\{\Pi_{ResR}, \Pi_{ResB}\} \end{array}$$

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

Proof. See Appendix 4 □

When the Incumbent is profit maximizing, the relevant outside option is Π^E_{Both}. The other options matter when the Incumbent is altruistic.

The intuition behind this result is standard: if the Incumbent wants to serve only the safe borrowers, she must exclude some of them. What is less standard is that the number of excluded borrowers depends on the prevailing Entrant's outside option.

To understand why, remember that, as in any screening model, the level of rationing is inversely proportional to the informational rent: the higher is the informational rent given to the Risky borrowers, the lower is the level of rationing needed to induce self-selection of the contracts. But the Entrant's profit (from serving only the Risky) is lowered by the informational rent that her customers must be given. Thus, the higher is the number of excluded Safe borrowers, the higher is the Entrant's profit. In other words, to induce screening, the Incumbent must exclude a high enough number of customers ($\hat{x}_s(D^I)$) in order to make the Entrant's profit higher than the outside options.

Note that $\hat{x}_s$ is not necessarily in the interval $[0, 1)$. If $\hat{x}_s > 1$, the constraints in Lemma 1 are not binding, and screening is possible for any $x^I < 1$. This could happen if the profit from outside options is 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 grant the Risky borrowers an adequate informational rent, allowing the Entrant to ration as few Safe borrowers as possible. The mechanism is detailed in the next lemma.

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

$$D^I_{min} < D^I \leq \hat{D}^I(x^I) := R_r - \frac{1}{x^I}\tilde{x}^E(R_r - D^I) \tag{7}$$

where

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

and $D^I_{min} < R_s$ is the minimum value of D^I making the Entrant indifferent between the screening profit and the relevant outside option, 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 4. □

Also in this case, to attain 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.

An important implication of the two lemmas above is that if specialization is an equilibrium in a microfinance market, then it is 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 merely 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 chooses the level of rationing in order to make the screening strategy optimal for the Entrant. In Lemma 2, the Incumbent increases the information rent offered to the Risky borrowers in order to reduce rationing of the Safe ones and increase the Entrant's profit. This 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.

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.

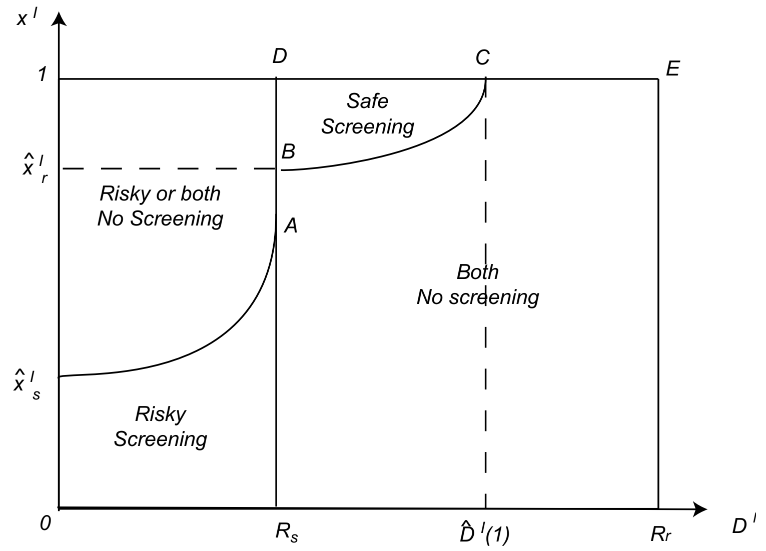

Figure 1: Entrant strategies as a function of the Incumbent strategies

In the first case Incumbent sets a contract with $D^I \leq R_s$, but $x^I \geq \hat{x}^I_s$ (region $\hat{x}^I_s AD1$). 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 $R_s R_r ECB$. This is a contract that only suits the Risky borrowers but does not fulfill the condition of Lemma 2. The Entrant has two possible strategies: (a) undercut the Incumbent's price. (b) 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 a 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.

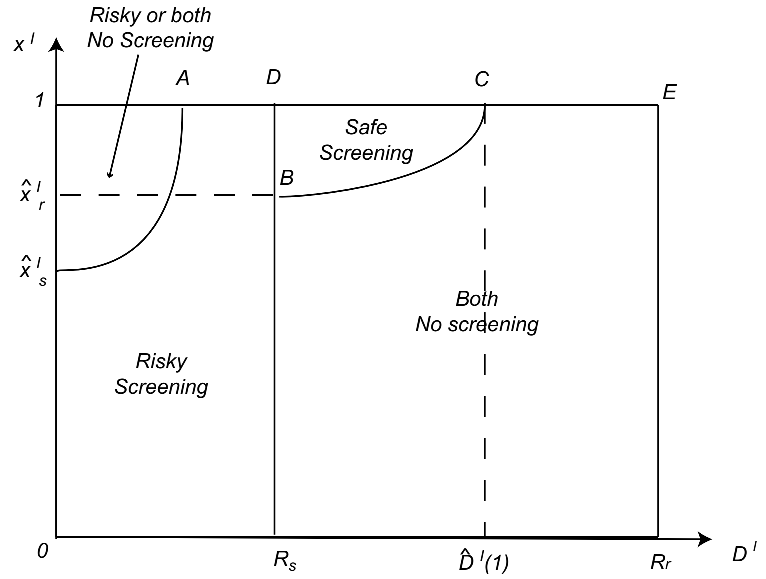

Figure 2: Entrant Strategies as a function of the Incumbent strategies: the case $\hat{x}_s \notin [0, 1)$

3.2 The Incumbent Strategy

We have now all the instruments to analyze the Incumbent's behavior. In order to better describe the special features of microfinance markets, we will consider three different behavioral assumptions: profit maximization, *naive* altruism and *smart* altruism. This will help us to understand more features of a highly heterogeneous phenomenon, and to provide some policy advice 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.* Despite the presence of many socially motivated institutions the biggest and more influential MFIs do claim to be able to make significant profits, and consider this ability as the result of a careful and business oriented management. This has remarkable implications: if microfinance showed to be effective in poverty reduction, then this result could be attainable in a costless or even profitable way.

This *win-to-win* promise has generated mixed reactions. On the one hand there has been a huge (and probably naive) wave of enthusiasm by a number of NGOs that glimpse in microcredit the ultimate solution to their financial problems. On the other hand a number or researchers and bureaucrats showed quite some skepticism. 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 seem to be the most numerous and the most influential, so that more and more MFIs are trying to follow their advice. In order to get a better theoretical understanding of the problems involved in this debate, we now examine a model describing a 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:

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

The Incumbent, just like the Entrant, can choose whether to specialize in a particular sector or to target 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.

Incumbent serves the Safe borrowers: If the Incumbent wants to attract *all* the Safe borrowers she needs to offer a contract satisfying the conditions in Lemma 1, inducing the Entrant to target the Risky borrowers and to offer 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 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 constraint $D \leq R_s$. This leads to $D^I = R_s$. If the constraint in Lemma 1 is not binding, then the Incumbent just set $x^I < 1$ (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:

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

Incumbent serves the Risky borrowers: If the Incumbent wants to serve *all* the Risky borrowers she can 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. $\hat{D}^I$ (see (7)) is increasing in x^I, so the Incumbent chooses $x^I = 1$, and $D^I = \hat{D}^I(1)$. This gives him the expected profit:

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

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

Incumbent serves both types: The Incumbent knows that when she chooses this 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:*

$$\Pi^I_B = \max\{\Pi_{ResR}, \Pi_{ResB}\} \tag{13}$$

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^I_b, D^I_b) 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:

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

The value of D^I_B is then obtained by solving the equation:

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

□

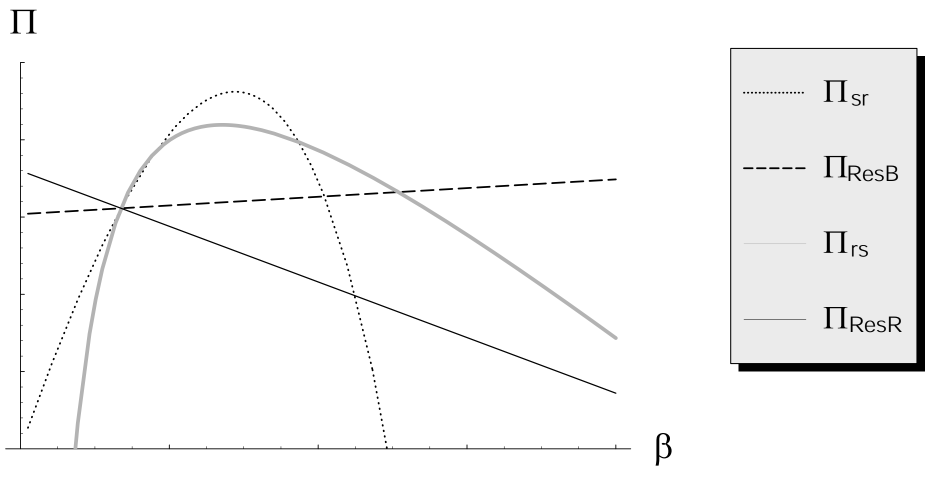

Figure 3: Incumbent Profit: Example 1.

In order to choose her optimal strategy, the Incumbent has then to compare equations (11), (12) and (13). Not surprisingly, the ranking depends on the values of the parameters. Let Θ be the set of parameters such that an equilibrium with screening prevails. More formally

$$\Theta = \{\alpha, \beta, p_r, p_s, R_r, R_s | \Pi^I_{sr} \geq \max\{\Pi^I_{rs}, \Pi^I_B\} \vee \Pi^I_{rs} \geq \max\{\Pi^I_{sr}, \Pi^I_B\}\}.$$

We prove that Θ is always non-empty and that under some general conditions has a strictly positive measure.

Proposition 1. *The set Θ is always non-empty. Moreover it has a strictly positive measure if one of the following conditions is satisfied:*

$$\alpha \leq \tfrac{m-p_r R_s}{m-1} \quad or \quad \alpha \leq \tfrac{p_r R_s - 1}{m-1} \quad or \quad \alpha \geq \tfrac{m-1}{2m-p_r R_s-1}$$

The conditions above ensure that either Π^I_{sr} or Π^I_{rs} intersects Π^I_B twice, as showed in Figure 3 and 4. Since Π^I_{sr} and Π^I_{rs} are concave, this is enough to show that the set Θ has a strictly positive measure. The three functions have a common intersection point in $\beta = \beta^c$. The conditions in Proposition 1 make sure that the second intersection point lies in the right region, to the left or to the right of β^c depending on whether Π_{ResR} is bigger or smaller than Π_{ResB}. Note that the three thresholds are well defined since they always belong to $[0, 1]$.

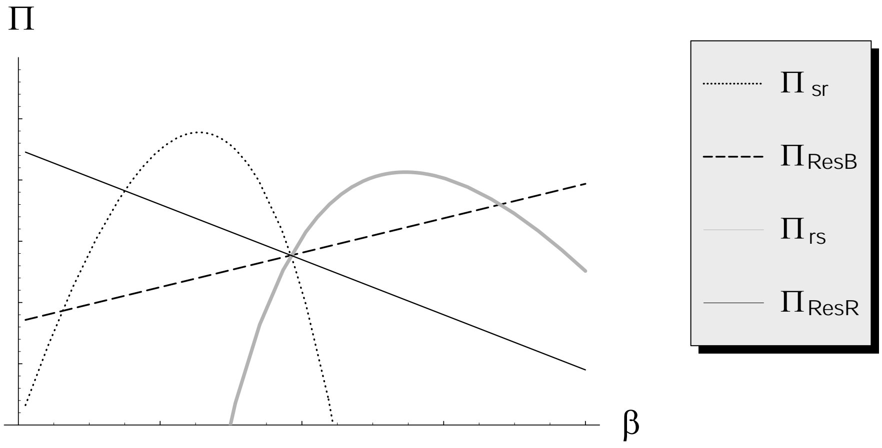

Figure 4: Incumbent Profit: Example 2.

This result shows that in a microfinance market the special kind of product differentiation we described is not a singularity. This is in line with the empirical findings of Navajas et Al. (cfr. [14]).

Welfare Anaysis: We can now examine the results above in order to understand the consequences of competition for the profitability of MFIs and the welfare of the borrowers. As a first conclusion, competition is always better than monopoly in terms of total welfare.

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

Proof. See Appendix 4 □

It must be stressed that this result depends mostly on the fact that, since $\alpha \leq 1$, the presence of two MFIs ensures a larger 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 4 □

The result is due to the fact that, in a competitive equilibrium, the MFI serving the Risky borrowers is able to extract a higher rent than a monopolist who does not want to exclude the Safe. Clearly the reverse is true if a monopolist prefers serving the Risky borrowers only. In such a case 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, in all the cases in which a monopolist would target both types, the Entrant earns the same profit she would earn if she were without competition. That provides one more possible explanation for the puzzling behavior of MFIs described by McIntosh, de Janvry and Sadoulet (2005) [11], 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 heterogeneous population of institutions, 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 striving 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 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 (NBC). 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 assumption is useful to describe small project-based programs, endowed with less resources and technical knowledge. Second, 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 better a market in which the Incumbent MFI is a larger institution running a well structured program.

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

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

subject to:

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

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 can screen 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. 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 $\alpha > \max\{\beta, 1-\beta\}$, which implies that 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 $D^I = \frac{1}{\beta p_s + (1-\beta)p_r}$. It 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 $\beta(m-1)$, 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. Depending on the values of the parameters, the Entrant's reaction is either to serve 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. This is particularly true when the lending capacity α is relatively small. In fact, 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, this behavior reduces the Entrant's profit, potentially hampering the development of a competitive sector and reducing the outreach. [7]

[7] We could speculate that this reduction has negative consequences in terms of total welfare, especially because lower profits might 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

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 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 is concerned with the welfare of her clients *and* with the welfare of the customers served by her competitor. In other words, she takes into account the consequences her strategy has on the Entrant's behavior and on her customers. As we will see, this different perspective can lead to different types of equilibria, in which the MFIs specialize in different market niches.

A *smart* altruistic Incumbent faces the maximization problem:

$$\max_{D^I,x^I} X^I(C^I, C^E(C^I), \alpha)[m - P(C^I, C^E(C^I))D^I] + \\ X^E(C^I, C^E(C^I), \alpha)[m - P(C^E(C^I), C^I)D^E(C^I)] \tag{15}$$

subject to:

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

The Incumbent has again three options: serve the Safe borrowers (inducing screening), serve the Risky ones (also inducing screening), or target both types. The option of serving the residual demand is clearly always dominated. In what follows, we analyze in more detail these possibilities.

Consider first the case in which she serves Both types of borrowers. There are no screening issues and the Incumbent's altruism has no effect on the Entrant's customers. To maximize the borrowers' utility functions 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:

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

The Entrant is left with the residual demand and the total borrower welfare depends on whether $\Pi_{ResR} > \Pi_{ResB}$ or vice versa.

In the next proposition we show how the Incumbent behaves if her goal is to induce screening.

Proposition 4. *If the Incumbent behaves as a Smart Altruistic MFI and she wants to induce screening, she optimally sets:*

1. $D^I = 1/p_s$ *if she wants to serve the Safe types only,*
2. $D^I = \max\{1/p_r, D^I_{min}\}$ *if she wants to serve the Risky types only,*

where D^I_{min} *is the value of* D^I *making the Entrant indifferent between the screening profit and the best outside option.*

Proof. See Appendix 4 □

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 renders the most interesting Entrant's outside options unfeasible. When the altruistic Incumbent serves the Safe borrowers, the Entrant cannot undercut anymore her contract, so that the relevant outside option is always serving the residual demand.[8] In a similar way, when the altruistic Incumbent serves the Risky borrowers, the Entrant cannot earn anymore Π_{Both} because D^I is set as low as possible – $1/p_r$ and D^I_{min} are both smaller than R_s – 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 also explained in the proof of Proposition 4, the Incumbent can set set $D^I < R_s$ and that makes the contract designed for the Risky borrowers 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^I_s) is determined only by the Entrant's outside options. In other words, the Incumbent's altruism affects the Entrant's profit only insofar as it changes her outside options, but the Entrant's contract for a given outside option, is independent of the Incumbent's one. Moreover, and more importantly, an altruistic MFI serving the safe types faces an important trade off: a lower value of D implies a lower value of x to attain screening, so that a lower price of the loan corresponds to more rationing. More rationing makes in turn the Entrant's outside option of serving the residual demand more attractive.

[8]Consequently in Lemma 1 the relevant value of $\hat{x}_s(D^I)$ is either the first or the second one.

This mechanism makes it less attractive for a Smart Altruistic Incumbent to specialize in the Safe borrowers. To reduce the repayment, she has to ration more than a profit maximizing 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 4 □

Whereas a Naive Altruistic Incumbent *always* finds the screening strategies less interesting than serving both types of borrowers, a Smart one would still opt for specialization in many cases. She does so when the capacity is relatively small. Let $\bar{\alpha}$ be the value of α making the Incumbent indifferent between serving the Risky borrowers in a screening strategy and serving Both types. The result is described in the next proposition:

Proposition 6. *A Smart Altruistic Incumbent prefers to serve the Risky borrowers rather than serving both types if and only if $\alpha \leq \bar{\alpha}$.*

Proof. See Appendix 4 □

The values of the threshold $\bar{\alpha}$ are calculated in the appendix. The result is quite intuitive. When α is high, an altruistic Incumbent can have a big impact just by serving the largest possible number of clients. But this is done at the expense of the Safe borrowers who subsidize the Risky ones. When α is small there are two effects. On the one hand the value of D^I_{min} increases, since the Entrant's outside option of serving the residual demand becomes more attractive. On the other hand the impact of the Incumbent on borrower welfare decreases. When α is small enough the second effect outweigh the first.

It is interesting to observe that $\bar{\alpha}$ is decreasing in β. This implies that the riskier is the market, the larger is the range of parameters for which equilibria with screening exist.

Note that when the altruistic Incumbent serves the Risky borrowers, in equilibrium rationing is bounded to be extremely low ($x^E_s = 1 - \epsilon$). 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, the troublesome incentive constraint is the one ensuring that the Risky borrowers do not prefer the contract designed for the Safe. Now, when the Incumbent is altruistic, the Risky borrowers are already given the maximal possible rent, and this mitigates the necessity to ration the Safe ones.

This has some consequences in terms of policy. The presence of an altruistic MFI has the obvious consequence of increasing borrower 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.

In contrast to this, under our assumptions, the presence of an altruistic MFI can also have a positive impact on the profit maximizing Entrant. 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. This clearly reduces the profit.

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

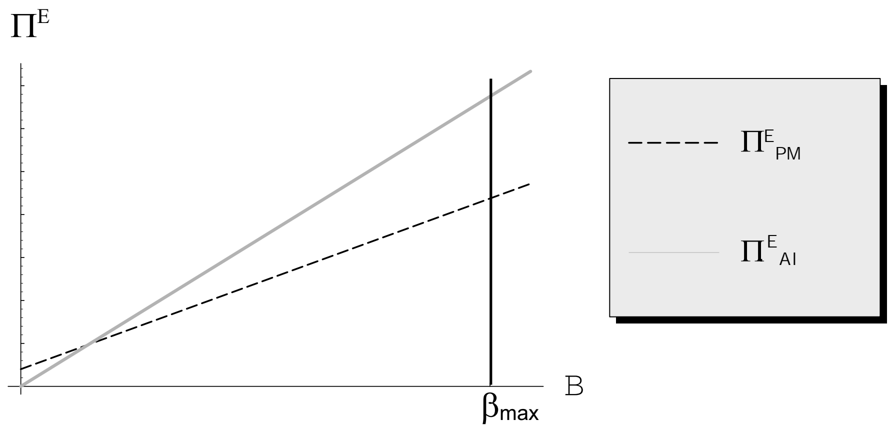

Figure 5: Entrant Profit: Comparison AI model and PM model

The figure shows the Entrant's profit as a function of β. We considered an example in which $1/p_r > D^I_{min}$ 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. Let $\beta_{max} = \bar{\alpha}(\beta)^{-1}$. Then 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 and the pool of borrowers must be heterogeneous enough (that is $p_s - p_r$ must be large).[9] 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 and competing with each other to attract clients. Our model describes the interaction between these actors in a tractable framework capturing the special features of microcredit markets.

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 implications it has on potential competitors, is very important for those who are working to enlarge the outreach and promote the development of microfinance.

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 our results but would add complexity.

[9]By equating Π^E in the two different models, we can solve for the value of β in which the two curves intersect, say β^*. Then, by simple algebra, in can be shown that $\beta^* \in [0, \alpha]$ if and only if:

$$\alpha \leq \frac{p_r(p_r R_s - 1) + p_s}{p_r(m + p_r R_s - 1)}$$

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Appendix A

Proof of Lemma 1. Suppose the Incumbent is willing to serve the Safe borrowers only, and that she offers the contract described in Lemma 1. We show that the Entrant's optimal reaction is 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 borrowers only, that is when $B^E(C^I, C^E) = 1 - \beta$ His maximization problem in this case is given by:

$$\max_{x^E, D^E} \Pi^E_{rs} = (1-\beta)x^E(p_r D^E - 1)$$

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^E. Solving it for D^E we get:

$$D^E = R_r - \frac{x^I_s}{x^E}(R_r - D^I)$$

What about x^E? Substituting D^E in the profit function we get:

$$\Pi^E_{rs} = (1-\beta)x^E[p_r R_r - p_r \frac{x^I}{x^E}(R_r - D^I) - 1] = (1-\beta)(x^E p_r R_r - x^E - p_r x^I(R_r - D^I))$$

that is clearly maximized for $x^E = 1$ given that $p_r R_r = m > 1$. So the Entrant can set:

$$\begin{cases} x^E = 1 \\ D^E = R_r - \frac{x^I}{x_r}(R_r - D^I) \end{cases} \tag{16}$$

that gives her the expected profit:

$$\Pi^E_{rs} = (1-\beta)[(m-1) - p_r x^I (R_r - D^I)] \tag{17}$$

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

1. Target the Risky sector, but serve only 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. Target the residual demand of Both types. This leads to profit $(1-x^I)[\beta(m-1) + (1-\beta)(p_r R_s - 1)]$.
3. Target both types undercutting the Incumbent's contract. This can be done by setting $x^E = 1$ and $D^E = D^I$. The profit is then $\Pi_{Both} = \alpha[\beta(m-1) + (1-\beta)(p_r R_s - 1)]$.

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

$$(1-\beta)[(m-1) - p_r x^I_s (R_r - D^I_s)] > (1-\alpha)(1-\beta)(m-1) \tag{18}$$

Note that the right hand side is pre-multiplied by $(1-\alpha)$ and not by $1 - x^I$. If we had $1 - x^I$ the inequality would be trivially satisfied and the Incumbent would set x^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^I we find the threshold:

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

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

$$(1-\beta)[(m-1) - p_r x^I (R_r - D^I)] > (1-\alpha)[\beta(m-1) + (1-\beta)(p_r R_s - 1)] \tag{20}$$

and solving for x^I we get:

$$\hat{x}_s := \frac{(1-\beta)(m-1) - (1-\alpha)[\beta(m-1) + (1-\beta)(p_r R_s - 1)]}{(1-\beta)p_r(R_r - D^I)} \tag{21}$$

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

$$(1-\beta)[(m-1) - p_r x^I (R_r - D^I)] > \alpha[\beta(m-1) + (1-\beta)(p_r R_s - 1)] \tag{22}$$

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

$$\hat{x}_s := \frac{(1-\beta)(m-1) - \alpha[\beta(m-1) + (1-\beta)(p_r R_s - 1)]}{(1-\beta)p_r(R_r - D^I)} \tag{23}$$

Note that in all these cases $\hat{x}_s$ is not necessarily in $[0,1)$. If $\hat{x}_s$ is greater than one, then screening is clearly possible for any $x^I < 1$. We still have to show that these values of $\hat{x}_s^I$ make screening possible. We have to verify that given the optimal reaction of the Entrant, the value $\hat{x}_s$ satisfies also condition (IC2). Replacing $x^E = 1$ and $D^E = R_r - \frac{x^I}{x^E}(R_r - D^I)$ in the IC2 we get:

$$x^I(R_s - D^I) \geq [R_s - R_r + x^I(R_r - D^I)] \Rightarrow x^I(R_s - R_r) \geq R_s - R_r$$

that is satisfied for any $x^I \in [0,1)$. □

Proof of Lemma 2. Suppose that the Incumbent wants to specialize in the Risky sector inducing the Entrant to serve the Safe sector and to offer an incentive compatible contract. In this case the Entrant solves this maximization problem:

$$\max_{x^E, D^E} \Pi^E_{sr} = \beta x^E (p_s D^E - 1)$$

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

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

We have to consider two possible cases: (i) the Incumbent sets $D^I \geq R_s$; (ii) the Incumbent sets $D^I < R_s$. We show that as long as $D^I > R_s$ the Incumbent can raise the Entrant's profit from screening by setting a lower D^I. But if $D^I < R_s$ the Entrant's profit might decrease because a lower D^E (necessary to have screening) is only in part compensated by a higher x^E. (i) $D^I \geq R_s$. This is the relevant case when the Incumbent is profit maximizing. Consider first the IC2. When $D^I \geq R_s$ the RHS is negative, and the PC binds. Thus the Entrant can set $D^E = R_s$. In order to attain screening, IC1 must be satisfied. Solving it for x^E we find the condition:

$$x^E \leq \frac{x^I(R_r - D^I)}{R_r - D^E} := \hat{x}_s \tag{24}$$

that is binding at the optimum. Notice that if $D^I = R_r$, (24) is true only for $x^E = 0$. So the Incumbent must offer a contract with $D^I < R_r$. The expected Entrant's profits are then:

$$\Pi^E_{sr} = \beta \hat{x}_s(m-1) \tag{25}$$

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

1. Target both types offering a non incentive compatible contract characterized by $D^E = R_s$ and $x^E = 1$. This strategy gives profit $\Pi_{br}^E = \alpha(\beta(m-1) + (1-\beta)(p_r R_s - 1))$. In this case, for the Incumbent to prefer serving the Safe types, we need $\Pi_{sr}^E \geq \Pi_{br}^E$. In formulas:

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

Replacing x^E with (24) we get:

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

2. Target the Risky sector, undercutting the Incumbent: also in this case, as showed above, to induce screening the Incumbent must set $D^I = R_r - x^E/x^I(R_r - R_s)$. We can determine the relevant value of x^E by solving the inequality :

$$\begin{aligned}&\beta x^E(m-1) \geq (1-\beta)[(m-1) - p_r x^E(R_r - R_s)] \Longrightarrow \\ &x^E \geq \frac{(1-\beta)(m-1)}{\beta(m-1) + (1-\beta)(m - p_r R_s)}.\end{aligned}$$

Now replacing again x^E with (24) we get:

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

If we define

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

then $\hat{D}^I(\tilde{x}^E)$ gives the upper bound for D^I. (ii) $D^I < R_s$. This case is relevant when the Incumbent is altruistic. We can rewrite the incentive constraints when the Incumbent sets $D^I \leq R_s$ and $x^I = 1$:

$$\begin{aligned}x^E p_s(R_s - D^E) \geq p_s(R_s - D^I) \quad &\Rightarrow \quad D^E \leq R_s - \frac{R_s}{x^E} + \frac{D^I}{x^E} \\ p_r(R_r - D^I) \geq x^E p_r(R_r - D^E) \quad &\Rightarrow \quad D^E \geq R_r - \frac{R_r}{x^E} + \frac{D^I}{x^E}\end{aligned}$$

The equations above delimit an interval of contracts satisfying both incentive constraints. Note that for $x^E < 1$ this interval for D^E exists and has a strictly positive measure. So, for any contract offered by the Incumbent with $D^I < R_s$, the Entrant can make screening possible by choosing $x^E < 1$ and $D^E = D^I - \epsilon$, with $\epsilon \in \mathbb{R}_+$, making the safe borrower's incentive constraints binding. By doing that she earns $\Pi_{sr} \cong x^E\beta(p_s D^I - 1)$. She chooses this strategy iff that gives her a higher profit than the possible outside options: serving the residual demand or undercutting the Incumbent's contract. Let then D^I_{min} be the value of D^I making the Entrant indifferent between the screening profit and the outside option. That gives the lower bound for D^I. $\square$

Proof of Proposition 1. It can be shown that equations (11), (12) and (13) have a common intersection at the point

$$\beta = \frac{m - p_r R_s}{2m - 1 - p_r R_s} := \beta^c.$$

Note that the value above is well defined since it lies always in the interval $[0, 1]$. This is enough to show that screening is a Nash equilibrium at least in one point. We now prove that screening equilibria exist over a larger range of parameters. We do it by showing that under the conditions stated in the Proposition, there exist an interval of β for which the functions Π^I_{rs} and/or Π^I_{sr} lie above Π^I_B (see Figure 3 and 4). First of all, note that: (i) the functions Π_{ResR} and Π_{ResB} are linear in β, the former being decreasing and the latter increasing, so that the function (13) describes a weakly convex 'v-shaped' curve; (ii) the curves Π^I_{rs} and Π^I_{sr} are first increasing and then decreasing, always concave in β. In fact, from equation (11) we have:

$$\frac{\partial \Pi^I_{sr}}{\partial \beta} = \frac{(m-1)^2 + (m-1)\alpha(m - p_r R_s)}{m - p_r R_s} - \frac{\alpha(m-1)^2}{(m - p_r R_s)(1-\beta)^2}$$

that 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:

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

that is always negative since $\beta < 1$. Similarly, from equation (12) we have:

$$\frac{\partial \Pi^I_{rs}}{\partial \beta} = \frac{\alpha(m - p_r R_s)(p_r R_s - 1) + \beta^2[\alpha(m - p_r R_s)^2 - (m-1)^2]}{\beta^2(m-1)}$$

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

$$\frac{\partial^2 \Pi^I_{rs}}{\partial \beta^2} = -\frac{2\alpha(m - p_r R_s)(p_r R_s - 1)}{\beta^3(m-1)}$$

that is also always negative. For screening equilibria to exist over an interval of β, we need Π^I_{rs} and Π^I_{sr} to cross $\Pi^I_B(\beta)$ twice. We already know one intersection point, β^c, so we have to find the second one. Consider first $\Pi^I_{sr}(\beta)$ and note that (i) the function crosses Π_{ResR} also in the point $\beta = 1 - \alpha$; (ii) the function crosses

Π_{ResB} also in the point $\beta = \frac{(1-\alpha)(p_r R_s - 1)}{\alpha(m - p_r R_s) + (p_r R_s - 1)}$. We have two cases to take into account. First, the functions cross in a point in which $\Pi_{ResR} > \Pi_{ResB}$. Since $\Pi_B^I(\beta) = \max\{\Pi_{ResR}, \Pi_{ResB}\}$, we need β^c to be bigger than $1 - \alpha$. This happens iff $\alpha \geq \frac{m-1}{2m - p_r R_s - 1}$. Second, the functions cross in a point in which $\Pi_{ResB} > \Pi_{ResR}$. Then we need β^c to be on the left of this point. This happens iff $\alpha \leq \frac{p_r R_s - 1}{m-1}$.

Consider now $\Pi_{rs}^I(\beta)$ and note that (i) the function crosses Π_{ResR} also in the point $\beta = 1$ (ii) the function crosses Π_{ResB} also in the point $\beta = \frac{\alpha(p_r R_s - 1)}{(m-1) - \alpha(m - p_r R_s)}$. We have again two cases. First, the functions cannot cross in a point in which $\Pi_{ResR} > \Pi_{ResB}$ since $\beta^c < 1$. Second, the functions cross in a point in which $\Pi_{ResB} > \Pi_{ResR}$. So the point $\beta = \frac{\alpha(p_r R_s - 1)}{(m-1) - \alpha(m - p_r R_s)}$ must lie on the right of β^c. This happens iff $\alpha \leq \frac{m - p_r R_s}{m-1}$. In all these situations, given the properties of Π_{rs}^I and Π_{sr}^I, the set Θ is an interval with a strictly positive measure.

$\square$

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 $\Pi_{sr}^I = \beta \hat{x}_s(R_s)(m-1)$ and the Entrant earns $\Pi_{sr}^E = (1-\beta)[(m-1) - p_r \hat{x}_s(R_s)(R_r - R_s)]$. 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 $[0,1]$ only if $\Pi_{Risky} > \Pi_{Both}$. This means, if the Incumbent were a monopolist she 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, and the Risky ones get $(1-\beta)p_r[\alpha(1 + \frac{(1-\beta)(p_r R_s - 1)}{\beta(m-1)})(R_r - R_s))]$. On the firms' side, the Incumbent earns $\Pi_{rs}^I = (1-\beta)(p_r \hat{D}^I - 1)$ and the Entrant $\Pi_{rs}^E = \Pi_{Both} = \beta\alpha(1 + \frac{(1-\beta)(p_r R_s - 1)}{\beta(m-1)})(m-1)$. Summing up and simplifying we get:

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

Suppose the parameters are such that a monopolist would decide to serve both types of borrowers. In this case only the Risky borrowers would 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}. Similarly, suppose the parameters are such that a monopolist would serve only the Risky borrowers. The total welfare would again correspond to the monopolist profit Π_{Risky}, that is also smaller than W_{rs}. $\square$

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 $(1-\beta)p_r x_s(R_r - R_s))]$. Since $x_s \in [0,1]$, the Risky borrowers' 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 $x^E\beta < \alpha$. $\square$

Proof of Proposition 4. 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 $x^I \leq \hat{x}_s$. We have to consider the effects of her choice on the Safe borrowers she serves *and* on the Risky borrowers the Entrant serves.
We show, first of all, that when $x^I = \hat{x}_s(D^I)$, the Entrant's optimal contract does not depend on the value of D^I. We know that the Entrant reaction is to offer $D^E = R_r - \frac{x^I}{x^E}(R_r - D^I)$. Substituting for the adequate value of $\hat{x}_s^I$, it is very easy to check that the value D^E is independent of D^I. It follows that also the Entrant's profit and the Risky borrowers' welfare are independent of the Incumbent's choice. In other words the Incumbent's altruism has no beneficial effects on the Risky borrowers served by the Entrant.
So, what matters is the utility enjoyed by the Safe borrowers. Note that, in all the cases analyzed in Lemma 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 $\beta x^I p_s(R_s - D^I)$. In the relevant interval this equation is decreasing and concave in D^I. The NBC becomes $\beta x^I(p_s D^I - 1) \geq 0$. The MFI chooses the lowest possible value of D^I, that is the value that makes her profit equal to zero. This is given by $D^I = 1/p_s$.

Suppose now that the Incumbent chooses to serve the Risky sector. 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. The value of D^I that makes the NBC binding is $1/p_r$. As a consequence of our assumptions $1/p_r \leq R_s$. As described in Lemma 2, the Incumbent can induce screening by setting $x^I = 1$ and $D^I = \max\{1/p_r, D^I_{min}\}$. This endows the borrowers served by the Incumbent with the highest possible rent. At the same time, it has a positive influence on the borrowers served by the Entrant, since tougher price competition forces her to reduce the repayment D^E and increase the value of x^E.

$\square$

Proof of Proposition 5. The total borrower welfare when the Incumbent serves the Safe borrowers inducing the Entrant to serve the Risky ones is given by:

$$B\bar{W}_{sr} = \beta\hat{x}_s(m-1) + (1-\beta)(m - p_r D^E) \tag{26}$$

We can compare it with the borrowers' welfare when the Incumbent serves both types, that is given by:

$$BW_b = \begin{cases} \alpha(m-1) \quad \text{if} & \Pi_{ResR} > \Pi_{ResB} \\ \alpha(m-1) + (1-\alpha)(1-\beta)p_r(R_r - R_s) \quad \text{if} & \Pi_{ResB} > \Pi_{ResR} \end{cases} \tag{27}$$

We have therefore two cases to examine. Consider first the case in which 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^E in equation (26). After some 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 in which 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^E in equation (26). The result is a strictly decreasing and concave curve in β. Note that $\Pi_{ResB} > \Pi_{ResR}$ if $\beta \geq \frac{m - p_r R_s}{2m - p_r R_s - 1} = \beta^c$. Substituting this threshold in (26) we get an upper bound:

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

We can prove that the first multiplier is smaller than one. This 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. $\square$

Proof of Proposition 6. Let $\Pi_{ResR} > \Pi_{ResB}$. Then D^I_{min} is the solution to the following equation:

$$\beta(p_s D^I_{min} - 1) = (1-\alpha)(1-\beta)(m-1) \quad \Rightarrow \quad D^I_{min} = \frac{(1-\alpha)(1-\beta)(m-1)+\beta}{\beta p_s}$$

For the Incumbent to prefer serving the Risky types it must be that:

$$\beta p_s(R_s - D^I_{min}) + (1-\beta)p_r(R_r - D^I_{min}) \geq \alpha(m-1).$$

Solving for α we get:

$$\alpha \leq \frac{(m-1)\left[(1-\beta)+\frac{p_r}{p_s\beta}(1-\beta)^2\right] - \beta(m-1) - (1-\beta)(m-\frac{p_r}{p_s})}{(m-1)\left[(1-\beta)+\frac{p_r}{p_s\beta}(1-\beta)^2\right]-(m-1)} := \bar{\alpha} \qquad (28)$$

Let now $\Pi_{ResB} > \Pi_{ResR}$. Then D^I_{min} is the solution to the following equation:

$$\beta(p_s D^I_{min} - 1) = (1-\alpha)(\beta(m-1) + (1-\beta)(p_r R_s - 1)) \quad \Rightarrow$$
$$D^I_{min} = \frac{(1-\alpha)(\beta(m-1)+(1-\beta)(p_r R_s - 1))+\beta}{\beta p_s}$$

For the Incumbent to prefer serving the Risky types it must be that:

$$\beta p_s(R_s - D^I_{min}) + (1-\beta)p_r(R_r - D^I_{min}) \geq \alpha(m-1) + (1-\alpha)(1-\beta)(m - p_r R_s).$$

Solving for α we get:

$$\alpha \leq \frac{\frac{p_r}{p_s\beta}\left[\beta(m-1)+(1-\beta)(p_r R_s - 1)\right] - \left(1-\frac{p_r}{p_s}\right)}{\frac{p_r}{p_s\beta}\left[\beta(m-1)+(1-\beta)(p_r R_s-1)\right]} := \bar{\alpha} \qquad (29)$$

If $1/p_r > D^I_{min}$, then by analogous reasoning we get:

$$(m-1) - \beta(\frac{p_s}{p_r} - 1) \geq \alpha(m-1) \quad \Rightarrow \quad \alpha \leq 1 - \beta\frac{p_s/p_r - 1}{m-1} := \bar{\alpha}$$

when $\Pi_{ResR} > \Pi_{ResB}$ and

$$(m-1) - \beta(\frac{p_s}{p_r} - 1) \geq \alpha(m-1) + (1-\alpha)(1-\beta)(m - p_r R_s) \quad \Rightarrow$$
$$\alpha \leq 1 - \beta\frac{p_s/p_r - 1}{p_r R_s - 1 + \beta(m - p_r R_s)} := \bar{\alpha}$$

$\square$