The Impact of Microfinance on the Informal Credit Market: An Adverse Selection Model

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March 29, 2010

Abstract This paper looks at 'the other side' of the much-celebrated microfinance revolution, namely its potential impact on the conditions of access to credit for non-members (the *residual market*). It uses a standard adverse selection framework to show the advantage of group lending as a single innovative lending technology, and then to assess how the apparition of this new type of lenders might change the equilibria on rural credit markets, taking into account the reaction of other lenders. We find that two antagonist effects coexist: a standard *competition effect* and a *selection effect*. While the former tends to lower the residual market rate, the latter raises the cost of borrowing outside microfinance institutions (MFIs) due to a worsening of the pool of borrowers. The relative weights of the two effects depend on the market structure, the heterogeneity of the population and the actual distance between lending technologies. If the individual-lending market is competitive, then the only possible effect is the increase of the interest rate charged by moneylenders, which will happen as soon as the pool of borrowers of the two types of lenders are overlapping. If traditional moneylenders have market power, then the two effects are at work. Even then, whenever a group-lending institution is present in the market, a monopolistic moneylender has to give up supplying credit to relatively safe borrowers, which can allow it to raise its interest rate (though making a lower profit). This arguably less intuitive impact of microfinance, which has been overlooked until now, is important given the nearly-universal coexistence of MFIs and traditional lenders in developing countries. Moreover, it is not only theoretically likely, but seems to match some empirical evidence presented in the paper. Our paper is thus a contribution in the understanding of the redistributive impact of the microfinance revolution that has been occurring in the last years.

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1 Introduction

Individuals and organizations engaged in promoting economic development are usually concerned not only with generating aggregate growth in developing countries, but also with ensuring that the beneficiaries of this growth include the poorest fringes of the population (so-called 'inclusive' growth). One of the main obstacle to achieving this goal has been the extreme difficulty for poor entrepreneurs to acquire the capital needed to finance their productive investments and other needs.

Indeed, given information problems and the presence of important transaction and fixed costs of lending, banks are usually absent of the rural world in developing countries. There, credit-constrained households rely on informal moneylenders (e.g. landlords, local traders, small businessmen), who usually have more information on borrowers and accept as collateral goods or services that a bank would not. However, it has usually been observed that they charge high interest rate and that they fail to serve all potential borrowers (e.g. Aleem 1990, Armendáriz de Aghion and Morduch 2005, Banerjee 2003, Robinson 2001). From the 80's on however, microfinance institutions (MFIs) have spread out around the world, exploiting new contractual structures and organisational forms to supply small, uncollateralized and cheap loans to poor people.

Today, the way most microfinance programmes achieve this is through the use of group-lending schemes, which can embrace a series of different mechanisms such as dynamic incentives, regular public repayments and joint liability. This paper explicitly models the latter, though it applies to any mechanism that implies some peer screening, monitoring or enforcement.[1] Under joint liability, individual borrowers have to form groups to apply and all group members are held collectively responsible for the repayment of each other's debt. Several authors have proposed various explanations for the new opportunities that this mechanism might offer (e.g. Ghatak and Guinanne 1999, or

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[1]In recent years, a growing number of MFIs have been turning to individual liability (e.g. ASA in Bangladesh, BancoSol in Bolivia). However, most of them still use groups to disburse and collect loans (in order to reduce transaction costs), which implies that some peer screening, monitoring or enforcement is still present. Moreover, this trend is by no means universal: in India, for example, Self-Help Groups, which adhere fairly strictly to the joint-liability contract, represent 73 per cent of the microfinance sector (Srinivasan 2009).

Guttman 2006 for a good review). We focus on the role of joint liability as instrument to allow better discrimination between entrepreneurs of different risk types and thereby to limit the risk of adverse selection. In this context, joint liability can be seen as a collateral substitute, which is particularly important in developing countries, both for borrowers (who often lack tangible assets and/or credible credit history) and lenders (who often lack due protection of property rights and effective enforcement mechanisms).

There exists some evidence that group lending - and joint liability in particular - have allowed microfinance to expand outreach and increase repayment performances (see e.g. Khandker et al. 1995, Ahlin and Townsend 2002, Karlan 2005, Armendáriz de Aghion and Morduch 2005, Kritikos and Vigenina 2005). However, the existing literature, by focusing almost exclusively on the problem of single lenders trying to tap excess demand, has not yet explored an important issue regarding the development of microfinance, namely its impact on residual credit markets (defined as the traditional individual-lending market) and on the welfare of non participants. Intuitively, the rise of MFIs can help to limit market power of traditional lenders. However, we argue that MFIs, because they select good borrowers, are also likely to worsen the information problems that cause traditional lenders to charge high interest rate. Therefore, MFIs may change the dynamics of credit markets in unintended ways, possibly raising interest rates or pushing moneylenders out of business, and ultimately hurting some poor borrowers. There is no doubt that MFIs will never be able to provide credit to all poor borrowers; rather, we observe a coexistence of MFIs and traditional lenders in developing countries around the world. For instance, a recent survey by the Reserve Bank of India found that between 1995 and 2006, while the number of MFIs was booming, the number of registered moneylenders increased by 56% and the number of unlicensed lenders was believed to have made similar gains (Gokhale, 2009). This paper is thus concerned with the redistributive aspect of the microfinance revolution. We do not study competition between moneylenders or between MFIs themselves, but competition between MFIs and other providers of financial services (for a model of competition in microfinance markets, see e.g. McIntosh and Wydick 2005 or McIntosh et al. 2005).

The remaining of the paper is as follows. First, section 2 motivates our research question. It provides some empirical support to the idea that the presence of MFIs in a traditional credit market might change its dynamics, and not always in the sense a reduction of the cost of borrowing. Then, section 3 gives the basic features of our model, which will hold throughout the paper. Section 4 develops the basic version of individual lending. We derive the conditions under which inefficient separating equilibria arise. Section 5 introduces the group lending technology. We show that, if assortative matching occurs at the group formation stage, joint liability lowers the probability of adverse selection, and increases efficiency and repayment rates. In section 6, we take a market-wide look and assess the effects on the different segments of the market that are predicted by our model. Facing the competition of MFIs operating group lending, traditional lenders have to increase their interest rate and can be driven out of the market. In section 7, we look at the effect of market power and analyse a competition game between a not-for-profit MFI and a monopolist moneylender. We show that the MFI presence can have two different impacts according to the initial situation: it can either force a decrease of the residual interest rate if the monopolist is rationing safe borrowers at equilibrium (competition effect), or foster an increase in the residual interest rate if the monopolist is offering a pooling equilibrium at equilibrium (selection effect). Whether the first effect will dominate the other depends on the importance of joint liability in the MFI's contract and on the heterogeneity among risk types in the population. Finally, we conclude.

2   Some facts about interest rates in rural markets

The starting point of our model is the field observation that traditional lenders often appear to charge higher interest rate when some MFIs are present in the market than when they are alone. This is rather counterintuitive as it goes again the traditional competition argument. However, as we will show theoretically in the next sections, it can be explained if we consider that MFIs affect the composition of the pool of borrowers

and therefore the average probability of repayment to incumbent lenders. Here below we display some evidence from India.

The first set of data comes from a survey on credit group members and non members that was realised in 2007 in the states of Orissa, Chhattisgarh and Jharkhand, India, where an NGO has been actively promoting MFIs (in the form of women Self-Help Groups, or SHGs). More information about the survey can be found in Baland et. al (2008). We use part of these data, in which non-SHG members were asked about the interest rate charged by different lenders, when they required small loans (doctor visits, daily consumption, etc.) or bigger loans (durables, business-related expenses, etc.). Here we focus on loans with positive interest rates that were made by moneylenders, traders and other neighbors (excluding relatives, landlords and/or employers, who face different informational structure). For both sizes of loans, we observe a significantly higher interest rate when there are some SHGs in the village (see figure A). Moreover, it doesn't seem to be a monotonic relationship: the interest rate charged by traditional lenders is on average lower when there are more than two groups than when there are one or two group(s).

In another survey about the same NGO's SHGs in the state of Jharkhand that we conducted in 2006 and 2009, we collected data on actual loans taken by members and non members (among other data - description of this survey can be found in Demont 2009). In these data, the interest rate is not anymore a general self report by respondents but is computed from actual debt contracts. When loans have been fully repaid, we use the amounts borrowed, repaid and the actual duration to reconstruct the implicit interest rate of the loans, while we use contract information (either the explicit rate or the amounts borrowed, to be paid and the duration) when loans are still pending. Yet, the results are comparable to those observed before: traditional lenders sharing the market with SHGs charge higher interest rates on average and the effect can reverse when there are many SHGs (see figure A).

Although we don't want to interpret those relationships as causal, which would require rigorous econometric analysis and is outside the scope of this paper, we consider the above evidence as an interesting indication that competition may not be the main force at work

in rural credit markets. The model that follows contributes to explaining how (and when) the equilibrium interest rate of traditional lenders can rise as a result of the entry of MFIs in the market.

3   Setup of the model

We use a simple one-period model of a rural credit market under adverse selection (Ĺ la Stiglitz and Weiss, 1981). The market is populated by a continuum of size 1 of risk-neutral households. Each household is endowed with a risky investment project which requires K units of capital and supplies inelastically one unit of labour. Their utility function U is assumed to be continuously differentiable and linearly increasing in income ($U' > 0$, $U'' = 0$). The opportunity cost of labour is $\bar{u}$, which may be viewed as an alternative income that the household would be able to produce if not committed to any project (e.g. wage work). By assumption, the households lack the capital required to enter the project, such that they have to finance their investment through borrowing by means of a debt contract.

Projects once started will yield either a high gross return R_i^h or will fail and yield a low gross return R_i^l, which is normalized to be 0 in the rest of the paper (henceforth R_i without any upperscript will refer to R_i^h). Households are indexed into two groups, safe (s) and risky (r), and the risk characteristic of each household is unknown to moneylenders (screening technology is prohibitively expensive). The proportions of safe and risky households in the population are π and $(1 - \pi)$ respectively, and are common knowledge. The term p_i represents the probability of success of the project of type i ($i = r, s$), with $1 \geq p_s > p_r \geq 0$. We follow Stiglitz and Weiss (1981) in assuming that $R_s < R_r$, so that the expected returns are equal for both types of households and lenders don't prefer any type to the other a priori: $E(R_i) = p_s R_s = p_r R_r = \bar{R} > 1$.[2] The project returns of different borrowers are assumed to be uncorrelated (for the effect of correlated types,

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[2]Making the alternative assumption that risky projects have lower expected returns, De Meza and Webb (1987) develop a symmetrical reasoning, leading to so-called advantageous selection: as a bank raises its interest rate, the marginal client that drops out is a risky client. Yet, this situation does not bring any Pareto improvement if the risky projects are efficient.

see Laffont 2000). We assume throughout that the investment projetcts of both types of household are efficient, such that their expected return ($\bar{R}K$) is greater than the opportunity cost of the capital and labour used up in the project. This means that, in a welfare-maximizing situation, all households should get funds.

Importantly, and this is a feature that is often omitted in existing models, the opportunity cost of capital to lenders is modelled having two components, variable and fixed. Indeed, in reality, a significant part of the costs of lending is independent to loan size (e.g. bookkeepers' wage) - which is in fact one of the main reasons why banks struggle to serve poor borrowers (Braverman and Guasch 1989, Aleem 1990, Armendáriz de Aghion and Morduch 2005). If the two type populations are of different sizes, the presence of fixed costs implies that the opportunity cost of capital is not the same accross households (for given investment size). Since they make small loan sizes costlier for lenders, fixed costs matter because borrowers in separating equilibria are worse off with respect to the case with variable costs only, which in turn affects their participation constraints. Alternatively, if borrowers can decide on the size of the loan (e.g. by co-financing their investment), they will face a trade-off between smaller principal and larger interest rate.

There is no moral hazard in the model: although actual returns are unknown to lenders, success is perfectly observed and repayment is enforceable.[3] In case of failure, we assume limited liability in the sense that borrowers cannot repay their loan, or that they are liable up to the amount of colletarisable wealth they agreed to pledge. In this work, it is assumed that borrowers don't possess any, for simplicity and also because it is likely to actually best describe the situation of most poor households around the world.[4] Together, limited liability and absence of collateral imply that most instruments used by conventional lenders to address information problems are not available. In this

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[3]This is obviously the case if ex-post state verification is costless. Nevertheless, Gale and Hellwig (1985) showed that, in one-period optimal debt contracts with (sufficiently) costly state verification, lenders pay that cost whenever borrowers default, which leads to the same conclusion as in our simple model (i.e. successful borrowers always repay). This is the case because, in the presence of limited liability, borrowers always have the incentive to declare realised returns as low as possible, and lenders impose a penalty in case of false reporting.

[4]Often, traditional moneylenders accept as collateral goods or services that have little or no economic value but whose role is to induce higher willingness to repay (given the positive value they have for borrowers). In our model without moral hazard, collateral is therefore not a crucial matter.

context, joint liability lending can be viewed as a 'simple mechanism that exploits local information to screen borrowers' (Ghatak 2000).

Throughout, we call 'mixed market' a market with two types of lending institutions - 'moneylenders' making individual loans and 'MFIs' operating joint lending. we call 'residual market' the market supplied by traditional moneylenders (or the share of a mixed market that is not served by MFIs).

4 Equilibrium with individual lending

In the basic version of the model, both borrowers and lenders are price-takers. We model individual lending as the following sequence of events. First, lenders compete and the market determines the equilibrium price of funds.[5] Second, borrowers observe the market rate r and decide whether to borrow at this rate or not.[6] Third, households who borrowed invest, Nature decides the outcome, and repayment is made according to the debt contract. Households who did not borrow enjoy the reservation income $\bar{u}$.

Since the risk characteristics of households are private information, discrimination is not feasible in the absence of collateral, and lenders charge a unique nominal interest rate. As it is well-known, two different equilibria can arise in this situation. If the break-even interest rate is low enough to attract all risk types, we have a pooling equilibrium: all creditworthy households have access to funds. This is the first-best equilibrium, which maximizes overall welfare. If the break-even interest rate is too high for some households to expect a positive net utility from borrowing, we have a separating equilibrium: only a subset of risky borrowers has access to credit (*adverse selection*). A separating equilibrium is inefficient because, due to the information asymmetry, it leaves worthy entrepreneurs without the funds required to start their project and we observe underinvestment (given our assumptions, it would always be efficient to extend loans to all borrowers).

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[5]The zero-profit constraint that we use can actually be seen as a reduced form of a profit maximization problem under perfect competition or Bertrand competition (with lenders all facing the same technology). Alternatively, it could be derived from utility maximization problem of altruistic moneylenders (e.g. not-for-profit institutions).

[6]As a tie-breaking rule, we assume that, if borrowers are indifferent between borrowing and enjoying the reservation income, they choose the first option and carry out their investment ('appetite for entrepreneurship').

Moneylenders break even by equalizing the expected repayment from the loans extended to borrower with the opportunity cost of capital (this condition is known in the literature as 'zero-profit constraint', or ZPC):

$$\pi p_s K r + (1 - \pi) p_r K r = A + \gamma K \tag{1}$$

where r is the gross interest rate (principal plus net interest rate), $A > 0$ is a fixed cost per loan and $\gamma > 1$ is the gross cost per unit lent (including bank's interest rate). Above, we imposed that the investment of both types of household is efficient. Given the cost structure in (1), this efficiency condition (EC) can be written as:

$$\bar{R}K > \begin{cases} \frac{A}{\pi} + \gamma K + \bar{u} & \text{for safe entrepreneurs} \\ \frac{A}{1-\pi} + \gamma K + \bar{u} & \text{for risky entrepreneurs} \end{cases} \tag{2}$$

At a pooling equilibrium (P), the solution is

$$r^{I,P} = \frac{\gamma + \frac{A}{K}}{\bar{p}} > 1 \tag{3}$$

where the upperscript I stands for individual lending and $\bar{p} = \pi p_s + (1-\pi)p_r$ is the average individual probability of success of households. Intuitively, the break-even interest rate decreases with the loan size K (due to the presence of fixed costs), the proportion of safe individuals π and the probability of success p_i. If this rate is too high, safe borrowers are not able to derive a positive expected payoff from investment (see proposition below). We then observe a separating equilibrium (S) and ZPC is satisfied iff

$$r^{I,S} = \frac{\gamma + \frac{A}{K(1-\pi)}}{p_r} > 1 \tag{4}$$

Note that the above debt contracts are credible: given (2), it is easy to check that $r^{I,P} < R_s$ and $r^{I,S} < R_r$. Also note that $r^{I,S} > r^{I,P}$: lenders have to cover the higher probability of default as well as the higher average cost of capital due to the reduced loan size. We can now assess the conditions of existence of the different equilibria.

Proposition 1 *When borrowing individually, $r_s^{I,\max} = \frac{p_s K R_s - \bar{u}}{p_s K}$ represents the maximum rate satysfying the participation constraint of safe borrowers. We have that:*

1. *if $r^{I,P} \leq r_s^{I,\max}$, all would-be borrowers apply and the market settles at a pooling equilibrium at rate $r^{I,P}$*

2. *if $r^{I,P} > r_s^{I,\max}$, only risky borrowers apply and the market settles at a separating equilibrium at rate $r^{I,S}$.*

Proof. Under the conditions described above, the net individual payoff from investment for a borrower of type i is $p_i K(R_i - r^I) - \bar{u}$. Would-be borrowers will apply if the actual debt contract they are proposed is such that this expression is non negative. Since $p_s > p_r$, expected payoff is larger for risky households (for given r), who have to repay less often than safe borrowers and are thus implicitly subsidized by the latter. As a consequence, if a separating equilibrium exists, it can only contain risky borrowers (since they will always accept what safe individuals would accept). In our setting, a separating equilibrium exists whenever $U_s^{I,P} = p_s K(R_s - r^{I,P}) < \bar{u} \iff \frac{p_s}{\bar{p}}(\gamma K + A) > \bar{R}K - \bar{u}$. The likelihood of adverse selection thus increases with the proportion of risky borrowers in the population and the cost of capital to lenders. To the contrary, if the difference between the safe wage and the expected risky return is important, safe households are likely to apply for a loan at equilibrium (this, in turn, will be determined by factors like the size, fragmentation and competition state of local markets for goods and services, and the education of households). Given (2), it is easy to check that risky households always borrow. ∎

5   Equilibrium with group lending

We now turn to the problem of a lender that lends to groups that are collectively responsible for repayment (joint liability). That is, although loans are still individual and every borrower is still responsible for paying back her own loan, successful group members have in addition to pay for (part of) the obligations of defaulting partners. As

is well known, this is a scheme that is widely used by microfinance institution (MFI) around the world in order to mitigate information asymmetries.[7]

We model group lending as the following game. First, the (unsubsidized) lenders choose joint liability contracts that satisfy zero-profit and credibility constraints. Second, borrowers who agree on those terms form groups and take up a loan. Third, as before, investment takes place, Nature decides about the realizations and lenders get reimbursed according to contract terms. To simplify analysis, we assume borrowers have to form groups of two (but our conclusions can be generalized for any group size).

Either because borrowers know well each other whithin a tightly knit village and due to repeated interactions or because they can signal each other's type by means of side payments, borrowers who are asked to form groups in order to access a loan will typically pair up with same types. Intuitively, this is because safe individuals who expect their project to be successful will want to avoid having to repay for defaulting peer as much as possible. In other words, pairing with risky individuals increases expected costs of borrowing, and it does increasingly so the safer the borrower.

Lemma 1 *Under joint liability, if borrowers have (or can get) some information about each others' risk type, we observe assortative matching at the group formation stage.*

Proof. Formally, given a debt contract (r^J, c), the expected utility of a household i who is paired with another household j is given by $U_{i,j} = p_i p_j (R_i K - r^J K) + p_i (1 - p_j)(R_i K - r^J K - cK) = p_i R_i K - (p_i r^J K + p_i cK(1 - p_j))$. Instead, pairing with a household k would give to household i the following net benefit: $U_{i,k} - U_{i,j} = p_i cK(1 - p_j) - p_i cK(1 - p_k) = p_i cK(p_k - p_j)$, which is positive iff $p_k > p_j$, i.e. if the second household is safer. That is, any household always prefers pairing with safer households. In addition, the safer the household (the higher p_i), the more it values pairing with safer households (and the higher the compensation it will be ready to pay for that if side payments are allowed). As a consequence, homogenous groups represent the only stable outcome of the pairing

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[7]Note that joint liability can be an equilibrium only in the presence of information asymmetries. Under perfect information, the first-best choice for lenders is to award borrowers type-specific, individual-liability contracts. Indeed, in a competitive market, the added expected costs of joint liability outweigh the expected gains from lower interest rates for borrowers (see Van Tassel 1999 for a formal proof).

game.[8] ∎

Given lemma 1, lenders face homogenous groups (S,S) and (R,R) with probability π and $(1 - \pi)$ respectively, so that the ZPC writes:

$$[p_s Kr + (1 - p_s)p_s Kc]\, \pi + [p_r Kr + (1 - p_r)p_r Kc]\, (1 - \pi) = A + \gamma K \qquad (5)$$

where $c > 0$ is the per-unit indemnisation that a successful group member has to pay if her mate cannot repay her loan.[9] We impose the constraint that the amount of joint liability is never greater than the amount of individual liability, s.t. the contract is credible:[10]

$$c \leq r^J. \qquad (6)$$

At a pooling equilibrium, the interest rate is:

$$r^{J,P} = \frac{\gamma + \frac{A}{K}}{\bar{p}} - \frac{c}{\bar{p}}(\bar{p} - \pi p_s^2 - (1 - \pi)p_r^2) > 1 \qquad (7)$$

(where the upperscript J stands for joint lending), and (6) rewrites

$$c \leq \frac{\gamma + \frac{A}{K}}{2\bar{p} - \pi p_s^2 - (1 - \pi)p_r^2} < \gamma + \frac{A}{K}.$$

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[8]This proof follows closely Ghatak (1999). Note that Sadoulet (1999) and Guttman (2008) show that this property does not necessarily hold if borrowers are denied future access to credit in case of group's default (dynamic framework) and if side payments are possible.

[9]In practice, there are differences in the way how MFIs enforce joint liability contracts. Sometimes, they require the group to pay a fixed penalty in case of one member's default. In this case, the interpretation of c is litteral. However, the form of joint liability for defaults in actual group-lending programmes often takes the form of denying future credit to all group members in case of default by one member, until the loan is repaid. Usually, the defaulting members pay back their obligations to other group members (Huppi and Feder 1990), but with a delay. In our static framework, the term c can then be interpreted as the net present discounted value of the cost of sacrificing consumption during the 'grace period' in order to pay joint liability for a partner. Note that this cost exists precisely because of the credit market imperfection (Gangopadhyay et al. 2005).

[10]Taking an amount of joint liability lower than the amount of individual liability seems to make sense, in order to avoid e.g. that successful partners of failing borrowers prefer to declare their partner to be successful. Moreover, this seems to be in line with what group-lending programmes do in practice. Note that, since in our model project outcomes are perfectly observable, such a constraint is not strictly needed (under similar conditions, Ghatak 2000 finds that the optimal joint liability contract displays the curious feature that $c > r^J$). Nevertheless, if the justification of this informational environment uses a costly state verification argument, the constraint that $c \leq r^J$ is actually needed (see Gangopadhyay et al. 2005).

As is obvious from (7), the joint liability technology allows a reduction in interest rate because it decreases the probability for the lender not to be reimbursed ('insurance effect'). At a separating equilibrium, MFI de facto faces homogenous groups (of risky individuals), and the break-even interest rate is

$$r^{J,S} = \frac{\gamma + \frac{A}{K(1-\pi)}}{p_r} - (1 - p_r)c > 1 \tag{8}$$

Again, it is easy to see that this rate is lower than in the individual-lending case.[11]

Using lemma 1, expected utility of borrowers at a pooling equilibrium now becomes:

$$U_i^{J,P} = p_i K (R_i - r^{J,P} - (1 - p_i)c) = \bar{R}K - \frac{p_i}{\bar{p}}(\gamma K + A) + cK\frac{p_i}{\bar{p}}(\bar{p}p_i - \pi p_s^2 - (1 - \pi)p_r^2)$$

Proposition 2 *For joint-liability loans with assortative matching, $r_s^{J,\max} = \frac{p_s K R_s - p_s(1 - p_s)cK - \bar{u}}{p_s K}$ represents the maximum rates satysfying the participation constraint of safe borrowers. We have that:*

1. *if $r^{J,P} \leq r_s^{J,\max}$, all would-be borrowers apply and the market settles at a pooling equilibrium at rate $r^{J,P}$*

2. *if $r^{J,P} > r_s^{J,\max}$, only risky borrowers apply and the market settles at a separating equilibrium at rate $r^{J,S}$.*

Proof. The first thing to note is that the utility of risky borrowers is still unambiguously higher than for safe individuals: $U_r^{J,P} - U_s^{J,P} = (p_r - p_s)\left(cK(p_s + p_r) - \frac{cK(\pi p_s^2 + (1 - \pi)p_r^2 + \gamma K + A)}{\bar{p}}\right) > 0$ (given (6)). That is, a separating equilibrium will still involve risky individuals only. It will happen if $U_s^{J,P} = \bar{R}K - \frac{p_s}{\bar{p}}(\gamma K + A) + cK\frac{p_s}{\bar{p}}(\bar{p}p_s - \pi p_s^2 - (1 - \pi)p_r^2) < \bar{u} \iff \frac{p_s}{\bar{p}}(\gamma K + A - cK(1 - \pi)p_r(p_s - p_r) > \bar{R}K - \bar{u}$. That is, the range of parameters which gives rise to pooling equilibria increases, and adverse selection becomes less likely. This is because the group-lending technology allows to (imperfectly) discriminate between borrowers. Although the explicit rate is the same

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[11]However, because joint liability payments are always bigger in a separating equilibrium than in a pooling equilibrium, $r^{J,S}$ is not necessarily greater than $r^{J,P}$ (depending on the size of c).

for every borrower in the market, MFI can implicitly charge a lower interest rate to safe borrowers and a higher interest rate to risky borrowers. This comes from the fact that, when borrowing in homogenous groups, safe borrowers do not have to cross-subsidize risky borrowers anymore. Finally, the utility of risky borrowers at a separating equilibrium is: $U_r^{J,S} = \bar{R}K - \gamma K - \frac{A}{1-\pi} > \bar{u}$ (given EC), s.t. risky borrowers always apply. ∎

Lemma 2 *Safe borrowers always prefer borrowing in groups (from MFI). In pooling equilibria, risky borrowers always prefer borrowing individually (from traditional moneylenders), whereas their preference depends on the parameters in separating equilibria.*

Proof. We distinguish 3 cases.

1. If $\bar{R}K - \bar{u} \geq \frac{p_s}{\bar{p}}(\gamma K + A)$, we have pooling equilibria both with group lending and individual lending. In this case, we have that $U_s^{J,P} > U_s^{I,P}$ iff $\bar{R}K - \frac{p_s}{\bar{p}}(\gamma K + A) + cK\frac{p_s}{\bar{p}}(\bar{p}p_s - \pi p_s^2 - (1-\pi)p_r^2) > \bar{R}K - \frac{p_s}{\bar{p}}(\gamma K + A) \iff cK\frac{p_s}{\bar{p}}(1-\pi)p_r(p_s - p_r) > 0$, which is always satisfied. Conversely, we have that $U_r^{J,P} < U_r^{I,P}$ iff $\bar{R}K - \frac{p_r}{\bar{p}}(\gamma K + A) + cK\frac{p_r}{\bar{p}}(\bar{p}p_r - \pi p_s^2 - (1-\pi)p_r^2) < \bar{R}K - \frac{p_r}{\bar{p}}(\gamma K + A) \iff cK\frac{p_r}{\bar{p}}\pi p_s(p_r - p_s) < 0$, which is always the case (whatever the specific contract terms $(r^{J,P}, c)$).

2. If $\frac{p_s}{\bar{p}}K(\frac{A}{K} + \gamma - c(1-\pi)p_r(p_s - p_r)) \leq \bar{R}K - \bar{u} < \frac{p_s}{\bar{p}}(\gamma K + A)$, a pooling equilibrium is feasible under group lending but not under individual lending. In that case, safe borrowers are obviously better off borrowing at MFI. As for risky borrowers, we have that $U_r^{J,P} > U_r^{I,S}$ iff $\bar{R}K - \frac{p_r}{\bar{p}}(\gamma K + A) + cK\frac{p_r}{\bar{p}}(\bar{p}p_r - \pi p_s^2 - (1-\pi)p_r^2) > \bar{R}K - \gamma K - \frac{A}{1-\pi} \iff \gamma K + \frac{A}{1-\pi} - (\gamma K + A)\frac{p_r}{\bar{p}} - cK\frac{p_r}{\bar{p}}\pi p_s(p_s - p_r) > 0$. Hence whether risky borrowers will prefer group lending over individual lending depends on the parameters: they have to trade-off lower interest rate with extra expected payments in case of default of the partner. Although the normal case is the contrary (using 'normal' parameters), risky borrowers could favour group lending if the joint liability component c is low (i.e. if the two lending technologies are actually quite similar).

3. Finally, if $\bar{R}K - \bar{u} < \frac{p_s}{\bar{p}} K(\frac{A}{K} + \gamma - c(1-\pi)p_r(p_s - p_r))$, we have a separating equilibrium even under group lending, and the lower interest rate is exactly compensated by the expected extra joint liability payments for risky borrowers: $U_r^{J,S} = U_r^{I,S} = \bar{R}K - \gamma K - \frac{A}{1-\pi}$, such that borrowers are indifferent.

∎

Using lemma 2 , we can conclude that group lending represents an improvement with respect to individual lending, but affects the welfare of borrowers differently.[12]

Conclusion 3 *For given lending costs, group lending with assortative matching limits credit rationing, attracting back safe borrowers in the market (as compared to individual lending). As compared to individual lending, group lending increases the efficiency of the market and the repayment rates. Welfare of safe borrowers is unambiguously higher whereas welfare of risky borrowers is lower in the region of parameters of pooling individual contracts. In the region of parameters of separating individual contracts, the welfare of risky borrowers will depend on the trade-off between interest rate and joint liability (though typically lower than under individual lending).*

Finally, note that, if the MFI can offer different contract terms, group lending can allow to screen borrowers since safer individuals will prefer a high degree of joint liability together with a lower interest rate, while riskier individuals will prefer a low degree of joint liability (at the price of a high interest rate). In these conditions, a lender could theoretically ensure that only safe households will accept borrowing at equilibrium (see Van Tassel 1999 or Ghatak 2000). However, it is very rare to observe MFIs proposing many different contract terms in the real world (Armendáriz de Aghion and Morduch 2005, Casini 2008, Demont 2009).

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[12]In the special case in which potential borrowers don't know each other and cannot get any information on the others' risk characteristics, groups are formed randomly and group lending does not offer any improvement upon individual lending. Indeed, using our model, it is easy to show that lower interest charges are then exactly compensated by expected joint liability payments (see also Laffont and N'Guessan 1999). However, this conclusion might not hold in the presence of correlation between entrepreneurs' returns (see Laffont 2000).

6 Putting everything together: equilibria in mixed market

Imagine the following situation. In a given geographical area, capital-constrained households have the opportunity to take up individual loans from traditional moneylenders or to participate in group loans organized by an MFI. Or, to state it differently, what happens when a MFI enters a competitive rural credit market? In this situation, who is prefering what, and what will be the consequence on the credit market and its implication for the welfare of the different types of borrowers? As indicates the conclusion of the previous section, the MFI's impact will depend on the initial situation that prevails in the traditional market.

If a separating equilibrium exists in the initial market with moneylenders only, the MFI can serve the unserved safe investors, thus solving the credit rationing and increasing efficiency (and improving overall repayment rates). In addition, if the MFI offers a pooling contract, it can also attract risky borrowers away from moneylenders (possibly pushing moneylenders out of business) and serve the entire market at rate $r^{J,P}$. In this case, since it increases all borrowers' utility, MFI increases welfare in the Pareto sense. If the MFI does not attract risky borrowers ('normal' parameter values), it has no impact on the residual market since the two lenders operate on different segments (note that, if it attracts only safe borrowers, the zero-profit MFI will decrease its rate to $r = \frac{\gamma + \frac{A}{\pi K}}{p_s} - (1 - p_s)c)$. Again, in this case, the MFI increases welfare in the Pareto sense. Finally, if capital costs are so high that the MFI cannot offer a pooling equilibrium either, it will share the population of risky borrowers with moneylenders, and has no effect on efficiency nor welfare.

If a pooling equilibrium exists initially on the market of individual loans, the apparition of an institution operating a group lending scheme will break it: safe borrowers will leave traditional lenders to form groups and get cheaper credit from MFI. In this case, a new separating equilibrium arises on the traditional market. Moneylenders, perceiving that their pool of borrowers is riskier, will increase interest rate to $r^{I,S} = \frac{\gamma + \frac{A}{K(1-\pi)}}{p_r}$, thus decreasing the welfare of the risky households who still have to rely on them. We are then

back in the first case described above: MFI can attract or not risky individuals, leading respectively to the eviction of moneylenders or to the segmentation of the market. Yet, in neither of those two cases does MFI increases welfare in a Pareto sense (with respect to the situation prior its entry).

Table 1 summarizes the borrowers' decisions and the impact of the MFI's entry in the credit market. An illustration is given in appendix.

Table 1: equilibria on mixed markets

IL \MFI	separating contract	pooling contract
separating contract	clients: $(\frac{R}{2}, \frac{R}{2})$ impact: 0	clients: $(R?, S + R?)$ impact: Δ^+ efficiency and welfare
pooling contract	impossible	clients: $(R?, S + R?)$ impact: Δ^+ interest rate

Conclusion 4 *If individual lenders ration credit (adverse selection), the apparition of a group lender in the market limits credit rationing by decreasing the cost of capital to safe borrowers. The efficiency of the market increases, as well as the welfare of borrowers. If individual lenders serve all borrowers, the apparition of a group lender in the market raises the equilibrium interest rate of the residual market by selecting away the good risks. Market efficiency is not affected in this case, but the welfare of borrowers who have to borrow individually decreases.*

7 Market power

In this section, we relax one of the major assumptions of the previous analysis, namely that moneylenders operate in a competitive market (or follow a zero-profit rule). We then answer to the same question as before regarding the consequence of the apparition of a group-lending institution (MFI) in the market. We first present the individual decision problem of a monopoly lender (ML), and then analyze the competition of a not-for-profit MFI.

Henceforth, we assume the following tie-breaking rule: when borrowers are indifferent between supplying their labour externally and carrying out their own investment, they choose the second option.

7.1 Individual lending under monopoly

The moneylender maximizes profit:

$$\max_r \Pi = D(r)p(r)r - A - \gamma D(r) \text{ s.t. } \Pi \geq 0 \tag{9}$$

where

$$D(r) = \begin{cases} K & \text{if } r \leq r_s^{I,\max} \\ (1-\pi)K & \text{if } r \leq r_r^{I,\max} \\ 0 & \text{if } r > r_r^{I,\max} \end{cases}$$

is the (non linear) demand function and

$$p(r) = \begin{cases} \bar{p} & \text{if } r \leq r_s^{I,\max} \\ p_r & \text{if } r \leq r_r^{I,\max} \\ 0 & \text{if } r > r_r^{I,\max} \end{cases}$$

Facing this problem, the moneylender has two possible strategies: either to offer a contract that is accepted by risky households only (regime 1) or to offer a contract that is accepted by both types of entrepreneurs (regime 2) - not supplying anything can never be profit maximizing given the efficiency assumption.

If it serves only risky (regime 1), then it is optimal to set r s.t. $p_r(R_r K - rK) = \bar{u}$, which leads to the equilibrium interest rate $r_r^{I,\max} = \frac{\bar{R}K - \bar{u}}{p_r K}$ and a profit equal to $\Pi^{M,1} = (1-\pi)\left[\bar{R}K - \bar{u} - \gamma K\right] - A$ (which is always positive given EC). Whereas if it serves both types of households (regime 2), it is optimal to set $r_s^{I,\max} = \frac{\bar{R}K - \bar{u}}{p_s K}$, yielding a lender's profit of $\frac{\bar{p}}{p_s}(\bar{R}K - \bar{u}) - \gamma K - A$ (which can be negative).

Whether the first strategy yields a higher profit or not depends on the relative size of the two type populations and the cost structure. We derive the following proposition:

Proposition 3 *If $\pi \gamma K > (\bar{R}K - \bar{u})(\frac{\bar{p}}{p_s} - 1 + \pi)$, regime 1 holds and the moneylender offers a separating contract at the interest rate $r_r^{I,\max} = \frac{\bar{R}K - \bar{u}}{p_r K}$.*

If $\pi \gamma K < (\bar{R}K - \bar{u})(\frac{\bar{p}}{p_s} - 1 + \pi)$, regime 2 holds and the moneylender offers a pooling contract at the interest rate $r_s^{I,\max} = \frac{\bar{R}K - \bar{u}}{p_s K}$.

Proof. We have that regime 1 yields a higher profit than regime 2 if $(1 - \pi)(\bar{R}K - \bar{u} - \gamma K) - A > \frac{\bar{p}}{p_s}(\bar{R}K - \bar{u}) - \gamma K - A \iff (\bar{R}K - \bar{u})(1 - \pi - \frac{\bar{p}}{p_s}) + \pi \gamma K > 0.$ ∎

We check that if the variable component of the cost of capital and the proportion of risky borrowers in the population increase, a separating equilibrium is more likely to happen. Also, the success probabilities influence the condition: if the relative success probability of risky individuals increases (meaning that both types become more equal), so does the likelihood of a pooling equilibrium. Finally, recalling the results of section 4, a monopolist chooses to ration credit more than competitive moneylender would do iff $\pi \gamma K + (\bar{R}K - \bar{u})(1 - \pi) > \gamma K + A$, which happens if the expected return to investment is relatively large (s.t. the credit supply of competitive moneylenders is large).

Under regime 1, utility of all borrowers is equal to $\bar{u}$. In the pooling equilibrium (regime 2), the utility of borrowers is given by

$$p_i K (R_i - \frac{\bar{R}K - \bar{u}}{p_s K}) \tag{10}$$

such that the moneylender extracts all surplus from safe borrowers ($U_s^{I,2} = \bar{u}$) and leaves a positive surplus to risky borrowers ($U_r^{I,2} = \bar{R}K - p_r \frac{\bar{R}K - \bar{u}}{p_s} > \bar{u}$).

7.2 Equilibrium in mixed markets: competition monopolistic moneylender vs. not-for-profit MFI

If a lender who uses the group-lending technology such as described in section 5 is present in the market, ML now has to leave borrowers at least the utility they get when they borrow at MFI if it wants to retain some clients. Thus, the demand function and repayment probabilities accross regimes are the same as before, but the thresholds for the different regimes are changing. From the preceding discussion, it is clear that regime 2

is not an option anymore for ML, since safe borrowers always prefer borrowing in groups than individually (even if the lender makes zero profit). The maximum rate that ML can charge in regime 1 depends on the nature of the equilibrium in the group loans market. If the participation condition

$$\bar{R}K - \bar{u} \geq \frac{p_s}{\bar{p}}K(\frac{A}{K} + \gamma - c(1-\pi)p_r(p_s - p_r)) \tag{11}$$

is not satisfied, safe borrowers are excluded (see proposition 2) and MFI charges $r^{AM,S}$. ML then has to set an interest rate such that

$$U_r^I \geq U_r^{AM,S} \iff \bar{R}K - p_r r K \geq \bar{R}K - \frac{A}{1-\pi} - \gamma K \iff r_S^{ML,max} = \frac{\frac{A}{1-\pi} + \gamma K}{p_r K}.$$

By contrast, if (11) is satisfied, MFI offers a pooling equilibrium and ML has to ensure that

$$U_r^I \geq U_r^{AM,P} \iff \bar{R}K - p_r r K \geq \bar{R}K - \frac{p_r}{\bar{p}}(A + \gamma K) + cK\frac{p_r}{\bar{p}}(\bar{p}p_r - \pi p_s^2 - (1-\pi)p_r^2) > \bar{u}$$

$$\iff r_P^{ML,max} = \frac{\gamma + \frac{A}{K}}{\bar{p}} - \frac{c}{\bar{p}}(\bar{p}p_r - \pi p_s^2 - (1-\pi)p_r^2).$$

Note that $r_r^{I,max} > r_P^{ML,max} > r^{AM,P}$, which indicates that (i) ML can take some surplus away from risky borrowers but not all, and (ii) risky will always accept this contract.

The following table summarizes the profit of the moneylender in the different cases:

Table 2: Profit of ML in mixed market

condition (11)	regime 1	regime 2
KO	$\Pi = (\frac{A}{(1-\pi)K} + \gamma)(1-\pi)K - \gamma(1-\pi)K - A = 0$	$\Pi < 0$
OK	$\Pi = (1-\pi)\gamma K(\frac{p_r}{\bar{p}} - 1) + A((1-\pi)\frac{p_r}{\bar{p}} - 1)$	$\Pi < 0$

Clearly, regime 1 is a dominant strategy for ML. Moreover, the presence of MFI in the market forces it to cut profit. Whether it will still be able to make some depends on the situation of the MFI's market (which in turn is determined by the parameters of

capital cost, joint liability and risk heterogeneity among the population). If MFI serves risky borrowers, the two lenders are competing for exactly the same pool of borrowers, which drives the profit to zero (competition à la Bertrand with perfect substitutability). However, the market is inefficient since safe borrowers are credit-constrained. If MFI offers a pooling contract, then ML can attract risky borrowers and make some positive profit (although this is not guaranteed). The level of profit depends on the importance of joint liability in the MFI's contract. The higher c, the more different from each other are the two lenders, the higher interest rate ML can charge and the higher profit it can reach. To the contrary, if c is low, the competition between the two lenders increases and ML's profit decreases (and eventually becomes negative at $cK = \frac{\gamma K}{p_s p_r} + A \frac{p_s}{p_r(1-\pi)(p_s-p_r)}$ - where ML exits the market).[13]

Conclusion 5 *When facing the competition of a (not-for-profit) lender using group lending, a profit-maximizing moneylender has no choice but to focus on risky borrowers. This means that, if it was serving all borrowers initially (regime 2), the interest rate on individual loans will increase (selection effect). Indeed, since its pool of borrowers becomes riskier, the monopolist can charge a higher interest rate (though making a lower profit). Conversely, if the moneylender was optimally adopting a separating equilibrium prior to MFI's entry (regime 1), the latter will force a cut in the interest rate (competition effect). Whether the first effect dominates the second depends on the importance of joint liability in the MFI's contract and on the heterogeneity among risk types.*

Proof. When ML is alone in the market, if parameters are such that MFI would offer a separating contract, then ML optimally chooses regime 1 for sure, whereas it can choose both regimes when MFI would serve all borrowers. As we have seen before, ML is more likely to choose regime 2 the more homogenous are the risk types in the population. Also, in the mixed market, ML's interest rate will be higher the higher the joint liability rate that is charged by MFI. Also see the illustration in appendix. ∎

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[13]This is naturally linked with the decision of risky borrowers in mixed markets that we explained in section **??**. If $U_r^{AM,P} < U_r^{I,S}$ (normal case - see conditions in section 5), then ML can serve risky borrowers while making some profit. It is obviously impossible if $U_r^{AM,P} > U_r^{I,S}$.

Finally, note that if there is limited financing capacity of MFI (meaning that it can only serve a proportion α of the market), it is even more likely to observe an increase in the interest rate. Indeed, according to the level of α, ML can find it profitable to charge the maximum interest rate given that it will anyway retain the share of risky borrowers who cannot get access to MFI. This being said, if $\alpha < \pi$, meaning that MFI cannot serve all safe borrowers, it could also be that regime 2 would still be the best option for ML, in which case there wouldn't be any rate increase.

8   Conclusion

There is no doubt that microfinance has managed expanding access to finance in poor areas worldwide. One of the distinctive feature that allowed this success is the practice of group lending, which is to be found in most microfinance programmes (such as, to name only the most famous, the Grameen Bank in Bangladesh, BancoSol in Bolivia, FINCA in Peru, NABARD in India or Bank Kredit Desa in Indonesia). However, while focusing on direct stakeholders, the existing literature has not yet touched the redistributive question of the microfinance revolution. Given that MFIs will never be able to serve all borrowers, it is important to analyse how they modify equilibria on residual markets and how they affect the welfare of non participants. It is indeed not clear that MFIs can be welfare-improving for all borrowers. In fact, field observations as the ones presented in section 2 often indicate that traditional lenders charge higher interest rates when MFIs are present in the same market. This work is thus a contribution to the issue.

We used an adverse selection model with moneylenders supplying individual loans and MFIs operating joint liability schemes, in the presence of fixed costs. In the standard version of the model, lenders are in a competitive environment and make zero profit. In this case, it was shown that, if there is assortative matching at the group formation stage, group lending institutions considerably modify the market. Since they increase utility of safe borrowers, MFIs typically increase efficiency by attracting safe borrowers back to the market. Yet, safe borrowers who borrowed from moneylenders will switch to MFI

upon its opening, leading to an increase in the riskiness of the pool of borrowers. As a consequence, traditional lenders will have to raise the interest rate of the residual market in order to avoid making losses in expected terms.

When lenders have market power, they can choose to serve all borrowers or only risky ones, depending on which strategy gives them the most profit. Once a group-lending institution settles in the market, only the separating regime is feasible for the moneylender. As a result, depending on the choice that the moneylender was making in the monopoly situation, the impact of MFI can be to force the moneylender to cut its interest rate (competition effect) or, once again, to increase the interest rate on the residual market (selection effect). We showed that the second effect is likely to dominate the former if the joint liability payments asked by the MFI are high (i.e. the two lending technologies are well-differentiated) and if the risk heterogeneity in the population is not too high (leading the monopolist to serve all risk types at the first place).

Therefore, our model predicts that, in a real world setting with a continuum of risk types, the likely effect of the development of microlenders under group-lending schemes is indeed to relax the credit constraint on relatively safe individuals (which is the classical effect emphasized in the literature), but also potentially to raise the interest rate of the residual market. The second effect will in fact arise if moneylenders have limited market power (such that the competition effect is weak) or if they optimally choose to serve relatively safe borrowers in a monopoly situation (such that the quality of the pool of borrowers is decreased). This means that poor borrowers who cannot access MFI (e.g. because they are too safe or to the contrary because there are perceived as too risky by their fellows, because they are lacking social connections set up a group, or simply because MFIs cannot supply the entire market) might well be hurt be the apparition of the same MFI.

This neglected potential impact of microfinance is of big importance given the very high interest rate that are often reported in rural credit markets and deserves serious empirical attention in the future. In any case, the small evidence presented at the beginning of this paper confirms that the mechanisms of our model are likely to be observed on the

field. Further research could explore moral hazard issues by assuming imperfect monitoring of the lenders. Other studies have showed that group lending can also attenuate moral hazard (e.g. Banerjee et al. 1994, Ghatak and Guinnane 1999). Therefore, there are good reasons to expect similar results : the quality of the pool of borrowers in the residual market worsens, leading to interest rate increases in order to cover anticipated losses. In this context, one could as well think about enforcement externalities between competing institutions (see Hoff and Stiglitz 1997). Also, one could want to switch to a dynamic framework, which could affect the nature of group formation. Finally, other competition frameworks could be envisaged, such as the competition between competitive moneylenders and a for-profit MFI (as this is a much-debated recent evolution of microcredit).

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A Some facts about interest rates in traditional credit markets

Figure 1: Average interest rates charged by traditional lenders, by number of SHGs in the village: self report from respondents
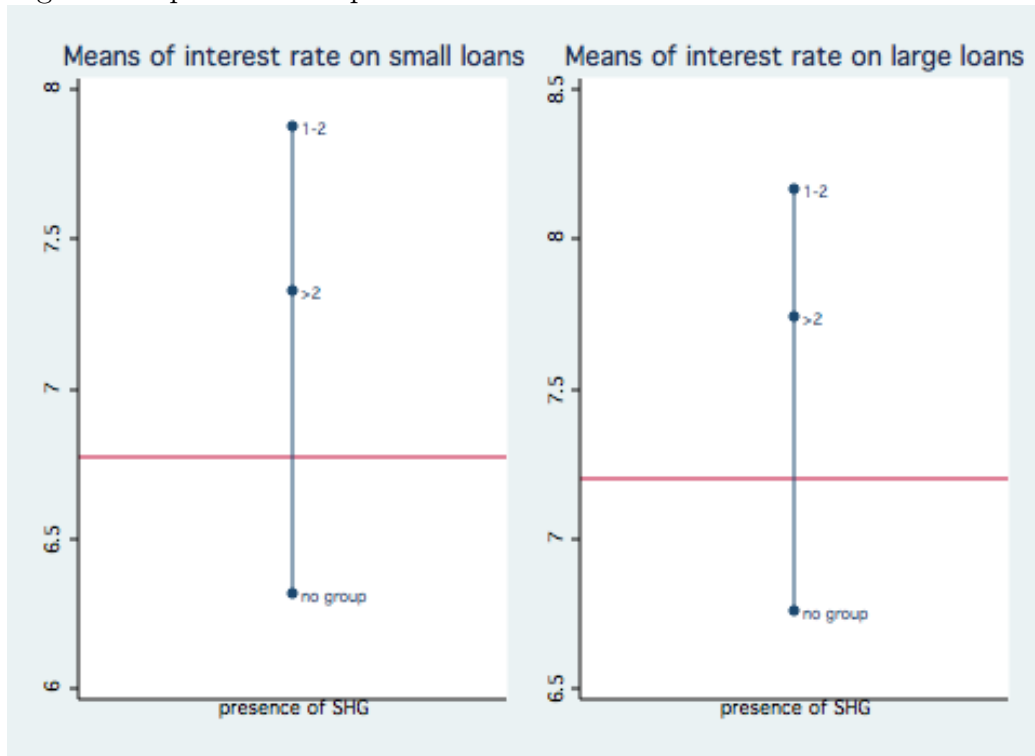
Notes: SHG data are actual groups currently functioning (and surveyed) in each village. Small loans are loans of several hundreds Rs. and less, big loans are loans of thousand Rs. and above. Number of observations for each category: no SHG in village 511 loans, 1 or 2 SHGs 90 loans and more than 2 SHGs 261 loans. Data are from Baland et al. (2008).

Figure 2: Average interest rates charged by traditional lenders, by number of SHGs in the village: actual debt contracts
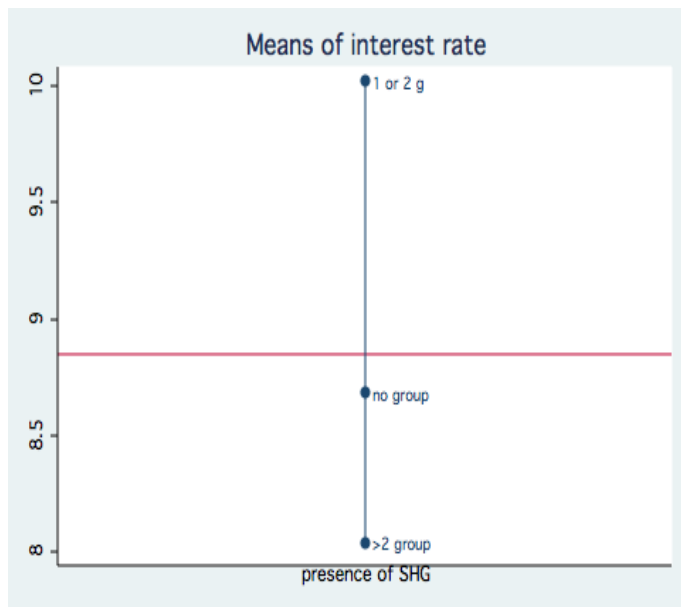
Notes: SHG data are actual groups currently functioning (and surveyed) in each village. Number of observations for each category: no SHG in village 155 loans, 1 or 2 SHGs 70 loans and more than 2 SHGs 333 loans. Data are from a survey carried out by the author and others.

B Summary: simulation

Figure 3: Interest rates across regimes and compositions of pool of borrowers
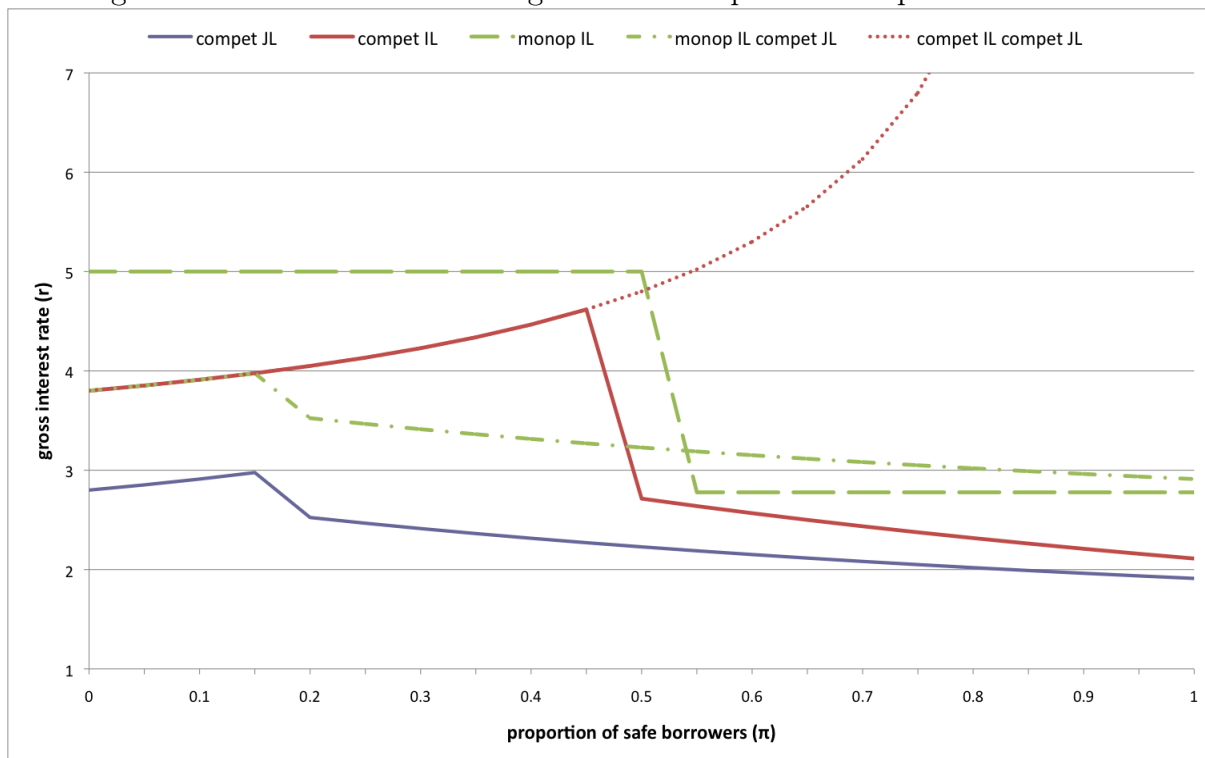
The figure presents a simulation with the following parameter values: $\gamma = 1.4, A = 0.5, K = 1, p_s = 0.9, p_r = 0.5$, and a varying proportion of safe borrowers in the population. It summarizes the major findings of our model. The two solid lines represent the benchmark perfect-competition situation of sections 4 and 5. The first part of the curves (with high interest rate and positive slope) is the separating-equilibrium region, while the second part (with low interest rate and negative slope) is the pooling-equilibrium zone. One can see easily that group lending allows both a reduction in the interest rate and an increase in the likelihood of a pooling equilibrium (the non-zero slopes reflect the presence of fixed costs). In mixed markets, traditional lenders can lend to risky individuals only (across the whole distribution of parameters, see the dotted line). The two dashed lines represent the market-power case (section 7). The monopolist increases the interest rate and the credit rationing (the flat curve reflects the full rent-appropriation by the monopolist). When it faces the competition of the MFI, it has to decrease its interest rate in order to retain risky clients (competition effect). In the region in which MFI serves only risky borrowers (leftwards), the monopolist is forced to make zero profit, while in the pooling-equilibrium region, the monopolist starts by making losses and then eventually can serve risky borrowers while still making some positive profit (in the second half of the distribution). We also see that, if the monopolist was serving all borrowers prior to MFI's entry (regime 2), the presence of the latter actually leads to an increase in the interest rate of the former (selection effect).