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A theory of interactions between MFIs and informal lenders

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ABSTRACT

We provide a theoretical analysis of effects of entry of a microfinance institution (MFI) into an informal credit market which is segmented, whereby informal lenders derive some market power owing to privileged information concerning borrower-specific default risks. Relative to informal lenders, the MFI has a cost advantage and an informational disadvantage regarding borrower risk. Borrowers differ along another dimension: landholding, which is observable to all lenders. MFI entry is shown to induce selection effects (across risk and landownership dimensions) in shifts of borrowers from informal lenders to the MFI, which could raise informal interest rates, as observed in many LDCs. The model is consistent with evidence from Bangladesh and West Bengal, in contrast to hypotheses based on cream-skimming, scale-diseconomy-inducing, collusion-facilitating or crowding-in effects of MFIs on informal credit. The model implies that MFI entry is Pareto improving for borrowers, irrespective of effects on informal interest rates.

1. Introduction

The ability of microfinance to deliver on its promise of alleviating poverty has recently been questioned. Experimental evaluations have found limited impacts on asset ownership and consumption (Karlan and Mullainathan, 2010; Banerjee et al., 2011; Karlan and Zinman, 2011; Desai et al., 2011). An added concern pertains to negative spillovers on borrowers not served by microfinance institutions (MFIs), arising from adverse impacts on interest rates on informal credit markets. Originally designed to rescue poor households from 'the clutches' of moneylenders, microfinance was expected to reduce the interest rate in informal credit markets. The failure of large infusions of credit from formal financial institutions between the 1960s and 1990s to reduce informal interest rates in many developing countries has been noted by a number of authors (Hoff and Stiglitz, 1990, 1998; Von Pischke, Adams, and Donald, 1983). Recent studies in the context of Bangladesh (Mallick, 2012; Berg et al., 2013) have provided detailed evidence that growth of microfinance resulted in a significant increase in informal interest rates.

A number of possible explanations for this phenomenon have been advanced in the literature:

(a) *Scale Diseconomies*: competition from MFIs may lead to loss of economies of scale for informal lenders, as fixed costs have to be spread over a smaller volume of lending, causing screening and monitoring costs to rise (Hoff and Stiglitz, 1998; Jain, 1999);
(b) *Cream-skimming*: MFIs may cream-skim low risk borrowers, leaving high risk borrowers to be served by informal lenders (Bose, 1998; Demont, 2012);
(c) *Collusion*: as formal credit is often channeled through informal lenders, the increased volume of credit available on the informal market can facilitate collusion among lenders (Floro and Ray, 1997);
(d) *Crowding in*: inflexible and frequent repayment requirements of MFI loans induce increased borrowings from informal lenders, raising demand on the informal market (Jain and Mansuri, 2003); non-exclusive contracting combined with moral hazard can result in higher informal borrowing and higher default risk (Kahn and Mookherjee, 1998; McIntosh and Wydick, 2005).

However, these theories turn out to be inconsistent with other empirical findings from the same contexts where a rise in informal interest rates has been observed consequent on MFI entry. Berg et al. (2013) find that increased borrowing from MFIs in Bangladesh was accompanied by reduced borrowing from informal lenders.[1] This finding is not consistent with the 'crowding in' hypothesis. In a recent experimental study of effects of MFI lending in the neighboring state of West Bengal, Maitra et al. (2014) found that borrowers applying for joint liability

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[1] Maitra et al (2014) also find no significant effect of MFI entry on borrowing from informal sources in the neighboring state of West Bengal.

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loans offered by an MFI were paying interest rates for informal loans that were above the average interest rate in the village corresponding to their landholding class. This directly contradicts the 'cream-skimming' hypothesis. Finally, the 'scale diseconomies' and 'collusion' hypotheses do not account for the higher interest rates observed consequent on MFI entry: Mallick (2012) finds that the effects of increased MFI penetration on informal interest rates in Bangladesh are robust to inclusion of controls for scale economies, competition among lenders and costs of information collection of lenders.

This paper provides an alternative model of interaction between MFIs and informal lenders. Similar to the theories discussed above, we assume that the credit market is subject to asymmetric information, where external lenders such as MFIs are less informed than local moneylenders regarding the risk type of borrowers.[2] The crucial departure with respect to the literature is the assumption that borrowers differ (orthogonally from risk type) on a second observable dimension: landholding.[3] Including this dimension is particularly important because it allows us to show that by offering joint liability loans, MFIs create selection effects across risk and landownership dimensions which could raise informal interest rates. Our model offers an explanation of this phenomenon, while being consistent with the empirical findings listed above for the contexts of Bangladesh and West Bengal.

An important aspect of our model is that the informal credit market is segmented, thereby providing informal lenders with some market power. In one form or another, the assumption of segmentation has been made in many theoretical treatments of informal credit markets in LDCs (Besley, 1994; Conning and Udry, 2007; Mishra, 1994; Bardhan and Udry, 1999; Basu, 1997) and is consistent with empirical evidence (Hoff and Stiglitz, 1990; Yadav et al., 1992; Bell et al., 1997).

In our model we assume that each segment has a privileged lender that knows the risk types of borrowers located in that segment, but not of borrowers located in other segments. This provides each informal lender an informational advantage with respect to other informal lenders or an MFI, enabling them to extract surplus from safe types. Prior to the arrival of an MFI, the equilibrium of this market involves Bertrand competition across all segments for high risk borrowers which results in an actuarially fair (high) interest rate for such borrowers. This co-exists with quasi-monopolistic behavior of lenders with respect to low risk borrowers within their own segment, owing to their privileged information of the latter's risk type. So informal lenders earn profits from lending to low risk types, while breaking even on high risk types. Informal interest rates for risky types therefore do not vary with landholdings of the borrower. For safe types they can vary with landholdings, while the direction of this relationship cannot be determined *a priori*, owing to opposing effects of higher borrower outside options (which lowers scope for lender extraction) and economies of scale (which raise surpluses that can potentially be extracted).

The MFI is a non-profit entity that seeks to maximize the welfare of borrowers, subject to a break-even constraint.[4] Informal lenders react to MFI entry and loan offers by altering the contracts they offer to borrowers. Lending contracts are exclusive, consistent with the findings of Berg et al. (2013). Hence MFI borrowing leads to crowding out of loans from informal lenders. Lacking access to privileged information concerning risk types of borrowers in any segment, an MFI is at an informational disadvantage *vis-a-vis* informal lenders. On the other hand, we assume it has access to capital at a lower cost. The entry of an MFI then results in competition with informal lenders in which both can co-exist. The MFI overcomes its informational disadvantage by offering joint liability loans which pool the two risk types.[5]

The MFI always succeeds in attracting all high risk borrowers, since it does not suffer from an informational disadvantage in serving this section of the population; its lower cost of capital implies that the interest rate offered to high risk types undercuts the rate at which they can borrow on the informal market. On the other hand, the MFI can attract safe borrowers only by offering joint liability loans. In the case where the MFI does not seek to cross-subsidize across landholdings, the MFI succeeds in lending only to those safe borrowers with enough land to shoulder the burden of joint liability. Therefore the only borrowers who continue to borrow from informal lenders are safe borrowers with low landholdings. This implies that MFI entry would increase the average informal interest rate, if the safe borrowers' informal interest rates decrease with landholding, and if the relative proportion of safe borrowers in the population is high enough.

On the other hand, if the MFI assigns a higher welfare weight to those with less land relative to those with more land, the MFI would induce the latter to cross-subsidize the former. The likelihood of MFI participation of the safe types could then be decreasing in landholdings. In this case, MFI entry would raise informal rates if the safe borrowers' informal interest rates conversely increase with landholding (provided again that the proportion of risky types is not too large).

These results extend to the case of a monopolistic informal lender (which corresponds to the limiting case where the entire village comprises a single segment), but not to the case of a perfectly competitive informal market (since interest rates do not vary with landholdings for either types in this case). Hence our results require the existence of some market power of informal lenders, which allow interest rates of safe types to vary with landholdings. Alternatively, in the perfect competition case one will need to extend the model to allow correlation between risk types and landholding so as to generate the required variation in interest rates to yield similar results.

While our model does not pin down informal interest rate or participation patterns, it is associated with a number of testable predictions. Controlling for landholding, risky types are more likely to switch to the MFI. In the context of West Bengal (Maitra et al., 2014), this prediction is verified: those who applied for group loans offered by an entering MFI paid informal rates about 3–4 percentage points above the village average rate. Second, if MFI entry raises informal interest rates, MFI participation rates and informal interest rates with respect to landholdings must slope in opposite directions. In the West Bengal context, Maitra et al. (2013) found that MFI participation rates were decreasing in landholdings, while informal interest rates were rising over a range of low landholdings (from zero to a half acre) which comprised the majority of the population.

Note that our explanation rests on the partial unobservability of landholding to the econometrician, while it is assumed to be perfectly observed by lenders. If landholding could be perfectly observed and controlled for, the effects of MFI entry on informal interest rates could not be positive. In other words, our theory rests on compositional changes in terms of landholding categories of borrowers that remain with informal lenders after an MFI enters, combined with variations in informal interest rates for safe types of such borrowers. We use the term 'landholding' as a proxy for borrower wealth or other characteristics that raise the borrower's outside options as well as productivity while performing the project. It is reasonable to suppose that lenders have access to detailed borrower characteristics pertaining to this broad notion of wealth or productivity, that are only imperfectly captured by actual measures of landholding used in empirical analyses, so it is not possible to perfectly control for 'landholdings'.

[2] In our model the notion of 'risk type' pertains to the intrinsic riskiness of the project financed by the loan. We conjecture that our results would continue to hold if risk was interpreted as likelihood that the borrower will be motivated to repay the loan when it is due. To this purpose, our model would need to be extended to the case where borrowers have varying time preferences, and safe borrowers are those that are more likely to repay under the threat of future penalties owing to lower impatience.

[3] The model assumes that landholding is perfectly observable to both informal lenders and the MFI, though not the econometrician. This is discussed further below.

[4] We conjecture similar results obtain when its objective is the size of its clientele rather than borrower welfare.

[5] It could alternatively provide safe types with a joint liability loan, while offering an individual liability loan to high-risk types. These allocations are payoff-equivalent in our model. In either case the safe types cross-subsidize the risky types.

Finally, our model is consistent with the general observation that informal lenders do not offer joint liability loans. The model explicitly allows both informal lenders and the MFI to offer (either or both) individual and joint liability loans, and shows that the former offer individual liability while the latter offer joint liability loans. The explanation is simple, resting on the informational disadvantage faced by MFIs which necessitates the use of joint liability as a screening device. Our model also explains why MFIs lend directly to borrowers, rather than indirectly by lending to informal lenders and expecting them to re-lend to final borrowers. This owes to the contrasting objectives of the MFI and informal lenders, and the ability of the MFI to expand credit options of poor borrowers which can lower the extent of surplus that can be extracted by local lenders.

Based on the empirical evidence that we are familiar with so far, our model performs better or at least as well as any of the principal hypotheses that have been advanced so far for the failure of MFI entry to lower informal interest rates. In light of this, the normative implications of our hypothesis are worth highlighting: MFI entry ends up always generating a weak Pareto improvement for borrowers, irrespective of parameter values. A strict Pareto improvement results for a nontrivial range of parameter values (*e.g.*, when the cost advantage of the MFI relative to informal lenders is large relative to their informational advantage). Even for borrowers not served by the MFI, the presence of the MFI can provide an outside option to the poor borrowers that effectively reduces the level of 'exploitation' by informal lenders (also previously noted by Besley et al. (2012)). The results of our model therefore indicate the need for caution in inferring negative spillovers from MFIs from evidence showing that they raise informal interest rates. Further research is needed to test and discriminate between competing models on the basis of empirical evidence before any inferences regarding welfare effects of MFI entry can be made.

In the next section we introduce the model. Section 3 serves as a prelude, where we study a market with only informal lenders operating in isolation. Section 4 then examines the implications of co-existence of an MFI and informal lenders. Section 5 explores how our results would change when the MFI lends directly to the informal lenders, when it cross-subsidizes across landholding classes and under alternative market structures. Section 6 concludes.

2. The model

All borrowers live in a village with a large population normalized to unity. Each borrower is endowed with a risky investment project. The project requires one unit of land (or other inputs) and one unit of capital. Borrowers lack sufficient personal wealth and need to borrow to launch the project.

The project can yield either a high or a low return; we refer to these outcomes as success (H) or failure (L). The outcome of a farmer's project will be denoted by the binary random variable $\bar{x}\in\{H,L\}$, which is observable and verifiable. The borrowers are characterized by (i) their (non-collateralizable) wealth $a \geq 0$, which also represents their outside option under autarky, and (ii) their unobservable probabilities of success p_i with $i \in \{r, s\}$ and $0 < p_r < p_s < 1$. We assume that these are independent of a, but it is easy to extend the analysis when this assumption is dropped.

Wealth takes the form of land or other inputs of production. Given that the project requires one unit of inputs, if $a < 1$ the borrowers need to lease in the remaining amount of inputs $(1 - a)$ required by the project. If a is land, leasing is on a sharecropping contract, where the borrowers retain a fraction of the output, the remaining going to the landlord.[6] Borrowers characterized by probability of success p_r and p_s are referred to as risky and safe borrowers respectively.

Risky and safe types exist in proportions θ and $(1 - \theta)$ in the population, where $\bar{p} \equiv \theta p_r + (1-\theta)p_s$. The proportion θ is independent of a. The outcomes of the project are independently distributed across borrowers. The return of a project of a borrower of type i is a random variable $\tilde{y}_i$, which takes two possible values: $Q_i(a)$ if successful, and 0 if not, where $Q_i(a) > 0$; $i = r, s$. Project returns are increasing in a. This reflects reduction in distortions associated with tenancy, ranging from inferior quality of leased in land to Marshallian undersupply of effort. To simplify the exposition, we assume $p_s Q_s(a) = p_r Q_r(a) \equiv \overline{Q}(a)$. Borrowers are risk-neutral and maximize expected returns. Note that each borrower is endowed with only one project, *i.e.*, borrows either from the MFI or the informal lender. Hence borrowing from the MFI will crowd out borrowing from the informal lender.

Loan contracts offered by informal lenders or the MFI are not collateralized and can involve either individual liability or joint liability. The former is a standard debt contract between a borrower and any lender with a fixed repayment R in state $\bar{x} = H$, and zero otherwise. The latter involves asking the borrowers to form groups of two, and offering an individual liability component R and a joint liability component C.[7] Owing to limited liability and the fact that lenders do not use collateral, a borrower does not repay if the project fails. If a borrower's project is successful then he is liable for his own repayment R in addition to C if his partner's project failed.

The cost of capital for the MFI is $\rho > 1$ which is lower than ρ^I, the capital cost for informal lenders. Each lender can offer as many loans as it likes in the village, as long as they break-even on average. All projects are socially productive in the sense that

$$p_i Q_i(a) > \rho^I + a \tag{1}$$

for all a and $i = \{r, s\}$. Informal lenders seek to maximize expected profit, while the MFI maximizes the welfare of borrowers (for some set of welfare weights across risk and land categories) subject to a breakeven constraint, as described further below. We assume the following tie-breaking rule: lenders offer individual liability loans if they earn the same expected profit with joint liability loans.

Since landholding a is observable, the market composed of borrowers with a given landholding a can be treated as an independent market. In what follows we focus on a given a, and suppress dependence of parameters on a.

The MFI cannot identify a borrower's risk type, while informal lenders know the risk type of borrowers in their own segment. Borrowers repay whenever they have the means to do so, *i.e.*, consistent with limited liability. Given the loan size is fixed, it is impossible for the MFI to screen different types using individual liability contracts. The only instrument controlled by the MFI would then be the interest rate, and both types would opt for the loan with the lowest interest rate. The same applies to the informal lenders when they deal with borrowers outside their segment for whom they have no information.

As Ghatak (2000) showed, it is possible for a lender to screen different types using joint liability loans and asking borrowers to form groups. Assuming that borrowers know each other's types, there is assortative matching: safe (resp. risky) borrowers pair up with safe (resp. risky) borrowers. The lender can induce self-selection between safe and risky groups, as described below.

Without loss of generality, each lender can offer a pair of contracts (R_{ra}, C_{ra}) and (R_{sa}, C_{sa}) designed for risky and safe groups of borrowers of landholding a. The expected payoff for a borrower of risk-type i and landholding a under a contract (R, C) is

$$U_{ii}(R, C; a) = p_i Q_i(a) - \{p_i R + p_i(1-p_i)C\}. \tag{2}$$

[6] Given that rents are paid after the harvest, leasing does not raise the needed borrowing level.

[7] Most models of group lending examine the case of two-person groups. See Ahlin (2013) and Maitra et al. (2013) for models of group lending under adverse selection with group size greater than two.

The MFI's objective with respect to borrowers of landholding a is represented by

$$V_a = \lambda p_r U_{rr}(R_{ra}, C_{ra}; a) + (1-\lambda) p_s U_{ss}(R_{sa}, C_{sa}; a), \quad (3)$$

where $\lambda \in (0,1)$ denotes the welfare weight that the MFI assigns to risky borrowers.

We initially suppose that the MFI has no redistributive objectives across borrowers of diverse landholdings. Then the analysis of the market of borrowers of a given landholding can be separated from that of any other landholding. Accordingly we suppress the notation for a in contracts and payoffs for borrowers below.

The MFI selects (R_r, C_r) and (R_s, C_s) to maximize Eq. (3), subject to the following constraints: (i) The *breakeven constraint*: $\theta[R_r + C_r(1-p_r)]p_r + (1-\theta)[R_s + C_s(1-p_s)]p_s \geq \rho$. Let $ZPC_{r,s}$ denote the set of pooled joint liability contracts that satisfy the zero-profit constraint with equality, and ZPC_i denote the set of joint liability contracts that satisfy the zero-profit constraint for a borrower of type i $(i = r, s)$ with equality. (ii) The *participation constraint*: $U_{ii}(R_i, C_i) \geq a$, where $i = r, s$. Let PC_i denote the set of joint liability contracts that satisfy the participation constraint of a borrower of type i with equality. (iii) The *limited liability constraint*: $R_i + C_i \leq Q_i(a)$, where $i = r, s$. Let LLC_i denote the set of joint liability contracts that satisfy the limited liability constraint of a borrower of type i with equality. (iv) The *incentive-compatibility constraint*: $U_{ii}(R_i, C_i) \geq U_{ii}(R_j, C_j)$, where $i, j = r, s$ and $i \neq j$. Let ICC_i denote the set of joint liability contracts that satisfy the incentive-compatibility constraint of a borrower of type i with equality. (v) The *ex-post incentive-compatibility constraint* for each type which requires that it is in the self interest of the group to report that a project failed when it actually did (see Gangopadhyay et al. (2005)): $R_i \geq C_i$ for $i = r, s$.[8] Let ICC_{ep} denote the set of joint liability contracts that satisfy the ex-post incentive-compatibility constraint with equality.

In dealing with borrowers outside their segments, the informal lenders maximize their own profit subject to the same constraints the MFI faces, provided that ρ is substituted by ρ^I. The following assumption then ensures that there exists a feasible joint liability pooled contract:

$$p_s Q_s(a) \geq \max\left\{\frac{p_s(2-p_s)}{\theta p_r(2-p_r) + (1-\theta)p_s(2-p_s)}\rho^I + a, \rho^I \frac{p_s}{\overline{p}} + \beta a\right\}, \quad (4)$$

where $\beta \equiv \frac{\theta p_r^2 + (1-\theta)p_s^2}{p_s \overline{p}}$. The two terms on the right hand side represent the relevant thresholds on the safe borrowers' project expected return. The first one ensures that there exists a contract the satisfies the safe type's participation constraint and the ex-post incentive compatibility constraint, whereas the second term guarantees the participation constraint and the limited liability constraint.

Fig. 1 illustrates the underlying reasoning in $(R–C)$ space. The ex post incentive constraint requires us to focus on points below ICC_{ep}, the 45 degree line. The break-even lines for safe borrowers alone, risky borrowers alone, and pooled contracts are represented by ZPC_s, ZPC_r and $ZPC_{r,s}$ respectively. LLC_s and PC_s represent the limited liability and participation constraints respectively for the safe type, while ICC_{ep} represents the ex post incentive compatibility constraint. The line segment AB represents pooled contracts that break-even and satisfy the limited liability and participation constraints for the safe type. Assumption (4) is equivalent to stating that this segment is non-empty.

A key point to note is that the risky type always attains a higher profit from any feasible contract compared with the safe type.[9] Hence any contract that satisfies the participation constraint for the safe type satisfies the same constraint for the risky type. The same is obviously true for the limited liability constraint also. Hence contracts AB are feasible for both types.

3. Before the MFI enters: informal lenders in isolation

In this section we describe the informal credit market. It is convenient to consider the case where MFIs are absent, especially as corresponding to the baseline situation before an MFI enters. The next section will examine the consequences of entry of the MFI.

The market is divided into a number of segments, either spatially or on the basis of social relations, wherein residents of each segment know a lot about each other and/or engage in a thick web of social and economic transactions. Each segment has one lender and many borrowers.[10] Owing to the thick interactions and exchange of information within any given segment in the past, the lender knows perfectly the risk types of borrowers in his own segment. Similar results obtain when the lender is better able to enforce loan repayment from safe types within his segment compared to other types or residents of other segments.

In the absence of the MFI the timing of the game is as follows: At stage 1, the informal lenders offer contracts to other-segment borrowers. At stage 2 informal lenders announce the contract for their own-segment borrowers. At stage 3, each borrower accepts at most one offer. At stage 4, contingent on the project being successful, the loan is repaid. The timing captures the additional advantage of dealing with own-segment borrowers, namely the ability to renegotiate the terms of their contracts following an offer from an external lender.[11] We think it is plausible that lenders can communicate more frequently with members of their own segment, so they can react to offers made by lenders in other segments. Finally, we assume that borrowers prefer to be served by their own-segment lender whenever they are indifferent and the latter makes positive profit. This assumption is not substantive, and simplifies the exposition.

Proposition 1. In the absence of the MFI, an equilibrium exists in the informal market. For any landholding a, every equilibrium results in the following outcome.[12]

(i) Outreach: All borrowers are served by the lender in their own segment.
(ii) Contract Choice: All borrowers receive individual liability contracts.
(iii) Interest Rate: Safe borrowers pay interest rate $R_s^I(a) = \min\left\{Q_s(a) - \frac{a}{p_s}, \frac{\rho^I}{p_r}\right\}$, while risky borrowers pay $R_r^I = \frac{\rho^I}{p_r}$.
(iv) Welfare: Every risky borrower is better off compared with autarky. Safe types are better off if and only if $Q_s(a) - \frac{a}{p_s} > \frac{\rho^I}{p_r}$.

To establish this, we first describe properties that must be satisfied in any equilibrium. The main point to be noted is that *there cannot be an equilibrium in which a lender in some segment* (*j*, *say*) *lends to a safe borrower in a different segment* (*i*, *say*). Clearly this cannot happen in a way that the lender makes a positive expected profit on the loan, since in that case it would be undercut by the lender in segment *i*. If the loan to the safe type results in a zero expected profit for the lender in segment *j*, then observe that it would earn an expected loss if the borrower was a risky type instead. A risky type in segment *i* would be able to receive the same loan, owing to the inability of the lender in segment *j* to distinguish safe from risky types in segment *i*. It must then be the case

[8] If this constraint is violated, the member of the group who succeeded may prefer to announce that both members succeeded even when her partner actually failed. This would entail paying the interest rate for both rather than paying back her own loan and paying joint liability for her partner.

[9] The expected return from the project is the same for the two types, while the expected cost of repayment for the risky type $Rp_r + Cp_r(1-p_r)$ does not exceed the expected cost $Rp_s + Cp_s(1-p_s)$ for the safe type as long as $0 \leq C \leq R$.

[10] If there is more than one lender within a segment, we assume they collude perfectly.

[11] Assuming instead that the announcements are simultaneous would not alter our main results substantially but it would complicate the analysis of the equilibrium in the informal market. Namely, the equilibrium would not exist whenever the informal lender is able to offer a set of contracts that satisfy the zero profit condition and also attract both risky and safe borrowers from other segments.

[12] We use the solution concept of a subgame perfect Nash equilibrium throughout this paper.

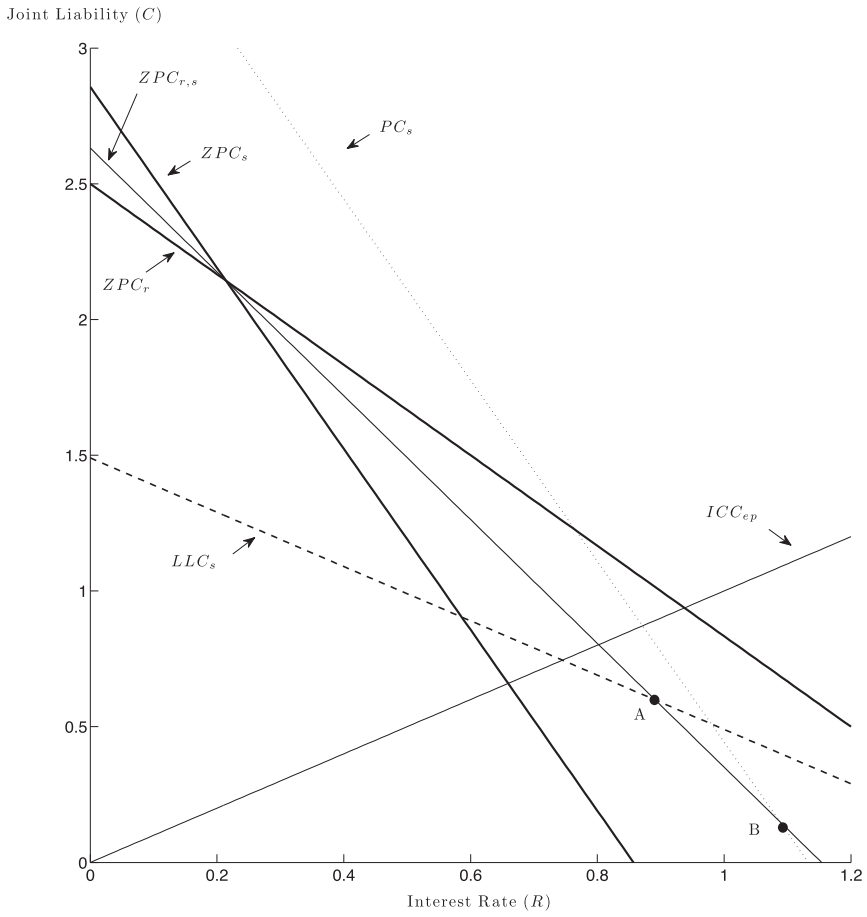

Fig. 1. The credit market when the MFI is the only lender.

that risky types in i have access to a loan which gives them an even higher expected utility, which would generate expected losses for any lender that offers it. This cannot be the lender in segment i, since that lender can identify risky types in segment i. So the risky types in i must be borrowing from some lender in another segment k different from i or j. But the same argument as above implies that the lender in segment k cannot earn positive profits from lending to either type in segment i. Hence the lender in segment k must be earning a loss from lending to borrowers in segment i, and would be better off dropping such loan offers.

It follows that lenders in any given segment i will have monopoly power over lending to safe types in i, and will thus be able to charge them an interest rate $R_s^I(a)$ which extracts a certain amount of their surplus. Since there are no incentive constraints operating on within-segment transactions, there is no benefit to the lender from offering a joint liability contract to the safe types. Given our tie-breaking assumption, safe types will receive an individual liability contract at interest rate $R_s^I(a)$.

Next, note that all lenders compete for risky type borrowers across different segments, and must end with earning zero expected profits from lending to them. Since the market for lending to risky types is effectively separated from the market for lending to safe types, there is no benefit from offering joint liability loans, and every risky type will end up with an individual liability loan with interest rate $R_r^I = \frac{\rho^I}{p_r}$. Given the tie-breaking rule, they will borrow from lenders in their own segment.

Finally it can be checked that the following constitutes an equilibrium: every lender offers individual liability loan to safe types in his own segment at interest rate $R_s^I(a)$, and to any borrower in the village at interest rate R_r^I.

Our model thus explains why informal lenders do not offer joint liability contracts. Note that the interest rate for risky types does not depend on their landholding. The interest rate for the safe borrowers never exceeds that for risky borrowers, and could depend on their landholding (when it falls below R_r^I). Effectively, lenders give a 'discount' to safe borrowers in their own segment, which varies with their landholding. Whether the safe interest rate rises or falls in a hinges on the shape of the return function $Q_s(a)$: whether $Q_s'(a)$ exceeds or falls below $\frac{1}{p_s}$.

4. When MFI and informal lenders co-exist

Finally we arrive at the main object of study: what happens when the MFI enters and competes with informal lenders? To this end, we add an additional stage to the timing presented in Section 3, namely at stage 0 we allow the MFI to make loan offers. Define

$$\delta \equiv \frac{\beta-1}{\beta}\left(\frac{\rho^I}{p_s} - \rho\frac{p_s}{[\theta p_r p_r + (1-\theta)p_s p_s]}\right), \tag{5}$$

$$\delta_I \equiv \frac{p_s(2-p_s)}{\theta p_r(2-p_r) + (1-\theta)p_s(2-p_s)}\rho, \tag{6}$$

and

$$\gamma(a) \equiv \frac{p_r}{p_s^2}a + \frac{\rho}{p_r}, \tag{7}$$

where δ represents the safe borrowers' lowest project return that satisfies the limited liability constraint on any joint liability loan offered by the MFI; δ^I is the lowest effective cost of credit at which the MFI

can lend to the safe borrowers; and $\gamma(a)$ represents the safe borrowers' lowest project return (for given landholding a) that satisfies the limited liability constraint on an MFI loan designed to break-even whenever risky borrowers are the only ones who accept it.

To start with, we assume that the MFI is constrained to break-even separately on each landholding category. Later we will discuss the consequences of dropping this assumption. The main result of this paper is the following.

Proposition 2. For any given landholding a for which the MFI is constrained to break-even, every equilibrium of the game where the MFI and informal lenders co-exist results in the following outcome:

(i) Outreach: Risky types borrow from the MFI. Safe types borrow from the informal lender in their own segment, if $\rho_I < \delta_I$, or if $\rho_I \geq \delta_I$ and $Q_s(a) < \delta$. Otherwise, safe types borrow from the MFI.
(ii) Contract Choice: Informal lenders always offer individual liability contracts. If the MFI serves both risky and safe borrowers, the MFI offers a joint liability contract designed for the safe type and an individual liability contract for the risky type. If the MFI serves only the risky borrowers, the MFI offers a joint liability contract if $Q_s(a) > \gamma(a)$, otherwise the MFI offers an individual liability contract.
(iii) Interest and Liability: R and C are set such that the MFI makes zero expected profit. If $Q_s(a) \leq \gamma(a)$, the safe borrowers served by the informal lenders pay the same interest rate they used to pay in the absence of the MFI. If $Q_s(a) > \gamma(a)$ they pay a lower interest rate.
(iv) Welfare: Every risky and safe borrower served by the MFI is better off compared with the equilibrium of the informal market without an MFI. Safe types that are not served by the MFI are weakly better off, and strictly better off if and only if $Q_s(a) > \gamma(a)$.

The argument is illustrated in Fig. 2, and proceeds through a number of steps. Region C1 depicts contracts that do not break-even for informal lenders while lending to safe types, while C4 consists of contracts that generate positive profits for informal lenders when they lend to risky types. C3 is the set of contracts where the MFI earns non-negative profits while the informal lender makes losses lending to the risky type. C2 consists of the remaining contracts satisfying the ex post incentive constraint $R \geq C$.

(a) *If the MFI offers a contract* (m_1, *say*) *in* (*the interior of*) *region C1, informal lenders will not lend to either safe or risky types in any equilibrium of the resulting continuation game*. Otherwise, an informal lender must offer a contract at least as attractive to borrowers as m_1, which will earn losses irrespective of the risk type of the borrower.
(b) *If the MFI offers contracts only in region C4, the subsequent equilibrium outcome will be the same as in the informal market in isolation described in* Proposition 1. In the continuation game among informal lenders, Bertrand competition among lenders will provide risky types with a utility corresponding to contracts on ZPC_r^I, which risky types (weakly) prefer to contracts offered by the MFI. With regard to safe types, their participation constraint *vis-a-vis* their own-segment lender will then be the same as in the case where the MFI is absent. Hence the equilibrium outcome will be the same as when the MFI is absent.
(c) *The MFI must offer at least one contract in the union of C1, C2 and interior of C3*. Otherwise, (b) implies that the MFI will not lend to anyone. The MFI would do better by offering a contract in the interior of C3, as it would attract some borrowers and break-even irrespective of their risk types.
(d) *If there exists a pooled contract* (m_2, *say*) *for the MFI which breaks even for the MFI, satisfies the limited liability constraint for the safe type, and does not break even for informal lenders when offered to the safe type, then it is optimal for the MFI to offer such a contract, and lend to both safe and risky types*. To begin with, note that, corresponding to any separating pair of contracts satisfying incentive constraints, there exists a pooled contract which leaves both types of borrowers with the same level of utility, and

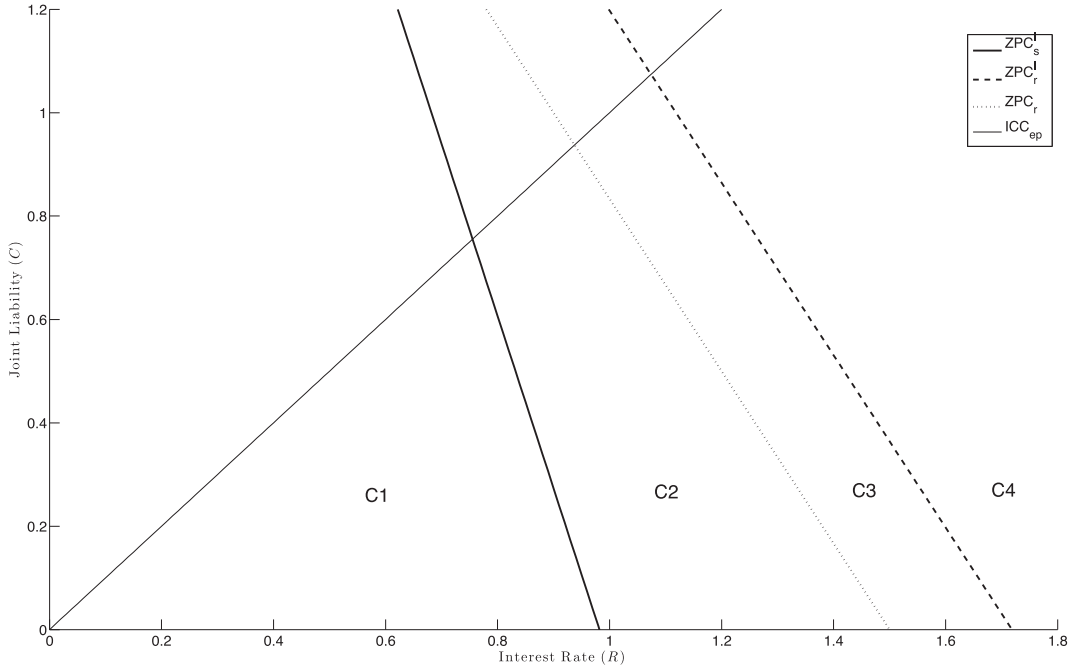

Fig. 2. Four contractual areas.

generates the same expected profit for the MFI.[13] Note also that the MFI is indifferent between offering a pooled contract m_2 or offering a separating pair of contracts, where the safe type is given a contract m_2, and the risky type is given any contract on the same indifference curve for this type which involves a lower joint liability and higher interest rate. If the MFI does not offer any contract such as m_2, or an equivalent one (in terms of borrower payoffs and MFI profits), the safe type will end up borrowing in region C2 from their own-segment informal lender.[14,15] The MFI would then do better to offer a contract equivalent to m_2, which would attract and benefit both safe and risky types, and break-even. Note that, by definition, all contracts such as m_2 must be on $ZPC_{r,s}$ and they are all candidates for the optimal MFI contract: choosing any contract to the left and below $ZPC_{r,s}$ would not break even for the MFI and selecting any contract to the right and above $ZPC_{r,s}$ would decrease the value of the MFI's objective function. Which contract within this set is preferred by the MFI will depend on the relative welfare weights assigned to the two types. Finally, note that the MFI is indifferent between offering a pooled contract on $ZPC_{r,s}$ and offering the same contract to the safe type and an equivalent individual liability contract to the risky type. Our tie-breaking assumptions imply that the MFI will do the latter.

(e) *If there exists no pooled contract such as m_2 described in (d) above, the safe type will borrow from the own-segment informal lender. The loan will maximize the expected profit of the lender, subject to a participation constraint for the safe type with an outside option represented by contracts on ZPC_r which satisfy the limited liability constraint for the safe type.* Now it is not possible for the MFI to lend to the safe type, as any loan offered in region C2 will also attract the risky type, so the corresponding pooled contract has to break-even for the MFI. It also must satisfy the limited liability constraint for the safe type. By hypothesis, no such contract exists.[16] Hence the MFI will end up lending only to the risky type in this case, and is limited to offering contracts on ZPC_r, from which (e) follows.

Finally note that if $\rho_I > \delta_I$ and $Q_s(a) > \delta$, then (d) applies, and both types are strictly better off compared to the situation where the MFI is absent. This corresponds to panels A and B in Fig. 3.[17] If $\rho_I < \delta_I$, or if $\rho_I \geq \delta_I$ and $Q_s(a) \leq \delta$, condition (e) applies, so the MFI will only lend to risky types in this case, who are strictly better off. This corresponds to panels C and D in Fig. 3. In panel C the safe type is better off despite borrowing from the own-segment informal lender owing to a strengthening of his outside option which now includes contracts on the segment AB on the line ZPC_r which satisfy his limited liability constraint. In panel D the safe type is not benefitted, as there is no contract on the line ZPC_r which satisfies his limited liability constraint.

Intuitively, the result of Proposition 2 can be explained as follows. All risky types move to the MFI since there is no distortion in the MFI lending to such types. Hence its information disadvantage *vis-a-vis* informal lenders does not matter, and its cost advantage is decisive. With respect to safe types, its informational disadvantage matters: it is forced to provide safe types a contract in which they are pooled with risky types and which involves a joint liability loan. There are two resulting distortions: the contract has to satisfy a limited liability constraint (which tends to bite for low a borrowers), and the safe types have to cross-subsidize the risky types which reduces the cost advantage of the MFI. If the cost disadvantage of the informal lenders is sufficiently small ($\rho_I < \delta_I$), the MFI cannot compete with the informal lenders in lending to any safe type. Otherwise, if $\rho_I > \delta_I$, the MFI still has a net cost advantage even after allowing for the cross-subsidy burden the safe types have to bear. The MFI can then lend to those safe types with landholding a large enough that the required joint liability contract satisfies the limited liability constraint. Sufficiently poor borrowers (those with $Q_s(a) < \delta$) will stay with the informal lender, under the maintained assumption that there is no cross-subsidization across wealth types by the MFI. As we explain below, this may no longer be true when cross-subsidies are allowed.

Note that risky types always benefit from the MFI's entry. So do safe types who obtain an MFI loan. Even other safe types can benefit, as their bargaining position can be enhanced by the MFI's presence. This happens whenever safe types are better off borrowing at the interest rate offered to risky types by the MFI compared with their autarky situation. This happens when $Q_s(a) > \gamma(a)$. The informal lender is then unable to extract all the surplus of these safe types.

What are the effects of MFI entry on informal rates? This depends on how interest rates for the safe type vary with land a. If they are falling in a, the average interest rate paid by safe types to informal lenders increases, since only borrowers with the lowest amount of land remain in the informal market. On the other hand, all risky types move to the MFI, which tends to reduce the average informal rate. The net effect could go either way, depending on the fraction of safe types in the population. If they are high enough, the average informal rate will rise. Take the numerical examples depicted in Fig. 3 and consider a village with $\rho^I = 0.68$ and a population of borrowers with landholding uniformly distributed in the interval [0, 1.2].[18] The entrance of the MFI leaves the informal lenders with safe borrowers with small landholding (approximately less than 0.4). If one were to compute the average interest rate in the informal market before and after the MFI enters, the result is an increase of 5%.

5. Extensions

5.1. Alternative market structures

Now consider how our analysis is modified under alternative market structures—monopoly and perfect competition. Monopoly corresponds to the case of a single segment and informal lender, while perfect competition corresponds to the case of multiple informal lenders all of whom know the risk type of all borrowers. Note to start with that conditions (5), (6) and (7) do not depend on the market structure: they only capture properties related to the MFI's cost of capital and

[13] For any separating pair, construct the pooled contract which is the unique intersection point of the indifference curves of the safe and risky types passing through their respective contracts. Incentive compatibility of the original pair requires the low risk types to select the contract with higher c and lower r. Hence the constructed pooled contract involves lower c and higher r, and $r + c$ must be smaller (as the indifference curves of the safe type are steeper than the LLC_r curve). It therefore satisfies LLC_s since the original safe type contract did. By construction it leaves welfares of both types unaffected, as well as expected profits of the MFI.

[14] Whenever such a separating contract exists, a pooled contract such as m_2 must also exist, as per the argument above.

[15] If the best contract from the MFI available for the safe type is in the interior of region C2, it will be optimal for the own-segment informal lender to undercut the MFI and offer a contract to the safe type which will earn positive profit. If it is on ZPC_r^I then also the safe type will borrow from the own-segment informal lender owing to our tie-breaking assumption.

[16] The discussion in (d) implies that if no pooled contract such as m_2 exists then there is also no separating pair of contracts which breaks even for the MFI, satisfies the limited liability constraint for the safe type, and does not break even for informal lenders when offered to the safe type.

[17] To obtain the examples presented in the graph we solved the model numerically. We assume that $Q_i(a) = 1 + a^2$, and the outside option is normalized to $a - \pi$. In all simulations we set $p_s = 0.7$ and $p_r = 0.4$, and we discretize the interest rate R and the joint liability C using more than 100 grid points for each variable. In Fig. 1 $a = 0.7$; $\pi = 0.45$; $\rho = 0.6$; and $\theta = 0.6$. In Fig. 3 panel A $a = 0.9$; $\pi = 0.6$; $\rho = 0.6$; $\rho^I = 0.85$; and $\theta = 0.6$. In Fig. 3 panel B $a = 0.7$; $\pi = 0.6$; $\rho = 0.6$; $\rho^I = 0.78$; and $\theta = 0.6$. In Fig. 3 panel C $a = 0.9$; $\pi = 0.6$; $\rho = 0.6$; $\rho^I = 0.6874$; and $\theta = 0.6$. In Fig. 3 panel D: $a = 0.7$; $\pi = 0.6$; $\rho = 0.6$; $\rho^I = 0.6874$; and $\theta = 0.6$.

[18] Additionally, set $\pi = 0.45$; $\rho = 0.6$; $\theta = 0.3$.

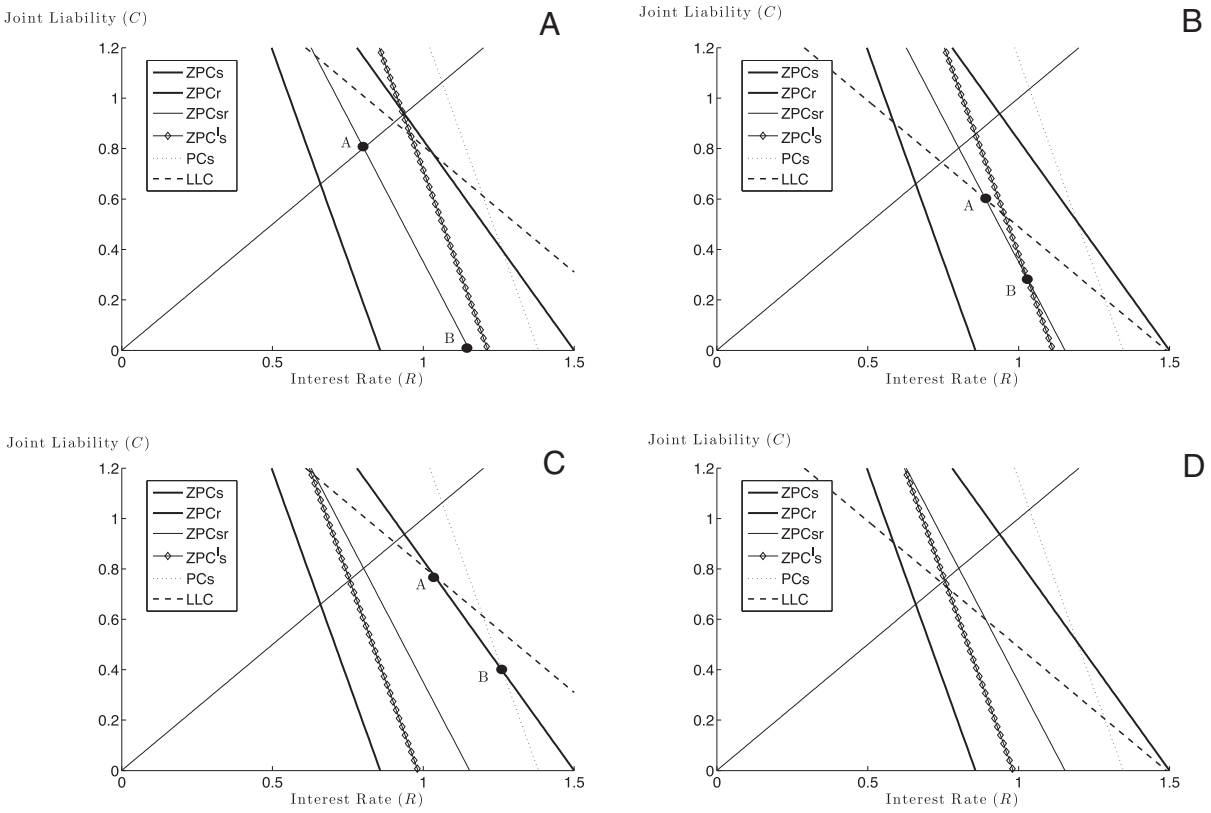

Fig. 3. Interactions between MFI and informal lenders.

the underlying distribution of risk types within the population of borrowers.

Our result on the impact of MFI entry on informal interest rates is essentially unchanged in the case of monopoly. It is easily checked that the same equilibrium results when the informal lender and MFI co-exist. The equilibrium contract for safe types prior to MFI entry is also unchanged when $Q_s(a) - \frac{a}{p_s} \leq \frac{\rho^I}{p_r}$. We need this condition to hold in the segmented case for interest rates not to fall consequent on entry by the MFI. The informal lenders extract all the surplus of the safe types they lend to, irrespective of the extent of segmentation, and this is what we really need in our theory to explain how informal rates can go up following MFI entry.

However, the case of perfect competition is different, as the informal interest rates for the safe types would not then vary with landholdings (under the current parametric conditions): MFI entry always decreases the average informal interest rate. By attracting all the risky borrowers and some of the safe ones, the MFI would unambiguously reduce the average informal interest rate. One would have to consider an extension of this model where competitive interest rates vary with landholdings, owing to possible correlation between landholding and risk type. For instance, if borrowers with more land are safer risks, informal interest rates would decrease in landholding. When MFI participation rates increase in landholding, it will continue to be possible for MFI entry to raise informal rates.

5.2. MFI lending to informal lenders?

What if the MFI decides to extend credit to the informal lenders instead of entering the market and competing with them? This would be tantamount to reducing the cost of capital of informal lenders, the benefits of which may trickle down to borrowers depending upon their market power and risk type. In general, however, when the informal lenders have some market power, the MFI would do better to offer loans directly to borrowers rather than lend to informal lenders. Indeed, the only scenario where lending to informal lenders may be in the MFI's interest is when the informal market is perfectly competitive, and only from the perspective of safe borrowers.[19] In that case the MFI can leverage the better information of informal lenders concerning borrower risks, without transferring any rents to the former.

5.3. Cross-subsidies across landholding classes

The results in the previous section were based on the assumption that the MFI does not want to cross-subsidize borrowers across different landholding levels. We saw above that it may end up not being able to lend to some low wealth safe types, who are unable to take on the burden of joint liability. If the MFI assigns a high enough welfare weight to such 'ultra-poor' borrowers relative to others who it can lend to without running at a loss, it would be motivated to get the latter to cross-subsidize loans to the former group. This would raise the effective interest rate for high a borrowers, and lower it for low a borrowers. If the welfare weight (or demographic weight) of the latter group is large enough, this can reverse participation patterns across landholding classes, with participation rates falling rather than rising in landholdings.

The case of cross-subsidies is illustrated in Fig. 4. Without cross-subsidies, borrowers in a low landholding class a' cannot be offered

[19] Risky borrowers cannot be better off in a regime with perfect competition and credit injection to informal lenders compared with one in which the MFI enters the market. Here is why. Consider first the scenario where there is perfect competition and credit injection. In this case, the risky borrowers' interest rate is $\frac{\rho}{p_r}$. Now consider the scenario where the MFI enters the market. If the MFI serves only the risky borrowers, Proposition 2 implies that it will do so at effective interest rate $\frac{\rho}{p_r}$. On the other hand, if the MFI offers a joint liability loan to both types of borrowers, the risky borrowers get cross-subsidized by the safe ones and end up paying an effective interest rate that is lower than $\frac{\rho}{p_r}$. The result follows.

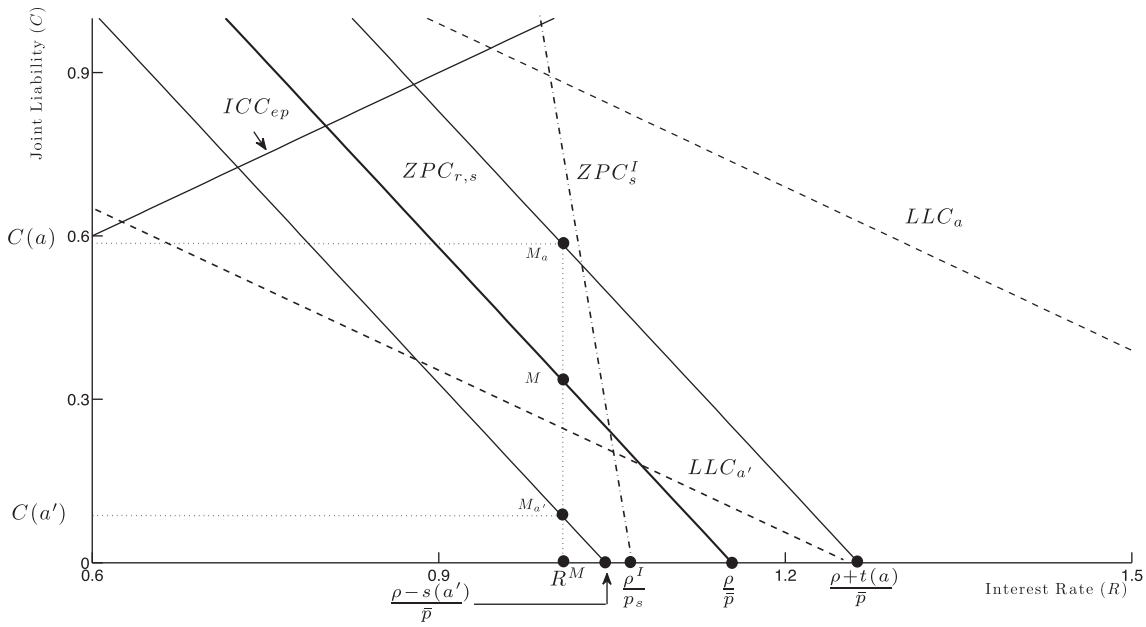

Fig. 4. Cross-subsidies across landholding classes.

loans (such as M) which pool safe and risky types, provide a better utility to safe types compared to what is offered by the own-segment lender, and meets the limited liability constraint for this class. But those in a higher landholding class a can be offered such a pooled contract, since these borrowers can afford the joint liability burden associated with such contracts. It is then possible for the MFI to lower the joint liability obligation C for the poorer class a' (by offering them the contract $M_{a'}$) and raise it for the wealthier class a (by offering them M_a), in a way that now allows it to lend to borrowers of both classes. This can be operationalized by a principle of graduating the joint liability requirement according to ability to pay, while maintaining the same interest rate for both land classes. It corresponds to an effective tax of $t(a)$ on class a borrowers which finances a subsidy $s(a')$ on class a' borrowers. Such a policy will now bring in the class a' borrowers into the ambit of MFI loans, without losing the class a. If the relative welfare weight assigned by the MFI to class a' borrowers is large, and the proportion of class a' borrowers is not too large relative to those in class a in the population, we may now witness a reversal of MFI participation patterns, with higher participation rates among poorer borrowers. Hence in general, the model is consistent with participation patterns that could be either rising or falling in landholdings.

Note similarly that the pattern of variation of informal interest rates across landholding sizes is also ambiguous. For risky types the interest rate does not vary with a, while for a safe type the informal interest rate is $Q_s(a) - \frac{a}{p_s}$. This is rising (resp. falling) locally in a if $Q_s'(a)$ is larger (resp. smaller) than $\frac{1}{p_s}$.

The net effects of the entry of the MFI on the average informal interest rate therefore depend on how MFI participation patterns and informal interest rates for safe types vary with landholdings. If they move in opposite directions, the average informal interest rate paid by safe types increases. The same is true for (unconditional) average interest rates if the proportion of risky types is not too large. The theory places no restrictions on these patterns, so empirical work is necessary to determine what the impact will be.[20]

[20] A calibration exercise to fit participation and interest rate patterns observed in the West Bengal experiment of Maitra et al (2014) yielded the following results. With at least 80% of the population comprised of safe types, the average informal rate would rise as a consequence of MFI entry. The details of this calibration exercise are in the previous version of this paper, and available from the authors on request.

6. Conclusion

The purpose of this paper was to provide a novel mechanism by which MFI entry can raise informal interest rates, while improving borrower welfares. Key to this is the two dimensional heterogeneity of borrowers by risk type and landholdings. MFI's lack fine-grained information concerning borrower-specific risks that informal lenders know. To overcome this informational problem, the MFI offers joint liability contracts which pool different risk types. In the absence of cross-subsidies across land types, poor borrowers would not be able to afford the joint liability burden necessary to allow the MFI to compete successfully with local lenders and break-even. The ultra-poor safe types would remain with local lenders, while all other borrowers would switch to the MFI. If informal interest rate for safe types is decreasing in landholding, and the proportion of risky types is not too large, the average informal interest rate would rise consequent on MFI entry. This is a result of the selection effects induced by MFI entry, rather than any negative externality on borrowers remaining in the informal market. Indeed, even borrowers that remain with informal lenders may benefit from an expanded set of outside options resulting from MFI entry.

The predictions of the model match empirical evidence from Bangladesh and West Bengal, unlike most existing models of interactions between MFI and informal credit in the literature. It is consistent with institutional features commonly observed in informal credit markets, such as segmentation, why informal lenders never offer joint liability loans, and why MFIs restrict lending to the poor. MFIs attract risky types in the model, consistent with the West Bengal evidence. It can explain observed MFI participation patterns, wherein borrowers owning less land participate in MFI loans at a higher rate.

The model deliberately made assumptions to generate unambiguously positive welfare effects of MFI entry, while generating patterns of MFI participation and interest rate variations across landholding classes that are empirically plausible in the West Bengal context. Our aim was not to argue that MFI entry along the lines of the West Bengal experiment or the Bangladesh experience had no adverse spillover effects. Rather the point is that it is difficult to make any inferences concerning welfare impacts, unless we empirically test competing models with different welfare implications. This is a challenging task for future research.

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References

Ahlin, C., 2013. Group lending under adverse selection with local information: the role of group size. Working Paper.
Banerjee, A., E. Duflo, R. Glennerster, and C. Kinnan, (2011). "The miracle of microfinance? Evidence from a randomized evaluation". Mimeo, MIT, JPAL.
Bardhan, P., Udry, C., 1999. Development Microeconomics. Oxford University Press, Oxford; New York (1999).
Basu, K., 1997. Analytical Development Economics: The Less Developed Economy Revisited. MIT Press, Cambridge, Ma.
Bell, C., Srinivasan, T.N., Udry, C., 1997. Rationing, spillover and interlinking in credit markets: the case of rural Punjab. Oxf. Econ. Pap. 49 (4), 557–585.
Berg, C., Emranm, M.S., Shilpi, F., 2013. Microfinance and moneylenders: the effects of MFIs on informal credit market in Bangladesh. Working Paper. World Bank Research Department.
Besley, T., 1994. How do market failures justify interventions in rural credit markets. World Bank Res. Obs. 9 (1), 27–47.
Besley, T.J., Burchardi, K.B., Ghatak, M., 2012. Incentives and the de Soto effect. Q. J. Econ. 127, 237–282.
Bose, P., 1998. Formal–informal sector interaction in rural credit markets. J. Dev. Econ. 56 (2), 265–280.
Conning, J., Udry, C., 2007. Rural financial markets in developing countries. In: Evenson, Robert, Pingali, Prabhu (Eds.), Handbook of Agricultural Economics, 1st ed. vol. 3. Elsevier (number 1).
Demont, T., 2012. The impact of microfinance on the informal credit market: an adverse selection model. Working Paper.
Desai, J., K. Johnson, and A. Tarozzi, (2011). "On the Impact of Microcredit: Evidence from a Randomized Intervention Rural Ethiopia. Mimeo, Duke University.
Floro, M.S., Ray, D., 1997. Vertical links between formal and informal financial institutions. Rev. Dev. Econ. 1 (1), 34–56.
Gangopadhyay, S., Ghatak, M., Lensink, R., 2005. Joint liability lending and the peer selection effect. Econ. J. 115 (506), 1005–1015 (October 2005).
Ghatak, M., 2000. Screening by the company you keep: joint liability lending and the peer selection effect. Econ. J. 601–631 (July).
Hoff, K., Stiglitz, J., 1990. Introduction: imperfect information and rural credit markets: puzzles and policy options. World Bank Econ. Rev. 4 (3), 235–250.
Hoff, K., Stiglitz, J., 1998. Moneylenders and bankers: price-increasing subsidies in a monopolistically competitive market. J. Dev. Econ. 55 (2), 485–518.
Jain, S., 1999. Symbiosis vs crowding-out: the interaction of formal and informal credit markets in developing countries. J. Dev. Econ. 59 (2), 419–444.
Jain, S., Mansuri, G., 2003. A little at a time: the use of regularly scheduled repayments in microfinance programs. Journal of Development Economics vol. 72(1). Elsevier, pp. 253–279 (October).
Kahn, C.M., Mookherjee, D., 1998. Competition and incentives with nonexclusive contracts. RAND J. Econ. 29 (3), 443–465.
Karlan, D., Mullainathan, S., 2010. Rigidity in microfinancing: can one size fit all? Discussion paper. QFinance
Karlan, D., Zinman, J., 2011. Microcredit in Theory and Practice: Using Randomized Credit Scoring for Impact Evaluation. Science 332 (6035), 1278–1284 (June).
Maitra, P., Mitra, S., Mookherjee, D., Motta, A., Visaria, S., 2013. Agent intermediated lending: a new approach to microfinance. Discussion paper. Institute for Economic Development, Boston University.
Maitra, P., Maitra, S., Mookherjee, D., Motta, A., Visaria, S., 2014. Financing smallholder agriculture: an experiment with agent-intermediated microloans in India. NBER Working Paper No. 20709 (November).
Mallick, D., 2012. Microfinance and moneylender interest rate: evidence from Bangladesh. World Dev. 40 (6), 1181–1189.
McIntosh, C., Wydick, B., 2005. Competition and microfinance. J. Dev. Econ. 78 (2), 271–298 (December 2005).
Mishra, A., 1994. Clientelization and fragmentation in backward agriculture: forward induction and entry deterrence. J. Dev. Econ. 45 (2), 271–285 (December 1994).
Rural financial markets in developing countries, 2007. In: Von Pischke, J.D., Adams, D.W., Donald, G. (Eds.), Johns Hopkins University Press, Baltimore, MD (441 pp.).
Yadav, S., Otsuka, K., Davi, C.C., 1992. Segmentation in rural financial markets: the case of Nepal. World Dev. 20 (3), 423–436.