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From 'No Collateral No Loan' to 'No Collateral No Default': The Economics of Group Lending Microfinance

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Abstract: In this study, we are exploring the economic mechanism that makes group lending microfinance working to extend loan to the poor without collateral while ensuring repayment. In group lending microfinance, MFIs are lending the poor without collateral and the borrowers who pledge no collateral repay loans whenever they are able to. The point is interesting from the fact that if the borrower defaults, she would have to loss almost nothing since, there is no collateral. The reality is, however, that MFIs extend loans without collateral and are rewarded with higher repayment rates. Having no-pledgeable assets by the poor neither prevents MFIs to extend loans nor does it leads borrowers to simply default. This study aims at exploring the economic mechanism through which group lending works. We see that joint liability group lending promotes peer monitoring, eliminates shirking in the group and ensures effort from the borrowers which in turn promotes repayment. We also, find that if loans are associated with dynamic or progressive lending, that is, if successful repayments are rewarded by a larger new loans, we do not need joint liability obligation to ensure repayment. Group lending microfinance with or without joint liability, we thus see, has certain mechanism that leads to assortative matching of borrowers, reduces effective interest rate, leads to peer monitoring and finally enforces repayment as long as borrowers are able to.

Key words: Microfinance, group lending, joint liability, collateral, repayment, agency problems, assortative matching, dynamic and progressive lending

INTRODUCTION

Over the past three decades many poor individuals across the developing world seem to have benefited from the microfinance revolution. In this period, it is generally seen across all the leading microfinance institutions to extend loans to the poor who are not considered creditworthy by the traditional commercial banks due to collateral problems and repayment enforcement thereby (Armendariz and Jonathan, 2005). This is highly significant from the economic standpoint that a distant lender is lending the poor without collateral requirement. At the same time, another interesting point to note is that microcredit borrowers repay loans successfully when they could simply default their repayment obligations once they get loans, since, borrowers do not have any seizeable collateral and if they default they would have lost nothing in a typical case (Wenner, 1995; Armendariz and Jonathan, 2005; Ahlin and Townsend, 2007). The reality is, however, that MFIs extend loans without collateral and are rewarded with higher repayment rates. Having no-pledgeable assets by the poor neither prevents MFIs to extend loans nor does it leads borrowers to simply default (Sharma and Zeller, 1997; Zeller, 1998; Abbink *et al*., 2006). In this study, we want to explore the economic mechanism behind these issues from theoretical perspective.

Historically, since, 1970s development practitioners, government and non-government organizations, donor agencies in developing countries have been considering credit access to the poor as the alternative instrument to alleviate poverty and to promote rural economy. Delivering efficient financial services, particularly extending micro-loans for productive purposes to those who have entrepreneurship skills but possess no collateral are considered as the suitable strategy (Zeller, 1998). As a result, from the late 1970s international donor agencies and governments of developing countries have taken various projects, support a number of financial institutions expanding agricultural and small-scale loans. Although, most of these financial initiatives suffer losses due to lower repayment and consequently becomes subsidy dependent. Operation of these programs thereby collapsed and rural poor remains the victim of rural moneylender's grip. Since, investment is essential for agricultural modernization and firm development, it therefore becomes a consensus that formal financial systems should be restructured in order to serve the poor (Bakshi, 2008).

'In the 1980s the imperfect information paradigm eclipsed and displaced the perfect information and monopolistic competition paradigms of rural credit. The classical recommendation to liberalize interest rate to cure observed rationing resulted in adverse selection' (Stiglitz and Weiss, 1981). This in turn reduces efficiency in the credit market, raising the interest rate per se. On the other hand, when interest rates increases, the low risk borrowers leave and only high-risk borrowers enter into the market. Lenders' profit and program's sustainability in this case, declines because of the presence of the risky borrowers who are more inclined to take risky projects and the resulting defaults. The traditional solution to the enforcement problem in this situation, collateral, proves to be ineffective and useless since, the poorer borrowers have no pledgeable assets to offer as collateral.

'Rural credit markets in developing countries have three characteristic problems: screening, monitoring and enforcement. Under the imperfect information paradigm, formal lenders discriminate against small borrowers because of costly information and weak enforcement capacity, even in liberalized interest rate regimes' (Wenner, 1995). Obviously, it is difficult for the distant lenders to truly justify the probability of default and to monitor how borrowers use the loan proceeds. Borrowers may not take safe projects that render a safe return, instead can take a risky project with uncertain return or may shirk what we call as the problem of moral hazard. The problems further aggravates when due to weak legal systems and socio-political pressure the lender can not pressurize a borrower to repay in case of a default. While, at the same time the presence of local moneylender charging unusually high interest rates is seen all over the developing world. The challenge for the development practitioners, for government agencies and formal financial institutions therefore remains to design appropriate credit delivery system to address these issues.

One potential solution to these problems is pioneered during the late 1970s as group lending microfinance with joint liability, thanks to Professor Muhammad Yunus of Grameen Bank from Bangladesh. With joint liability group lending, borrowers of a group are supposed to be responsible for the total loans taken by all the group members, i.e., borrowers of a group are jointly liable to repay their entire group loan obligation. Thus if one group member does not repay her loan installment, others have to contribute to ensure repayment. In the classic Grameen Bank model, however, non-repayment of loan by the group is generally resulted that the group will be denied from future loan access. In this way, group lending creates pressure and incentive for the group members to monitor over other's investment projects of the group and to enforce repayment. Joint liability group lending is thus generally believed to be the key factor working behind the higher rates of repayment and the success story of many microfinance institutions.

Group lending addresses the asymmetric distribution of information by transferring the burden of default risk to the contracting borrowers, thus transfers the costly screening to be done by the borrowers themselves. Screening borrower's risk is critical since, it affects loan repayment and lender's profit thereby. 'Group lending schemes induce borrowers to engage in assortative matching wherein local knowledge about each other's assets, capabilities and character traits are used to sort and self-select. The 'better risks' signal their creditworthiness by forming a jointly liable credit group. On the other hand, the 'poorer risks' find it too costly to 'signal' so they are excluded from the incentive scheme and are either forced to do without credit or seek loan contracts with higher interest rates. Secondly, group lending provides a potential solution to the monitoring or incentive problem by inducing members of the credit group to monitor their peers. Specially, if the group is relatively small and the members live close to each other, it is not difficult to detect diversion of funds if any or to assess whether borrowers were shirking or appropriate production techniques are employed. Thirdly, group lending associated with dynamic lending opportunity improves enforcement capacity through the termination threat' (Wenner, 1995). Since, the entire group is denied from credit access in case of default by any borrower, it creates pressure on the group to monitor every single project of the borrowers to ensure repayment.

In this context, the overall research question of this study is to focus on the functioning of group lending. We are categorically exploring the economic mechanism behind the functioning of joint liability group lending extending loans to the poor in absence of collateral and its repayment enforcement mechanism. Also we will explore the limitations and weakness, if any, of group lending financing the poor.

The study is a theoretical investigation of the functioning of group lending. The characteristic and at the same time the limitation of the study is that it is solely based on surveying scientific publications from peer reviewed journals in the respected field. We are neither developing nor estimating any model that affects repayment in group lending; rather we are studying a collection of theoretical works in this vibrant arena.

AGENCY PROBLEMS FACING THE POOR WHILE SEEKING A LOAN

Providing financial services to the poor is severely constrained by the multifold challenges faced by the traditional financial institutions. Suppose a borrower who needs financing for her investment project and seeks a loan for it. In order to convince the moneylender, she has to offer sizeable collateral so that the lender feel assured of repayment. When the potential borrower is unable to offer any collateral, as the poorer are often in a position, she has to make the case that she will certainly pay back the principal and the interest in time. But for a bank located outside of the village is usually unlikely to be convinced by the potential borrower in this case, particularly because it is unable:

- To observe the borrower's characteristics.
- To observe the borrower's effort in her project in question.
- To observe borrower's profits when project is realized.

All these information problems can arise in different stages of a lending contract. First, while signing a loan agreement the lender may have insufficient information about the characteristics of the potential borrower. The problem is that this insufficient information can lead the lender to extend loan to a low quality borrower. Bakshi (2008) termed it as the First Agency Problem facing the poor. Second, while the loan has been extended, the lender has no command over the loan proceed and does not surely know the way the loan amount will be used. The borrower can work hard at one extreme and shirk at the other extreme. This, as Bakshi (2008) termed as the Second Agency Problem facing the poor. Third, while the investment project is matured, the lender might remain ignorant about the return of the borrower's project. Borrower, in this case, can easily claim that her project was a failure and consequently she is unable to repay, although, her project was a success. This informational deficiency prevents the lender to claim recovery of his lending amount. This, Bakshi (2008) called as the Third Agency Problem the poor are facing. In this situation, the decision for the lending bank is very simple: not to take any risk by extending loan (Bakshi, 2008).

Agency problems, in this way, beget lack of formal financial institutions serving the poor. The problems become specially difficult when thousands of potential borrowers are unable to offer any seizeable collateral or when due to legal and social norms it becomes difficult for the lending institution to seize the collateral. These agency problems thus create inefficiencies by discouraging banks extending loans to the poor which group lending microfinance attempts to solve through the invention of joint liability and dynamic loan incentive.

The origin of microfinance dates back to 1970s. Although, there were earlier historical instances of cooperative finance and state sponsored finance in order to serve the rural peasant, it is 1970s when microfinance programs successfully revealed 2 notable characteristics namely, one, that poor people can be relied on to repay their loans and 2, that it is possible to provide financial services to the poor through market-based enterprises and without subsidy dependence.

Guinnane (2001) however, presented that the lending mechanism of Friedrich Wilhelm Raiffeisen's village banking in Germany in 1864 meet both of these above mentioned criteria. Guinnane shows that these village-based credit unions enjoyed both the information and enforcement advantages required to extend loans to the rural poor who are excluded from the formal bank loans (Guinane, 2001). It is also to be noted that the Caisse Populaire Movement founded by Alphonse Desjardins in the early 19th century in Quebec, also enjoyed the above mentioned characteristics (Roland, 1990). In the 1970s, however, a new wave of microfinance enterprises emerges. Solidarity group lending appears as an effective strategy lending the poor, pioneered specially by the 2006 Nobel Laureate (in Peace) Dr. Muhammad Yunus in Bangladesh at Grameen Bank. Microfinance institutions start operations extending loans in the remote rural areas, to the poorer of the poorest usually considered not creditworthy lacking pledgeable collateral, by extending loans without collateral.

The group lending methodology is, however, initially seen in the functioning of Rotating Credit and Savings Association (ROSCA) like savings and credit associations. The microfinance revolution later, however, strengthens and extends the scope of the group mechanism in lending the poor without collateral. ROSCAs are formed by a group of individuals who form a group and contribute a specified amount to a create group fund. Members decide how much they will contribute every period. The mechanism is that all the members are contributing a small amount at a time but the sum collected at a single period is given to one member to meet her investment demand. In the next period another member is given the total contributions made by all the members. In this way, all the members of a ROSCA are 'depositing' a smaller amount in each period but get the lump sum amount when it is her turn as a 'credit'. This explains the name rotating savings and credit associations (Bauman, 1979).

The basic advantage of the ROSCA is that it offers an opportunity for members to save and to borrow with mutual assistance. It gives opportunity to save if someone is not interested to borrow from the group fund. While it opens the door to the members to undertake bigger investment projects from their collective savings. Since, contribution to the group fund is regular; there is no additional worry of enforcement of the loan from the group fund by a member. ROSCAs are thus seen to exploit the information and enforcement advantages successfully.

The problem of adverse selection and group lending microfinance: The first agency problem, as we mentioned that for the traditional bank the problem in lending to poorer people with limited liability is that the bank lacks good information about the characteristics and riskiness of the borrower's project. Banks are therefore unable to discriminate between the safe and the risky borrowers and interest rates become high. The high rates of interest again drive the safe borrowers out of the credit market. The situation thus ultimately leads to market inefficiency, excluding the safe borrowers from the lending market.

Stiglitz and Weiss (1981), Maitreesh (1999) and Armendariz and Christian (2000) developed models on adverse selection which the banks traditionally face and indicated the way group lending addresses it. We can present the nature of adverse selection here and the resulting inefficiency for the banks in lending the poor lacking insufficient information. As evidenced in Armendariz and Jonathan (2005), suppose there are some investors who seek \$1 loan each to invest in their projects. Consider again that the kinds of borrowers are of 2: The 'safe' borrowers with a certain return $\underline{y}$ from their investments. Whereas, there are 'risky' borrowers with uncertain return, $\bar{y}$. To make the riskier project attractive suppose that the return from risky project is greater than that of the safe project, $\bar{y} > \underline{y}$, otherwise borrowers have no incentive to take the riskier project. Suppose the probability that the risky investment be successful is p, where $0<p<1$. The risky investment, when is successful yields $\bar{y}$, while if unsuccessful yields a zero return. Since, it is assumed that the borrowers have no collateral and protected by the limited liability, as we described in study, it is clear that the risky borrower can not repay the loan if her investment project is unsuccessful. We assume further that the expected returns from the investment projects are same for both risky and the safe borrowers, i.e, $\underline{y} = \bar{y}p$. Suppose that the cost of lending \$1 for the bank is k and the expected returns are greater than that in order the investment projects to be feasible, i.e., $\underline{y} = \bar{y}p > k$. If there were only the safe borrowers in this economy, assuming no information asymmetry as we have discussed in the study, safe borrowers will always earn a secure return and will pay back with certainty, yielding that the competitive interest rate for the banks would be certainly equivalent to k. But the problem for the bank is that there are both risky and safe borrowers and lacking information it can not distinguish the safe borrowers from the risky borrowers and consequently the interest rate goes up to $R_b>k$ irrespective of the borrower's type. In this scenario, if the share of safe borrower is q and the share of risky borrower is 1-q then it implies that:

$$k = [q + (1\text{-}q)\, p]\, R_b \tag{1}$$

Solving the equation we get:

$$\begin{aligned} R_b &= k/[q + (1\text{-}q)\, p] \\ &= k\,[\,1 + (1\text{-}q)\,(1\text{-}p)]/[q + (1\text{-}q)p] > k \end{aligned} \tag{2}$$

Thus, the information asymmetry leads the bank to charge an inefficient interest rate of $R_b(>k)$ to all borrowers, irrespective of the borrowers whether safe or risky.

The problem aggravates when R_b exceeds returns of the safe borrowers and consequently they are just excluded from the lending mechanism. This happens if $\underline{y} < R_b < \bar{y}$ and the bank's information problems preclude the safer borrowers inefficiently. The bank in this situation, finances only the risky borrowers and since, $p<1$, the bank can not expect full recovery of its lending amount.

Group lending microfinance with joint liability can mitigate this inefficiency. As Maitreesh (1999) shows that, facing joint liability for loans, the safe borrowers will form group with safe types only avoiding risky types carefully. The risky borrowers, similarly, have no alternative but to form groups with other risky types, leading to a segregated outcome.

To present the model, Maitreesh (1999) considers following assumptions:

- Borrowers know each other types whereas the lender does not know due to information asymmetry.
- Banks can only see the outcome of a investment project when the project is realized but can not see the magnitude of the return.
- Borrowers can not default once the project is successful and the cost of enforcing repayment is negligible.
- Borrowers have no wealth to offer as collateral and non-financial punishment or social sanction is also excluded in case of any default.

Now suppose that there are 2 forms of loan contracts: individual liability contract and joint liability contract. With individual liability contract, repayment obligation for the borrower is k when her project is successful. If her project is a failure, she is not paying, as by assumption, she has no initial wealth and is protected by limited liability. On the other hand, under joint liability contract, individual borrower is obliged to repay her own loan burden of k and in addition she has to consider that some of her fellow peer can default and consequently she has to shoulder a joint liability component l, for each of her fellow defaulting peer, if any. However, the borrower in this case, too is not repaying anything if her project is unsuccessful by limited liability. Assume now that the bank offers a contract with interest rate k and an amount of joint liability component l to the borrowers. Borrowers are now in a position to choose their peer in order to secure and share the loan contract.

Now suppose that the success of a borrower with joint liability is given by p and that of her partner is given by p'. Expected payoff of this borrower in this case is:

$$EU_{p,p'}(k, l) = p\,p'\,(Y(p) - k) + p\,(1 - p')\,(Y(p) - k - l) = pY(p) - \{kp + lp\,(1 - p')\}$$

Given this scenario, Maitreesh (1999) establishes the following property of joint liability.

Lemma 1: A borrower of any type prefers a safe partner, but the safer the borrower herself, the more she values a safer partner.

Proof: Suppose that a borrower with probability of success p can choose her partner from a group of potential borrowers with probability of success p' and p''. If she chooses her partner with probability p', her expected payoff will be $Eu_{p,p'}(k, l)$.While, if her partner has the probability p'' her payoff is $Eu_{p,p''}(k, l)$. The difference in expected payoff for the borrower in this case is:

$$Eu_{p,p'}(k, l) - Eu_{p,p''}(k, l) = k\,l\,(p' - p'')$$

If p' > p'', this differences in expected payoff will be positive and borrower will certainly prefer to have a partner with probability of success p'. The borrower in such a case, will be willing to pay a strictly positive amount to have the borrower whose probability of success is p'. But the maximum amount a borrower of type p is willing to pay to have a partner of type p' over a partner of type p'', kl (p'- p''), is increasing in her own probability of success. This implies that the expected gain from having a safer partner is realized only when the borrower herself is successful and hence, is higher the safer her type (Maitreesh, 1999).

Suppose now that there are groups with same types of borrowers: some homogenous groups with the risky borrowers only and some other groups with the safe only borrowers. Since, the difference of expected payoff, pl (p'- p''), having a partner of type p' over a partner of type p'' is strictly positive, a risky borrower might be interested to have a safe partner by offering her a positive side payment. It is evident that the expected gain for a borrower of type p' when she is leaving her fellow peer and replace by a borrower of type p is given by l p' (p- p'). Conversely, the expected loss for the borrower of type p in this case, is l p (p- p'). Since, we assumed that $p' < p$, by lemma 1, it follows that the expected loss in this case, is greater than the expected gain, i.e, $l\,p\,(p - p') > l\,p'\,(p - p')$ and consequently any potential attempt of transferring the borrowers is inefficient. This implies that a risky borrower can not offer a sizable amount of side payment to attract a safe borrower and attempt to do that is not feasible, that is, the homogenous groups remain intact discarding any potential reorganizing. Now suppose that the groups are random and each of these groups have mixed numbers of borrowers with probability p and p′. In this case, by lemma 1, if the 2 borrowers of type p wish to leave their groups, their existing peer (type p′ in this case) will not be able to profitably hold them in their respective groups by offering sufficient side payments. In conclusion we thus see that a safe borrower with a certain probability of success prefers and is willing to have a safe partner. Being unable to attract and to pay a safe partner, a risky borrower is ultimately forced to form a group with a similar risky borrower. The safe borrowers are thus forming group with the safe ones and the risky borrowers with the risky types leading to a segregated outcome.

Since, investment projects undertaken by risky borrowers fail more often and the safe borrowers by definition earn a safe return, risky borrowers, with this segregated outcome, have to repay for their defaulting peer very often under group lending with joint liability. Safe borrowers no longer have to shoulder the burden of default by the risky types. Ultimately, this transfers the risk from the bank to the risky borrowers themselves. It also means that, effectively, the safe borrowers pay lower interest rates than the risky types, because they no longer have to cross subsidize the risky borrowers. In present study, we see that due to the first agency problem, i.e., the adverse selection problem, safe borrowers were inefficiently pushed out of the market for high interest rates. Here, in contrast, reduction of effective interest rate faced by the safe borrowers further encourages them to reenter into the market, mitigating the market failure. The case is further formalized in Armendariz and Jonathan (2005).

As Armendariz and Jonathan (2005) explained, let us suppose that there are 2 borrowers forming a group. Suppose also that $\bar{y} > 2R_b$. That is, if the project of a risky borrower is successful she can repay the entire loan of her group ($2R_b$) under joint liability contract. Since, the probability that the risky project is successful is given by p, the probability that she is unlucky is (1-p). It implies that the probability that both the risky borrowers are simultaneously unlucky is $(1-p)(1-p) = (1-p)^2$. The probability that any one of the risky borrower is lucky, or both of them are lucky and the bank is fully repaid is thus can be denoted by, $g = 1-(1-p)^2$. As earlier, the probability that the safe borrowers will repay is 1. For the bank, expected repayment from a particular borrower, irrespective of whether she is risky or safe, is thus:

$$[q + (1-q)\,g]\,R_b \tag{3}$$

Equation (3) implies that the bank can expect repayment R_b with certainty from the safe borrowers' group, of which probability is q, while it can expect repayment R_b only g proportion of time from the remaining (1-q) portion of the risky borrowers. Now, suppose that the expected repayment covers the lending costs of the fund, k, i.e., $k = [q + (1-q)\,g]R_b$. Rearranging it for the repayment R_b gives us,

$$R_b = k/[q + (1-q)\,g] \tag{4}$$

Now comparing with the interest rate in Eq. (2), $R_b = k/[q + (1-q)\,p]$ we can see that $R_b = k/[q + (1-q)\,g] < k/[q + (1-q)\,p]$. This is evident since, $g = 1-(1-p)^2 > p$. This implies thus that the interest rate under joint liability group lending is smaller than that of in the individual lending. The interest rate is smaller under joint liability group lending comes from the fact that with $\bar{y} > 2R_b$, the risky borrowers can repay their loans for their fellow peer even if someone fails and someone succeeds. The probability of getting repaid for the bank is higher under joint liability than under individual lending. For example, if one risky borrower is successful and one is unsuccessful then under joint liability the bank will still be repaid $2R_b$. But it can expect only R_b in the same scenario while lending individually. Under joint liability the bank can thus reduce the interest rate in an efficient level to bring back the safe borrowers who are out of market due to high interest rate in individual lending.

It is thus evident that the group lending contract eliminates cross subsidization of the risky borrowers at the cost of the safe borrowers. Even if the bank and the borrowers as well are unaware about the type of the borrowers, assortative matching induced by the group lending contract renders a situation in which safe borrowers effectively pay less and risky borrowers pay more interest rate. It thus brings back the worthy safe borrowers into the market and restores efficiency.

Peer monitoring: Addressing the second agency problem: The second agency problem, as we explained in the study, relate to moral hazard that arise when lenders can not observe the effort made by the borrower in her project. The efforts (and the realization of project returns) would not be problem if the borrowers were not protected by limited liability (i.e., by only the current flow of income) and that the borrowers have no collateral. In th research, these moral hazards compel formal financial institutions to exclude the poor from their credit network. Group lending mechanism in microfinance solves these problems and let the MFIs to serve the poorer successfully. In this sub-section, we will look into the models of group lending that address the second agency problem facing the poor.

Ex-ante moral hazard: When the efforts delivered by the borrowers in the investment project are not subject to observe by the lender, we call it ex-ante moral hazard, which is the second agency problem. These ex-ante moral hazards affect the probability of realizing potential project returns. Following Armendariz and Jonathan (2005), suppose that the investment project is again a \$1 one time project. When loan is made, there is always possibility that the borrower can extend effort in her project or can shirk, since, there is no way for the lender to monitor. Assume that the project is safe and if the borrower puts efforts in her project, she can make profit y with certainty. On the other hand, if she shirks her profits will be uncertain. Suppose that the probability that she will earn a positive profit y while she is shirking is p and clearly our discussion follows that $p<1$. Suppose c is the opportunity costs if she extends effort in her project (e.g., working as a wage labourer) and repayment is R. It is assumed that $R>k$, since, repayment R can not be lower than the cost of capital k. Since, we have assumed limited liability and that the borrower has no collateral, it follows that repayment will occur only when borrower's project is a success.

The net returns for the borrower if she works is the project return which is safe and certain deducted by the repayment obligation and her opportunity costs $(y - R - c)$. If she shirks, her expected return is the project return minus gross repayment times probability that she will earn a positive return despite shirking, $p(y - R)$. Borrower's choice of working is thus straightforward, she will work only if $(y - R - c) > p(y - R)$. By rearranging for R we get,

$$R < y - [c/(1-p)] \tag{5}$$

Equation (5) implies that the borrower is not extending effort if the gross interest rate R is greater than y - [c/(1-p)]. In that case she has no net return for her effort and she will prefer to shirk thereby.

Suppose now that the lending cost for the bank is k and (y-c)>k. That is, if the borrower extends efforts there is positive net return with certainty. In a competitive scenario the bank would extend a loan and the borrower will extend her effort and make a positive net return. However, the bank can not monitor whether the borrower is extending her effort or not. Since, by assumption the borrower is not repaying anything (due to limited liability) if the investment turns down there might be the tendency that the borrower can shirk, which is evident by the fact that the expected return for the shirking borrower p (y - R) is positive. The problem further aggravates if the cost of fund k is such that (y-c)>k> y - [c/(1-p)]. The gross interest rate will be then R>y-[c/(1-p)] and in such a case and by Eq. (5), the borrower has no incentive to extend efforts. Obviously, this will ultimately halt the bank from extending loans leading to a market failure.

The joint liability group lending contract allows the market to work out effectively solving this problem. Stiglitz (1990) formalized a model explaining how joint liability group lending promotes peer monitoring to solve the ax-ante moral hazard problem financing the poor. Armendariz and Jonathan (2005) presented an adaptation of this model. Accordingly, suppose that in a 2 person group, if both extend effort, they can pay back loans with certainty and enjoy a positive net return (y -R -c) by each. However, if both of the borrowers are shirking, the probability that they can repay their entire repayment obligation 2 (y - R) is $p^2<1$. We further assume that if one of them is successful, by joint liability, she will repay the entire joint obligation leaving her no surplus. In this situation, joint liability requires that, for the borrower, positive profits can only be attained when both projects are successful, which could be ensured only when both of the borrowers extend efforts, implying that:

$$2\,(y - R - c) > p^2 2\,(y - R) \qquad (6)$$

Equation (6) implies that the sum of benefits of the 2 borrowers from extending effort in their designated investment project must be greater than the sum of benefits from shirking. That is, a positive benefit is rewarded to each of the borrowers if only both of them put effort on their respective projects and monitor over other's so that the fellow peer is also successful. Joint liability thus ensures peer monitoring over each other, solving the 2nd agency problem as we mentioned in the study and both the borrowers are better off.

For the MFIs, equivalently Eq. (6) means, by rearranging, the gross interest rate is:

$$R < y - c/(1-p^2) \qquad (7)$$

Now, since, p<1, it follows that $p^2<p$. This in turn implies that $(1-p^2)> (1 - p)$. Equivalently, this implies that for the bank interest rate under joint liability given in Eq. (7) is larger than that of in the absence of joint liability, R<y-[c/(1-p)], given in Eq. (5). The bottom line is quite convincing: peer monitoring, induced by joint liability group lending thus produces higher gross interest rate for the MFIs and the market is correctly functioning.

Addressing the third agency problem: ex-post moral hazard and strategic default: The ex-post moral hazard refers to the 'enforcement problem' when the project return is realized, that is the third agency problem as we described. Even if everything goes perfect and the investment project yields a good return, the borrower may decide not to repay: 'to take the money and run'. This is quite natural when lenders can not observe borrower's profit and the borrowers are protected by limited liability. The borrower in that case might falsely claim a loss in her investment project and default in repayment. There might also be the case that potential borrowers can migrate and easily change her identity and the legal enforcement is too weak. In such an extreme case, there will be no loan at all from the lender's viewpoint.

Armendariz and Jonathan (2005) nicely formalized this problem. Accordingly, suppose that the investment project again requires \$1 investment and yields a safe return y. Suppose that, the borrower possesses and offers collateral of wealth w, it is evident that lending contract is individual in this case, bank charges an interest rate of R to break even and the probability that the case of 'default' can be verified is s. Now, if the borrower repays her loan, her payoff is y+w-R, that is, her net payoff in this case is the sum of her return from the project plus her initial wealth deducted by the repayment obligation. While if she does not repay it is (1-s) (y+w)+sy. Since, s is the probability that the case of strategic default be verified, 1-s is the probability that the default can not be verified. Hence the term (1-s) (y+w) represents the amount if she is able to default strategically and she can keep her wealth intact along with the project return. She is lucky in this case to keep her revenue plus wealth intact. While the term, sy, represents the amount if she is caught from verification of her project outcome and consequently her wealth is confiscated. All these imply that the borrower will think to default strategically when y+w-R>(1-s) (y+w)+sy. Solving this we get R<sw. This implies that

gross interest rate can not exceed the wealth times probability of confiscating that wealth to curb the ex-post moral hazard, that is, gross interest can not exceed the amount of expected confiscated wealth. The implication is very significant. If the borrower has no wealth at all (i.e., $w = 0$), or the probability of confiscating the wealth is fairly small (e.g., for limited liability this is zero), i.e., $s = 0$, there will be no loan available, since, R can not be negative. This implies that the lender can not enforce repayment from the poor who has no collateral since, borrowers are not jointly liable and have no collateral too. In this case, the decision for the bank is very simple: not to extend loan at all.

Joint liability group lending, however, solves this problem. It induces each borrower to monitor actual profit realized by her fellow peer and thereby can ensure repayment. Following Armendariz and Jonathan (2005), suppose that q is the probability that a borrower can monitor the profit realized by her peer. Suppose that monitoring cost is m and let d denote the social sanction to be applied if a borrower defaults and is caught. Now with gross interest R, a borrower will repay if:

$$y - R > y - q\,(d + R) \tag{8}$$

that is, if

$$R < [q/(1 - q)]d \tag{9}$$

This implies that the bank can extend loans up to $[q/(1 - q)]d$. It is evident that having no joint liability and the resulting peer monitoring, $q = 0$, implying that there is no lending at equilibrium. With joint liability, we have $q>0$ and the market is perfect. What we need is a credible threat of social sanction that induces borrower to monitor over her peer's profit.

One limitation of this model is that it requires imposing a social sanction or a credible threat of its potential use. This is an additional institution to joint liability group lending and in this discussion the role of joint liability group lending itself to overcome the third agency problem is unclear thereby.

Besley and Coate (1995) however, developed a model to challenge the third agency problem. Ahlin and Townsend (2007) later presented an adaptation of this model. In their adaptation, let that the borrowers chose to invest a $1 investment projects each and the investor extends loan to the borrowers. Let again that the investment projects are successful and the problem arises when it is the time for the borrowers to repay. Since, borrowers are protected by limited liability, as we have discussed in the study, borrowers can repay the loan or can default. The gross interest rate in this model is r, including capital and interest. Financial costs of repaying are therefore equal to r, while if borrowers are defaulting there are threats of potential official penalties from the lender and unofficial penalties from her fellow peer.

Suppose that 2 borrowers are forming a group. Suppose further that borrower's returns (Y) are given by a distribution $[0, Y_{max}]$ and repayment decisions are independent. Since, the lending contract is assumed jointly liable, the lender is supposed to impose an official penalty to each of the borrower whenever he is not securing the entire group repayment, 2r. Both the delinquent borrower and the repaying borrower are thus equally punished officially in case of a default. Let that this official penalty is proportional to borrower i's output, i.e., $c^{o}(Y_i)$. In their model, Besley and Coate also assumed that this official penalty is no longer greater than the borrower's return, Y_i. All these imply that, for a borrower, willingness to repay the loan is proportionate to her project return. The higher the return is the greater is the willingness to repay and vice versa. Given this scenario, the authors define a cut-off function such that,

$$Y(r) = (c^{o})^{-1}(r) \tag{10}$$

Since, penalty is proportional to borrower's return, borrower is more inclined to repay when $Y \geq Y(r)$ and will delinquent when $Y<Y(r)$. Conversely, the lender is penalizing more than r when return is greater than Y (r) and vice versa.

Given this context, we can chalk out conditions under which the group as a whole will repay the loan. Accordingly,

- when $(Y_i, Y_j) < Y(r)$, the group will default,
- when $Y(r) \leq (Y_i, Y_j) < Y(2r)$ the group will repay,
- when Y_i or $Y_j > Y(2r)$ the group will repay
- when $Y_i < Y(r)$ and $Y(r) \leq Y_j < Y(2r)$ the decision is uncertain.

The cases mentioned above are consistent with the model we have presented so far. In case, the group will find it profitable not repaying since, each of the borrower's returns is lower than the repayment requirement. Official penalties become ineffective in this case to enforce repayment. In case, each borrower will simply wish to repay in order to avoid the harsh penalties, since, $Y>Y(r)$ and the potential penalties could be higher than the repayment obligation. The group will repay too in case, since, both Y_i and Y_j can bail out individually the entire group repayment obligation. Borrowers will repay in this case in order to avoid the official and unofficial penalties which are increasing in project return and in case and borrowers are in a situation of conflicting interest and group repayment is uncertain thereby. In this case, borrower i prefers not to repay while borrower j will favour to repay. The group will, however, ultimately default in this case since, it is beneficial for borrower i to default while borrower j can not repay the entire repayment obligation. Given this scenario, Besley and Coate (1995) proposed an unofficial penalties on borrower i who is defaulting. Accordingly, if the unofficial penalties are severe enough, the delinquent borrower will be in pressure to repay the loan, while if it is weaker she will default with certainty.

Now, let us define the unofficial penalties by $c^u (Y_i, \Lambda_j)$, implying that it depends both on the defaulting borrower's return (Y_i) and on the willingness to repay by her fellow peer (Λ_j) which in turn depends on the later's project return, Y_j. Considering all these official and unofficial penalties, we can now construct a new cut off output level for optimal repayment. Let for borrower i it is denoted by $\hat{y}$ (r, Y_j), which is inversely related to her fellow peer's willingness and ability to repay. This is because the higher her fellow peer's willingness to repay, the greater is the potential unofficial penalties, so the lower is the cut off output, $\hat{y}$, to ensure repayment and vice versa. Thus, considering both the official and unofficial penalties, we can see that, default for the group occurs, when

- Output for both borrowers are not enough to repay $(Y_i, Y_j) < Y(r)$.
- When for j, $Y(r) \le Y_j < Y(2r)$ and for i, $Y_i < \hat{y}(r, Y_j)$.

For the second case here, borrower i simply prefers not to repay as she is below the cut off level of output to repay the loan and borrower j is unable to bail out the entire joint obligation. While, for the first case, both of them are better off from defaulting.

We can now define the repayment rate p considering all these facts as:

$$P = 1 - \{F[Y(r)]\}^2 - 2\int_{Y(r)}^{Y(2r)} F[\hat{Y}(r, y)]dF(y) \quad (11)$$

It follows from Eq. (11) that the repayment rate is higher when both the official and unofficial penalties are higher and vice versa. This is also to note that unofficial penalty itself is higher when official penalty is higher. This is because when official penalty is higher it increases willingness of borrower who has Y>r to repay to avoid harsh official penalties. This in turn induces her to impose higher unofficial penalties on the delinquent borrower to enforce repayment.

Now assume that the borrowers can cooperate and enforce repayment agreements costlessly. Assume further that the utility is transferable and additive, so that the borrowers are trying to maximize their payoffs in total conditioned on the sum of the official penalties (since, unofficial penalty is absent with cooperation). We thus have:

$$c^o(Y_i) + c^o(Y_j) \ge 2r \quad (12)$$

That is, borrowers are considering to repay when the sum of official penalties is greater than the entire repayment obligation. The cooperative repayment rate in this case is:

$$P = 1 - \{F[Y(r)]\}^2 - 2\int_{Y(r)}^{Y(2r)} F\{Y[2r - c^o(y)]\}dF(y) \quad (13)$$

which follows that, the cooperation leads to the unofficial penalties unused and thus affects repayments.

Cooperation, in this model, lowers repayment rate if unofficial penalties are greater than the non-defaulting borrower's loss from default and vice versa. Accordingly, the cooperative setup is isomorphic to the non-cooperative case where $c^u(Y, \Lambda) = \Lambda$. In the non-cooperative case, if unofficial penalties are stiffer the low-output borrower will repay to avoid the unofficial penalties even though the output is such that official penalties are less than 2 r. While, if the group is acting cooperatively so that the stiffer unofficial penalties are unused, the low-output borrower could compensate her partner for her loss Λ not repaying the loan and still she might have some surplus to be shared. Cooperation thus seems to lower repayment in this case.

The limitation of this model is that it brings additional institutions (official and unofficial penalties) to joint liability group lending. According to this model, it is not the joint liability per se but the sanctions that are important to overcome ex-post moral hazard. Furthermore, if we assume that borrowers are protected by limited liability, it is very uncertain what kind of official penalties we can impose to defaulting borrowers. The same is true for unofficial penalties: what kind of unofficial penalties will be used and in what way this can be imposed are not clearly specified. However, the importance of the model is that it presents mechanism under which joint liability group lending addresses ex-post moral hazards and thereby shows an way how MFIs can work lending the poorer people without collateral.

RELAXING JOINT LIABILITY: INNOVATIONS IN GROUP LENDING MICROFINANCE TO ENFORCE REPAYMENT

Group lending microfinance experiences a variety of recent development in its lending methodology. A distinguished feature of the group lending microfinance is that borrowers are rewarded with dynamic loan incentive, that is, borrowers are provided increasing amount of loan access for their successful repayment of earlier loans. Once borrowers are repaying their loans, they are allowed larger loans suitable to carry out large scale investment projects yielding higher returns in turn. Skilled borrowers, looking for maximum possible returns, are therefore inclined to repay their initial loans in order to secure the subsequent larger loan contracts. Dynamic loan incentive, in this way, works as a successful enforcement mechanism for the microfinance institution.

The theoretical models we have presented in the study, confirm that joint liability group lending leads to effective screening, monitoring and enforcement among group members. In this study, we are discussing theoretical models presenting how dynamic incentive works to ensure repayment. We are particularly presenting the progressive lending model by Dominik (2004) and dynamic incentive model by Tedeschi (2006).

Progressive lending as a repayment mechanism: Under progressive lending loans start with small amounts which increase over time when borrowers repay in time. Progressive lending works as an enforcement mechanism in a way that borrowers looking for new and larger loans with potential increasing returns have to repay the earlier loans as a prerequisite.

Dominik (2004) presented a model describing how progressive lending enforces repayment. He assumed in his model that:

- Loan applicants are not able to provide collateral.
- Loan amounts are smaller at the beginning which increases over time.
- Investment projects are divided into different phases instead of a single period financ.
- There are different types of borrowers: the ‘deadbeat’ who can take the money and run and the ‘good debtor’ who repays loan obligation when her project succeeds.
- Borrowers know their type but the investor does not, although, he knows the proportion of good and bad debtors in the population.
- Borrower knows her project profitability but she has no initial wealth.

Taking all these assumptions, Dominik (2004) showed that progressive lending mitigates deadbeat risk and enforces repayment.

The model: Suppose that we have an investment project that consists of 2 subprojects, A and B. We assume that project B requires bigger investment than project A, that is $k_B>k_A$ where, k_i is the amount of investment in project i. Suppose further that the return of the investment project, π_j is safe and certain. By assumption, mentioned above, we have 2 types of entrepreneurs: the deadbeat and the good debtor. Now suppose that $P_0 \epsilon [0, 1]$ is the probability that the entrepreneur is good and she will repay. Suppose, on the other hand, that $1\text{-}p_0$ is the probability that the entrepreneur is bad and she will default strategically when default is beneficial. By assumption, the investor knows only the probability of repayment p_0 at the beginning of a period. Suppose that $\beta \epsilon$ [0, 1] is the probability that a bad entrepreneur repays r_1. Total probability of receiving repayment r_1 in period 1 then can be given as $q = p_0+\beta (1 - p_0)$.

Indivisible project: Dominik (2004) divides his model into different sub-sections: indivisible project, small projects with given sequence, small projects with any sequence and finally divisible large scale projects Suppose here that the investment project is indivisible which yields a certain return $\pi>k$. By assumption a good entrepreneur will always repay but repayment of the bad entrepreneur is uncertain. The investor will extend a loan when his expected repayment p_0r is no less than his investment k; so that $p_0r\geq k$ or $r\geq k/p_0$. Conversely, repayment r can not exceed the project return π since, we have assumed that the borrower has no initial wealth and protected by limited liability; i.e. $r\leq\pi$. These 2 constraints require that $p_0\geq k/\pi = \Delta$. In this case, a good entrepreneur will propose a repayment $r = k/p_0$ which maximizes her income π-r. A bad entrepreneur will obviously follow the good entrepreneur to conceal her type. This is because if the bad entrepreneur proposes repayment $r<k/p_0$ this will be unacceptable to the investor, while if she proposes $r>k/p_0$ it will reveal her intention. There is no way therefore for the bad entrepreneur than following the good entrepreneur.

We can now derive conditions under which an investor will accept or reject a proposed repayment r, denoted by $\gamma^* \epsilon [0, 1]$. Clearly,

$$\gamma^* \{ = 0 \text{ if } r<k/p_0, \quad \epsilon[0, 1] \text{ if } r = k/p_0 \text{ and } p_0 = \Delta, \quad = 1, \text{ if } r>k/p_0 \text{ and } p_0>\Delta, \} \quad (14)$$

Accordingly, the investor will definitely decline a proposed repayment when $r<k/p_0$, that is when his expected repayment is smaller than his investment. While he accepts with certainty if the expected repayment is clearly larger than his investment, $r>k/p_0$ and $p_0>\Delta$. Finally, when $r = k/p_0$ and $p_0 = \Delta$ probability that he will accept the proposed repayment is positive but less than 1. That is, there exists positive probability in this case that the investor will accept the proposed repayment but the probability is not certain. It is evident that both the investor's and the entrepreneur's payoffs are positive when π k/p_0. However, since, by information asymmetry the entrepreneur is in a dominant position, she offers repayment $r^* = k/p_0$ so that the investor is just accepting the contract while maximizing her payoff π-r.

Small projects with given sequence: In this study, we assume that there are 2 sequential projects A and B. Suppose that project sequences are given, for example project A can be taken first following by project B. Suppose that project A has been undertaken; now if the entrepreneur repays r_1 she will be rewarded with project B which yields B with certainty. On the other hand if she defaults she can retain entire profit π_B at the moment and will loss nothing, since, borrower requires no collateral by assumption. Clearly, she will default when repayment cost π_A in the first period exceeds the potential profit π_B in the second period. This implies that the probability that a bad entrepreneur will default:

$$\beta^* = 0 \leftrightarrow r_1>\pi_B$$

Borrower defaults in this case as the reputational rent is negative, π_B-r_1<0, that is, there exists no incentive to build reputation in the first period. On the other hand a bad entrepreneur repays in the first period when her potential return from the next period is no less than the repayment obligation in the first period, that is when $r_1 \le \pi_B$. In this case she repays in the first period in order to secure a second period contract. Her net profit in this case is π_B-r_1. With $p_0 \ge \Delta_B$, she will choose $\beta = 1$ to make sure the second-period contract.

Consider now the contracting problem in period 1. Suppose that the investor expects repayment of q^*r_1 where q^* denotes probability that the entrepreneur will repay. He must seeks a repayment that is no less than his investment, k_A, i.e.,

$$r_1 \ge k_A/q^* \tag{15}$$

Since, we have assumed that the entrepreneur has no initial wealth, repayment can not be larger than the project return,

$$r_1 \le \pi_A \tag{16}$$

Given this scenario, Dominik (2004) derives conditions for a reputational equilibrium in which repayment probability is $\beta^* \epsilon$ (0, 1). Accordingly, repayment probability less than 1 implies $\beta^* = \overline{\beta}$ and is possible only if the reputational rent is nonnegative; i.e.

$$r_1 = \pi_B \tag{17}$$

so that (π_B- r_1)≥0 and if the choice of β^* matters, $p_0<\Delta_B$ Eq. (15-17) are compatible if and only if:

$$\min\{\pi_A, \pi_B\} \ge r_1 \ge \frac{k_A}{p_0}\Delta_B \tag{18}$$

implying

$$p_0 \ge \max\{\Delta_A, \Delta_B, \frac{k_A}{p_0}\Delta_B\}.$$

Suppose all conditions stated so far are fulfilled. Then if the good entrepreneur is to choose a contract promising a repayment r_1 satisfying Eq. (18), she will choose r_1 as low as possible in order to maximize her income. Hence she proposes $r_1^* = k_A/p_0 \Delta_B$ A bad entrepreneur is forced to mimic the good type as any other proposal would reveal her true type. And at the end of the first period, probability that the deadbeat borrower will repay is $\beta^* = \overline{\beta} \epsilon (0, 1)$.

Dominik (2004) further derives conditions under which a pooling equilibrium exists so that $\beta^* = 1$, that is, borrower repays with certainty. Accordingly, repayment probability $\beta^* = 1$ also requires that the pooling rent is nonnegative ($r_1 \le \pi_B$) but the choice of β^* does not matter ($p_0 \ge \Delta_B$). From Eq. (15-17), this implies, $\min\{\pi_A, \pi_B\} \ge r_1 \ge k_A$. Given these conditions, a good entrepreneur will offer r_1 as low as possible in order to maximize her income. Hence, she offers $r_1^* = k_A$. Again, a bad entrepreneur is forced to follow the good entrepreneur to hide her type. At the end of the first period both the good and the bad entrepreneur will repay with certainty, in this case, in order to secure the second period contract.

We can now see the conditions for the separating equilibrium ($\beta^* = 0$), that the entrepreneur defaults with certainty. According to our assumption, repayment probability is 0 when $r_1>\pi_B$, that is, second period's profit is smaller than the first period's repayment obligation. In this case default is more attractive than repayment since, reputational rent π_B-r_1<0. From Eq. (15-17) it follows that $\pi_A \ge r_1 \ge k_A/p_0$, such that $p_0 \ge \Delta_A$. In this case, a good entrepreneur will propose $r_1^* = k_A/p_0$ and the deadbeat entrepreneur will follow her. At the end of the first period the deadbeat borrower will default with certainty since, $r_1>\pi_B$.

Small projects with any sequence: Suppose now that the projects can be taken in any sequence. Entrepreneur can choose to take project A at the beginning followed by project B or she can choose the reverse. Suppose for simplicity that the sequence {A, B} is taken where $\pi_A<\pi_B$. From the condition of reputational equilibrium mentioned above it follows that there exists equilibrium with $\Delta_B>p_0\geq$ max $\{\Delta_A,\Delta_B,\ k_A/\pi_B\ \Delta_B\}$. Since, we have assumed $\pi_A<\pi_B$ it thus follows that the deadbeat entrepreneur would be more interested to secure project B. Therefore, if project B is financed first she will default with certainty. However, if project A is taken first, there exists positive probability that she will repay in order to secure project B contract.

Divisible large-scale project: Suppose now that the investment project is large enough but divisible. Suppose further that the project requires investment of k_A+k_B rendering profit $\pi_A+\pi_B$. As we see in case of indivisible project, the investor will accept an offer to invest k_A+k_B if $p_0\geq (k_A + k_B)/(\pi_A + \pi_B) = \Delta_{ND}$. If $p_0<\Delta_{ND}$, the investor should divide the project into 2 sub projects A and B. In this case, as we have already discussed in the previous section, if $\pi_A<\pi_B$, the investor should postpone project B for the second period while financing project A at the beginning. Otherwise, if project B is financed first, given that $\pi_A<\pi_B$ there exists no incentive for the deadbeat borrower to repay at the end of the first period and she will default with certainty.

In this research, we thus see that progressive lending eliminates deadbeat risk conditioned that investment projects can be split up and the more profitable project can be postponed for the later periods. It thus shows that if projects are not divisible, or sequential, progressive lending is not working. Furthermore, if the more profitable subproject can not be postponed for later investment, progressive lending can not ensure repayment. However, if these 2 conditions are met, progressive lending can ensure repayment even without collateral requirement and in the absence of joint liability. The implication of this model is that if lender can distinguish projects in terms of potential returns and if he can postpone the high-profit subproject for later investment, a deadbeat borrower even can be forced to repay. Progressive loan incentive in this way acts as a successful enforcement mechanism that eliminates risk of default. We thus, see that as long as $\pi_A<\pi_B$ and $r_1 \leq \pi_B$, there exists positive probability that the borrower will repay when her project succeeds in the first period.

Dynamic loan incentive to enforce repayment: Tedeschi (2006) showed how dynamic incentive enforces repayment. The model consists of a single microfinance lender and a group of borrowers. The lending portfolio is a repeated lender-borrower relationship. At the start of the game borrower and lender enter into a lending phase. A successful repayment is rewarded by a larger amount of loan. However, if the borrower defaults there comes a punishment phase where no further loans are extended. After the punishment has been served, borrower returns to the lending phase, with prior unpaid debts forgotten or with some partial repayment. One of the implications of this model is that it is not necessary to permanently refuse borrowers from lending who default. The optimal length of punishment is thus less than infinity but more often strictly positive.

To explain the model, Tedeschi (2006) assumes that:

- Borrowers have similar projects but differ in the level of risk they face.
- The lender is assumed to be non-profit making, just covers its break-even while maximizing borrower's payoff.
- There is only a single lender or there exists sharing of credit information between lenders so that borrowers can not access further loan once she defaults.
- Default can both be strategic and due to negative economic shock. The lender is unable to distinguish between strategic default and default due to economic shock.
- A negative economic shock necessarily result in default since, borrower has no initial wealth.
- Economic shocks are unanticipated and uncorrelated across borrowers.

With all these assumptions, let us consider now that α_i is the probability that a borrower will default and $(1-\alpha_i)$ the probability that she will repay. We have already assumed that the borrowers are different in risk but similar in projects and loan demands. In this context, suppose that β_0 denotes low risk borrowers and $(1-\beta_0)$ are high risk, with $\alpha_R>\alpha_S$. Suppose that there is information asymmetry: individual borrowers know who are safe and who are risky while the lender only knows the distribution of the borrowers. That is, the lender can only see the chance of repayment but can not see who are who: who is repaying and who not. We assume that the punishment phase is denoted by T periods. Let that T is large enough to discourage strategic default. It thus follows that T is finite and we are not excluding a defaulting borrower permanently from lending contract. Whereas, if T is fairly small, borrower may not consider it something harsh, that leads punishment to be ineffective. We assume further that r denotes interest rate so that the borrower has to repay (1+r) B if she borrows a loan amount of B in the lending phase. The borrower, if successful, earns wB and repays (1+r) B. By assumption, the repaying borrower is rewarded by a new loan. On the other hand if she defaults, she will enter into the punishment phase being denied from accessing subsequent loan. However, as we already have mentioned, borrower can return to the lending phase when her punishment term is over.

Suppose that V_i^+ is the payoff at the beginning of the lending phase and V_i^- is the payoff at the beginning of the punishment phase. It thus follows that:

$$V_i^+ = (1-\alpha_i)[\,(w-(1+r))\,B + \delta\, V_i^+] + \alpha_i \delta\, V_i^- \qquad (19)$$

where, the first term is the payoff if the borrower repays, probability of which is $(1-\alpha_i)$. The second term is the payoff if she is not repaying and enters into the punishment phase and $\delta$is the discount factor of expected payoff in the following period.

As we already mentioned, there is no loan for a defaulting borrower in the punishment phase. However, since, the punishment phase is not infinite, she can be back to the lending phase after the punishment time. Thus, she can seek loan in the T+1st period or in T+2nd period or later. Since, access to loan is competitive, let γdenotes the probability that a borrower secures a loan in the T+1st period, γ (1-γ) for T+2nd period and so on. The payoff in the punishment phase is thus:

$$V_i^- = \gamma\delta^T V_i^+ \sum_{t=0}^{\infty} \delta^t (1-\gamma)^t = \frac{\gamma\delta^T}{1-\delta(1-\gamma)} V_i^+ \qquad (20)$$

As Tedeschi (2006) mentions, there are 2 constraints for borrower's equilibrium: the participation and the incentive constraints. According to the participation constraint, borrower takes loan only when it is efficient, that is, when w>1+r. As long as the borrower can retain a net benefit from her investment project meeting the repayment obligation, she will borrow and invest. If she can not, there will be no incentive for the borrower to carry on a project. On the other hand, incentive constraint requires that in absence of collateral the cost of punishment must have to be greater than the gain from default in order for equilibrium to exist, such that:

$$[w-(1+r)]\,B + \delta V_i^+ \geq wB + \delta V_i^- \qquad (21)$$

This is so because in absence of collateral the borrower will only care about the potential future earnings. If the instant gain from strategic default is no greater than the potential future earnings, borrower will not default. Rearranging Eq. (21) gives us:

$$\delta[V_i^+ - V_i^-] \geq (1+r)B \qquad (22)$$

it thus follows that the borrower will repay if her potential loss from foregone future earnings is larger than the immediate gain from a strategic default. Otherwise, the borrower will have no incentive to repay the loan and will be better off by defaulting.

Tedeschi (2006) further mentions that for the existence of an effective punishment T* we need to fulfill certain conditions. Firstly, taking loan should be efficient, that is, the gain from taking a loan should be larger than its cost, $w(1-\alpha_R)>1+r^*$. Accordingly, if the cost of borrowing is larger than the expected benefit from taking a loan, a borrower will not find it interesting to take a loan. We also need that δ is large enough so that borrower values future. To Tedeschi (2006), punishment is effective when borrower weighs future. If borrower is only concerned about her immediate return and not for the potential return from future investment projects, punishment can not be effective. Finally we need that the probability of returning to the lending phase (γ) after serving the punishment phase is large enough. If returning probability to the lending phase is smaller, borrower can not think of returning to the lending cycle after punishment which ultimately undermines the effectiveness of punishment. Given all these conditions are met, dynamic incentive enforces repayment as long as borrowers are able to repay since, it is beneficial to them than defaulting.

The model thus presents that enforcing repayment is possible even if there is no collateral or in absence of joint liability among the borrowers given that there exists dynamic incentive of future borrowing for the successful repayment. Informational asymmetry between the lenders and the borrowers which usually hinders the poorer from accessing formal credit is thus removed in this model through dynamic loan incentive. It shows that microfinance institution can extend loans without collateral and without creating joint liability pressure if we have dynamic loan incentive. One further implication of this model is that lending contract is not finite here: as long as lending is efficient, that is w>1+r, lending can continue since, for the borrower it is beneficial to repay and get access to further credit in this condition.

Other theories on group lending repayment rates: Wydick (2001) stated that a credible threat of not expanding future credit to defaulting borrower helps maintaining group discipline. In this model, groups are formed endogenously and members come to help a borrower if there are any negative economic shocks, while it penalizes a borrower in case of a strategic default or if the borrower shirks or allocates the loan proceed in a risky project. As like Tedeschi (2006), Wydick also mentions that for sanctions to be effective, it is essential that defaulting borrowers should not be able to access credit from alternative sources.

According to Besley and Coate (1995) joint liability in group lending enforces repayment. Furthermore, they mentioned that social tie among the group members improves repayments significantly. We have discussed the basic of this model in this study.

Stiglitz (1990) stated that in group lending microfinance, homogeneity of group members affects repayment by facilitating peer monitoring and peer pressure. It follows that when groups are homogenous it becomes easier for the borrowers to verify the return of anyone's investment project. Consequently borrowers can easily detect if someone is defaulting strategically and take necessary action thereby. The model is discussed in section 3 of this study.

Jain and Mansuri (2003) suggest that the high repayment rates of group lending microfinance are due to their use of regularly scheduled repayments. Most of the MFIs are using weekly or bi-weekly installments. According to Jain and Mansuri, this brings 'fiscal discipline' among borrowers. Regularly scheduled repayments also help the MFI staff and the group members to come to know whenever someone is facing difficulties in repaying. It thus serves as an important way of transmitting information from individual borrowers to the lending MFI. Regularly scheduled repayments, by eliminating informational asymmetry, thus helps a group and the lending MFI to take necessary steps to recover in time whenever repayment problem arises.

CONCLUSION

The joint-liability group lending improves efficiency in micro lending. Firstly, we see in the adverse selection models that joint liability eliminates information asymmetry for the MFIs, leads to form groups in assortative matching. That is, joint liability renders a segregated outcome, with safe borrowers forming groups with safer ones and the risky borrowers with the risky types. As a result safe borrowers do not have to shoulder any burden of the risky borrowers having them in the group and when the risky projects are unsuccessful, reducing the effective interest rate they face. Joint liability group lending thus solves the problem of adverse selection and brings back the poorer safe borrowers into the market. Furthermore it also helps reducing the interest rate charges by the MFIs improving both repayment and efficiency. Secondly, in the moral hazard models we see from Stiglitz (1990) that joint liability group lending promotes peer monitoring that eliminates shirking in the group and ensures effort from the borrowers. When monitoring is so clearer under group lending, it is not possible for a borrower to shirk and claim that her project is unsuccessful. Group lending thus ensures borrower's effort through peer monitoring. Third, we see that a credible threat of official and unofficial penalties ensures enforcement. Since, under joint liability all the borrowers are denied from future credit access in case of a default and the good borrowers have to repay for their defaulting peer, it induces good borrowers to create pressure on the defaulting borrowers. Since, borrowers are monitoring each others' projects under joint liability; this persuasion thus results in a good repayment. In this study, we thus see from the standpoint of economic theory, that joint liability group lending contract addresses the agency problems raised in the study, successfully.

The theoretical models presented further postulate that dynamic incentive (Tedeschi, 2006) and progressive lending incentive (Dominik, 2004) can ensure repayment even in the absence of joint liability. Where the models demonstrate that joint liability group lending promotes peer monitoring over borrower's effort in their designated investment projects, ensures safer and higher yield thereby and combined with social sanction ensures group repayment by eliminating strategic default; the models display that if loans are associated with dynamic or progressive lending, that is, if a successful repayment is rewarded by the lender by a larger new loans, we do not need joint liability obligation to ensure repayment. It is thus evident from th study that group lending microfinance, with or without joint liability, has certain mechanism that leads to assortative matching of borrowers, reduces effective interest rate, leads to peer monitoring and finally enforces repayment as long as borrowers are able to honour their debt. All these demonstrate that lending to the poor and without collateral, is not an over ambitious deal. Equivalently we can say that lending to the poor need not necessarily to be a charity; rather it has strict economic reasoning to become a 'win-win' business for both the borrowers and the lending microfinance institutions across the world.

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