Microcredit, the Timing of Strategic Default, and the Role of Third Party Lending

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Abstract

We analyze a three-stage microfinance model that incorporates strategic default and instalment payments. A novel feature of our analysis is the modelling of opportunities for strategic default at various times (or stages of the game). Instalment payments are often due before the returns from the project. We show that strategic default, and the low level of collateral that poor borrowers can provide, make single instalment loans infeasible for the MFI. Multiple repayments, on the other hand, force the poor borrower to be dependent on loans for a third party lender for the repayments that are due before her project yields a return. The third party is often a local moneylender with less vulnerability to strategic default. This, together with the nature of strategic default in our paper, has a significant impact on the constraints within which the terms of a feasible microcredit contract must be determined. Next, we consider a "benevolent" MFI whose objective function includes not just its own profit, but also the income of the borrower, and show that the results do not change in any significant manner. Our paper demonstrates the importance of taking into account the existence of both strategic default and repayments at various points in time during the life of a microcredit contract.

Keywords: *Microcredit, frequency of instalment, informal money lender, strategic default.*

1. Introduction

Although microcredit was instigated in 1970s to alleviate poverty and to emancipate the poor from 'exploitive' moneylender in the rural credit market, after more than three decades the six randomized evaluations published in the American Economic Journal in 2015 on microcredit impacts fails to find any significant positive and transformative impact on household income (Banerjee *et.al.* 2015). The implication of this finding is crucial because it has brought a vibrant message to the practitioners and academics to re-think and to re-examine the characteristics of the micro-credit program.

The very high repayment rate is the most cited and acclaimed indicator of success of the microcredit program emphasized by the practitioners and proponents of the micro credit program who strongly believes that frequent repayment which they define as 'fiscal discipline' is required for high repayment rate particularly for the poor borrower. On the other hand, classical economic theory argues that the rational individual borrower should benefit from a more flexible repayment schedule and less frequent repayment should not increase default or delinquency (Fischer and Ghatak, 2010). So the theory and empirics contradict each other in this regard which has not received much attention to researchers and academics until recently but mostly dominated by very few empirical studies.

Over the last two decades a large number of micro-lenders converted their program from joint liability to individual liability (Fischer and Ghatak, 2010). But still the repayment rate is very high which place a big question mark on the early theoretical works by well-known academics such as Stiglitz (1990), Varian (1990), Ghatak (1999) on microcredit contracts who identified joint liability as the key factor to high loan recovery rate. So this phenomenon brings back the important old question - what causes high repayment rate? – to search for a new answer. This study aims to address this important question using a simple theoretical model that can explain the causes and consequences of high frequent repayment instalment loan of the micro-credit program.

It is well established in the micro-credit literature that there is a link between micro-credit program and the interest rate of the informal money lender (Berg *et.al.* 2013, Guirkinger 2008, Mallick 2011, Jain and Mansuri 2003). Mookherjee and Motta (2014) analyze the implications of

co-existence of MFIs and informal lenders and conclude that entry of MFIs in the market is Pareto improving for the borrowers irrespective of effects on informal interest rate. But the link between micro-credit program and the existence of informal money lender did not get enough attention in the theoretical literature. This study aims to analyze this relationship through examining the relationship between the frequencies of repayment instalment in micro-credit program and the existence of informal money lender in the market. The specific research questions of this study are as follows: i) Why microfinance institutions (MFIs) do not offer single instalment repayment loan to the poor borrower? ii) Is there any linkage between frequency of repayment instalment and the existence of informal money lender in this market? iii) Is multiple instalment repayment loans mutually beneficial for MFIs, money lender and the borrower comparing to single instalment repayment loan? To address these questions this study models the supply side of the micro credit market using a game theoretic approach.

We have organized the paper as follows. In **Section 2**, we review a brief literature on characteristics of the micro credit contract, the micro credit impact on borrowers, causes of very high repayment rate, the relationship between micro credit and interest rate of the informal money lender and empirical and theoretical stance on the high frequency of repayment instalment. In **Section 3**, we explain the basic features and assumptions of our three-period model. **Section 3.1** illustrates the model of a single instalment repayment loan and explains possible equilibrium of the monopolist MFIs. **Section 3.2** demonstrates the model of a two-instalment repayment loan and examines different possibilities of the equilibrium. In **Section 3.3**, we extend our basic model to incorporate the poverty reduction objective of the MFIs. **Section 4** summarizes the findings of the study and critically analyzes the intuition and implication of the findings. In **Section 5**, we have suggestive conclusion.

2. Literature

The numbers of poor borrowers in microfinance institutions, all over the world have increased exponentially from 10000 in 1980 to more than 150 million in 2012. Having a large volume of literature on poverty impact of microfinance, recently academics and researchers focusing attention on two issues. First, why the repayment rate is so high while the poverty impact is

ambiguous? Second, has the microfinance movement fared any better in delivering the rural poor from the "clutches" of moneylenders? (Berg *et.al.* 2013).

On the one hand Stiglitz (1990), Varian (1990) and Ghatak (1999) identified joint liability as the key factor to high loan repayment rate; on the other hand, some other academics recognized the potential cost of joint liability (Banerjee, Basely and Guinnane 1994, Fischer 2010). Using a randomized field experiment in Philippines Gine and Karlan (2009) finds that individual liability does not increase the default rate. Even though the cause and effect is not clear cut, recently a large number of micro-lenders altered their program from joint liability to individual liability (Fischer and Ghatak 2010). As borrowers are required to repay their loan in a tight schedule of instalment which begins just after one week of loan disbursement, this allows the informal lenders to persist in the credit market in parallel to the formal sector because borrowers need to borrow from informal sector to repay the loan in the formal sector. Hence, both of the higher volume of loan and higher interest rate in the informal credit sector are due to high frequency instalment repayment in the micro credit program (Jian and Mansuri, 2003). Pioneer of micro-credit program and Nobel laureate Muhammad Yunus himself mentioned in his book titled 'Banker of the poor' as-

"It is hard to take a huge wad of bills out of one's pocket and pay the lender. There is an enormous temptation from one's family to use that money to meet immediate consumption needs...Borrowers find this incremental process easier than having to accumulate money to pay a lump sum because their lives are always under strain, always difficult" (Banker to the Poor, p.114).

So frequent repayment instalment is considered as an important means by which the classic 'Grammen model' limits the lending risk (Field *et al.* 2012). Using a field experiment in India, Field *et al.* (2011) contrast the classic microfinance contract which requires repayment begin immediately after loan disbursement with a contract that includes a two-month grace-period and find that shift to a grace-period contract increased short-run business investments and long-run profits but the variance of profits and default rates increased. However, there is growing evidence that in spite of its success in high repayment, impact on microenterprise growth and household income is little (Banerjee *et al.* 2015; Karlan and Zinman 2011, Kaboski and Townsend 2011, Angelucci *et.al*. 2015, Augsburg *et.al.* 2015, Attanasio *et.al.* 2015, Crépon *et.al.*

2015, Tarozzi *et.al.* 2015). Using a randomized experimental field survey data from India, Field and Pande (2008) show that the less frequent repayment schedule significantly reduces the transaction cost without increasing default rate.

Although proponents of micro credit program argue that competition in microfinance institutions (MFIs) reduces both moneylender's interest rate and household's reliance on informal credit, the critics argue opposite which is supported by the recent empirical evidence. Berg et al (2013) used both cross sectional and panel data from Bangladesh to show that high MFIs coverage increase money lender's interest rate significantly, but it reduces the dependence on informal credit which might be due to the 'cream screaming ' effect of MFIs lending. Mallick (2011) shows the same result that MFIs coverage causes higher interest rate by moneylenders and higher demand for moneylender's loan is due to frequent and tight repayment of MFIs and insufficient seasonal working capital from MFIs. Efficient direct screening, monitoring and loan recovery technique enable informal lenders to offer loans with more generous restructuring conditions in case of default thus lower risk than the formal sector. So, risk-averse household may prefer informal loan though it is more expensive (Guirkinger 2008). Bottomley (1975) finds that default risk increases from fast to last on the list of money lenders, commercial banks, cooperatives and government credit agency. Mukherjee (2013) finds the same result as Botomley that the interest rate is higher in the informal sector than in the formal sector and argue that if the same interest rate is charged in both sectors, the default rate will be lower in the informal sector.

As borrowing from MFIs with very high frequency installment is theoretically puzzling because a high frequency of installment should not benefit poor borrowers, then the important question addressed in this study is – why poor borrowers are borrowing from MFIs? Is there any enticement in the contract designed by the lender that induce the borrowers to accept the contract? Recent literature identified present biasness of the borrower as one of the important causes of borrowing high frequent installment loan by the poor household. Bauer *et al.* (2012) dealt with the question, if the untapped economic returns to borrowing are so high, why don't households save their way out of credit constraints? They draw a link between features of microcredit contract and present biased preferences of the borrowers and argue those present-biased women borrowers are more likely to borrow from MFIs. Almost one-third of MFIs borrower in India exhibit present biased preferences (Bauer *et al.* 2012) which is similar to the

Philippines and the United States (Ashraf, Karlan, and Yin 2006; Meier and Sprenger 2010). When one loan is repaid, microcredit borrowers receive another larger loan immediately, so borrowers have outstanding credit nearly all the time. Poor households regularly borrow from multiple sources to smooth their cash flows (Collins, Morduch, Rutherford, and Ruthven 2009). Evidence also shows that multiple borrowing may be associated with better repayment rates in some environments (Krishnaswamy 2007). Central bank of Morocco estimated that 40 percent of borrowers had loans from more than one MFIs just when the repayment crisis began. There are similarly pre-crisis estimates for Nicaragua, BiH, and Pakistan (Chen et al. 2010). A book about the micro credit crisis of 1999 in Bolivia made an appropriate analogy, "Apparently credit is like good food: when seated at the table in front of a feast, many people eat too much and regret it later…" (Rhyne 2001). Lending concentration and multiple borrowing, overstretched MFIs capacity, and a loss of MFIs credit discipline have been identified as the main reason for the recent repayment crisis in MFIs in four countries Nicaragua, Morocco, BiH and Pakistan (Chen et al. 2010).

Demanding review of literature safeguard the following two solid contributions of this study: *First,* the model can clearly explain the answer of the following important long-debating questions in the contemporary literature: I. Why MFIs does not offer less frequent instalment repayment loan to the poor borrower? II. Why borrowers are accepting theoretically puzzled high frequency instalment repayment loan contract? III. Does frequent instalment repayment loan mutually beneficial for all three parties, namely the MFIs, borrower and the money lender? *Second,* this study also answers another important question: Why both MFIs and informal money lender still co-exist in the market after a long time of the intervention of MFIs even though one of the primary goals of the micro credit program was to freeing the poor from money lender? Both of these contributions fill up the vacuum in the theoretical literature.

3. The Model

This study builds a three period model under two different scenarios based on the frequency of the repayment installment. Three periods are defined as period 1, period 2 and period 3. Five basic assumptions of the model are: i) MFIs work as a monopolist who offers a loan amount L to the borrower for investment to generate income, not for consumption and ii) borrower's saving is zero in each period. iii) return from investment in period 2 is zero and return in period 3

is y iv) borrower has time preferences which are represented by $0 < \delta < 1$. v) The cost of default also treated as the collateral is constant, C which is less than L and the lender offers the contract in period 1 and the borrower who accepts the contract invests it in the same period 1. Model is developed in two steps where we consider two possible credit contracts: single and two-period repayment. Section 3.1 start with the single installment repayment loan where the MFIs offers amount L in period 1 which is invested by the borrower at the same time period and repays the gross amount M_2 in the last period 3, which is the only installment for the loan. In section 3.2, initial model is extended by assuming that borrower needs to repay a total of ($M_1 + M_2$) to MFIs in two instalments: in period 2, M_1 and in period 3 M_2 instead of only in period 3. As returns from investment in period 2 is zero, borrower has to borrow M_1 from third party (informal money lender) at a gross interest rate $R > 1$ in period 2 to repay MFI's loan. So borrower has to pay in total, of $(RM_1 + M_2)$ for the loan amount L. It is also assumed that due to informational advantage and socioeconomic power, the local informal money lender can recover a proportion $0 < \alpha \leq 1$ of RM_1 in period 3 if borrower absconds with M_1 in period 2. For simplicity, we start with $\alpha = 1$ implies that informal moneylender can recover the whole amount RM_1 in period 3 in case of default.

3.1. Scenario I: Single Instalment Repayment

Consider a three period model. We assume that: i) MFIs is a monopolist who offers a loan amount L for investment ii) borrower's saving is zero in each period. iii) return from investment in period 2 is zero and return in period 3 is y iv) both lender and borrower has time preferences, which is represented by $0 < \delta < 1$ v) cost of default also treated as the collateral is constant, C.

For any period, the borrower only repays if the present value of the return of investment is greater than or equal to the payoff from committing strategic default.

Period 1:

Borrower invests L in period 1 and repay the loan to MFIs if the present value of the return of investment is greater than or equal to the payoff from not investing and committing strategic default. That is,

$$\delta^2(y - M_2) \geq L - C$$

The left-hand side of this inequality is the present value of the return of investment and right-hand side shows the payoff from not investing and committing strategic default in period 1.

This requires $M_2 \leq y - \frac{1}{\delta^2}(L - C)$ (1)

Period 2:

As the borrower invested the amount L in period 1, there is nothing left to run away with in period 2. So the payoff of absconding in period 2 is the negative value of the collateral.

$$\delta(y - M_2) \geq -C$$

The left-hand side of this inequality is the present value of the return of investment and right-hand side shows the payoff of committing strategic default in period 2.

This requires $M_2 \leq y + \frac{1}{\delta}C$ (2)

Period 3:

Borrowers receive a return y and repay M_2 to MFIs if:

$$(y - M_2) \geq y - C$$

The left-hand side of this inequality is the present value of the return of investment and right-hand side shows the payoff of committing strategic default in period 3.

This requires $M_2 \leq C$ (3)

The lender's objective is to maximize return M_2 subject to the incentive compatibility repayment constraints, that is, maximize lender's objective function:

$$\delta^2 M_2 - L \geq 0$$

Subject to the incentive compatibility repayment constraints:

(1) $M_2 \leq y - \frac{1}{\delta^2}(L - C)$

(2) $M_2 \leq y + \frac{1}{\delta}C$

(3) $M_2 \leq C$

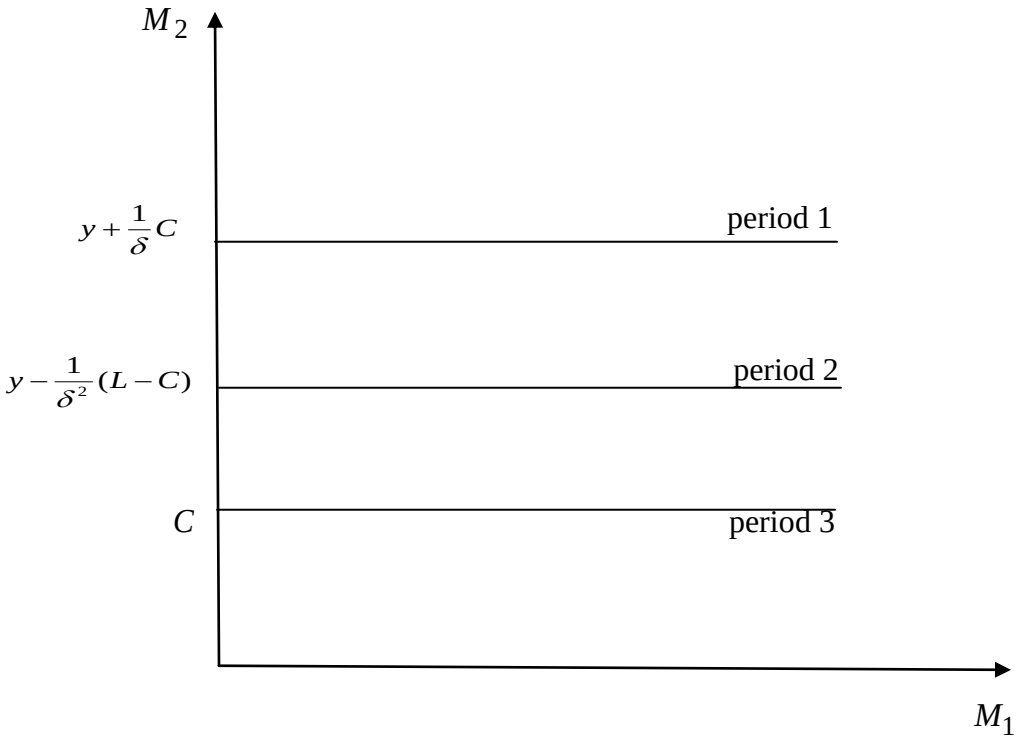

Fig.1: Single instalment repayment loan, borrowing from MFIs.

Comparing equation (1), (2) and (3) we have, $M_2 = C < y - \frac{1}{\delta^2}(L-C) < y + \frac{1}{\delta}C$ if $y > \frac{1}{\delta^2}L + \left(1 - \frac{1}{\delta^2}\right)C$. So, the maximum amount of return the monopolist MFIs can have is, $M_2 = C$ to avoid strategic default by the borrower. This implies that MFIs will offer the loan if the cost of default or the size of the collateral is higher than the size of the loan, $C > L$ which is not consistent with our assumption that $L > C$. This suggests that single instalment repayment loan is not feasible to MFI's under the assumption that $L > C$. So in a single instalment repayment loan monopolist MFIs can lend only to those borrowers who have collateral, $C > L$. But as MFIs provide loans to the poor borrowers, the condition $C > L$ implies that the size of the loan will be very small because the poor borrower does not have too much collateral and consequently the number of eligible applicants will be lower. Moreover, the borrowers who have enough collateral will prefer to borrow from the standard banking system at a lower interest rate.

3.2. Scenario II: Two Instalment Repayment

We assume that: i) MFIs is a monopolist who offers a loan amount L for investment

ii) borrower's saving is zero in each period. iii) Return from investment in period 2 is zero and return in period 3 is y iv) both lender and borrower has time preferences, which is represented by $0<\delta<1$ v) cost of default also treated as the collateral is constant, $C.$, vi) the first instalment, $M_1>0$, is due in period 2 that borrower has to borrow from third party (informal money lender) at gross interest rate $R>1$ to repay MFI's loan and borrower will repay RM_1 to money lender in period 3 vii) $\alpha=1$, implies that informal moneylender can recover whole amount RM_1 in period 3 in case of default viii) the second instalment, $M_2>0$ is due in period 3 after borrower realize the return, y from the project. ix) τ is the cost of lending each dollar by informal money lender. So, informal money lender will lend if the present value of the return (δRM_1) is greater than or equal to the total cost of lending $(1+\tau)M_1$:

$$\delta RM_1-(1+\tau)M_1\geq 0\Rightarrow R=\frac{1+\tau}{\delta}$$

For any period, the borrower only repays if the present value of the return of investment is greater than or equal to the payoff from not investing and committing strategic default. Within this framework, we solve for the maximum total return to MFIs for which repayment is incentive compatible.

Period 1:

Borrower invests L in period 1 and repays the loan to MFIs if the present value of the return of investment is greater than or equal to the payoff from not investing and committing strategic default in period 1.

$$\delta^2(y-M_2-M_1R)\geq L-C$$

The left-hand side of this inequality is the present value of the return of investment and right-hand side shows the payoff from not investing and committing strategic default in period 1.

This requires $M_2\leq y-M_1R-\frac{1}{\delta^2}(L-C)$ (4)

The slope of this incentive compatibility constraint is:

$$\frac{dM_2}{dM_1} = -R = -\frac{1+\tau}{\delta}$$

Period 2:

In period 2, borrowers borrow M_1 from informal money lender and repays to MFIs if:

$$\delta(y - M_2 - M_1 R) \geq M_1 - (C + \delta R M_1)$$

The left-hand side of this inequality is the present value of the return of investment and right-hand side shows the payoff from committing strategic default in period 2. Borrower can commit default in period 2 and run away with M_1 borrowed from a money lender incurring total cost of default equals to $(C + \delta R M_1)$.

This requires $M_2 \leq y - \frac{1}{\delta} M_1 + \frac{1}{\delta} C$ (5)

The slope of this incentive compatibility constraint is: $\frac{dM_2}{dM_1} = -\frac{1}{\delta}$

Period 3:

The borrower receives the return y and repays both to MFIs and the money lender if:

$$(y - M_2 - M_1 R) \geq y - M_1 R - C$$

The left-hand side of this inequality is the present value of the return of investment and right-hand side shows the payoff from committing strategic default in period 3.

This requires $M_2 \leq C$ (6)

The slope of this incentive compatibility constraint is: $\frac{dM_2}{dM_1} = 0$

The MFIs objective is to maximize total return $(M_1 + M_2)$ subject to the incentive compatibility repayment constraints, that is, maximize lender's objective function: $\delta M_1 + \delta^2 M_2 - L \geq 0$

Subject to the incentive compatibility repayment constraints:

(4) $M_2 \leq y - M_1 R - \frac{1}{\delta^2}(L - C)$

(5) $M_2 \le y - \frac{1}{\delta} M_1 + \frac{1}{\delta} C$

(6) $M_2 \le C$

Different Possibilities of Equilibrium:

Possibility I: Constraint in period 1 and period 3 are binding

Under this possibility, constraints in period 1 and in period 3 are binding if the following condition holds as shown in **Fig. 2**: $C < y - \frac{1}{\delta^2}(L - C) \Rightarrow y > \frac{1}{\delta^2} L + \left(1 - \frac{1}{\delta^2}\right) C$

So in equilibrium: $C = y - M_1 R - \frac{1}{\delta^2}(L - C) \quad \Rightarrow M_1 = \frac{1}{R}\left[y - \frac{L}{\delta^2} + \left(\frac{1}{\delta^2} - 1\right) C \right]$ and $M_2 = C$

Total return to MFIs, $(M_1 + M_2) > C$ unambiguously because $M_1 > 0$ and $M_2 = C$ (7)

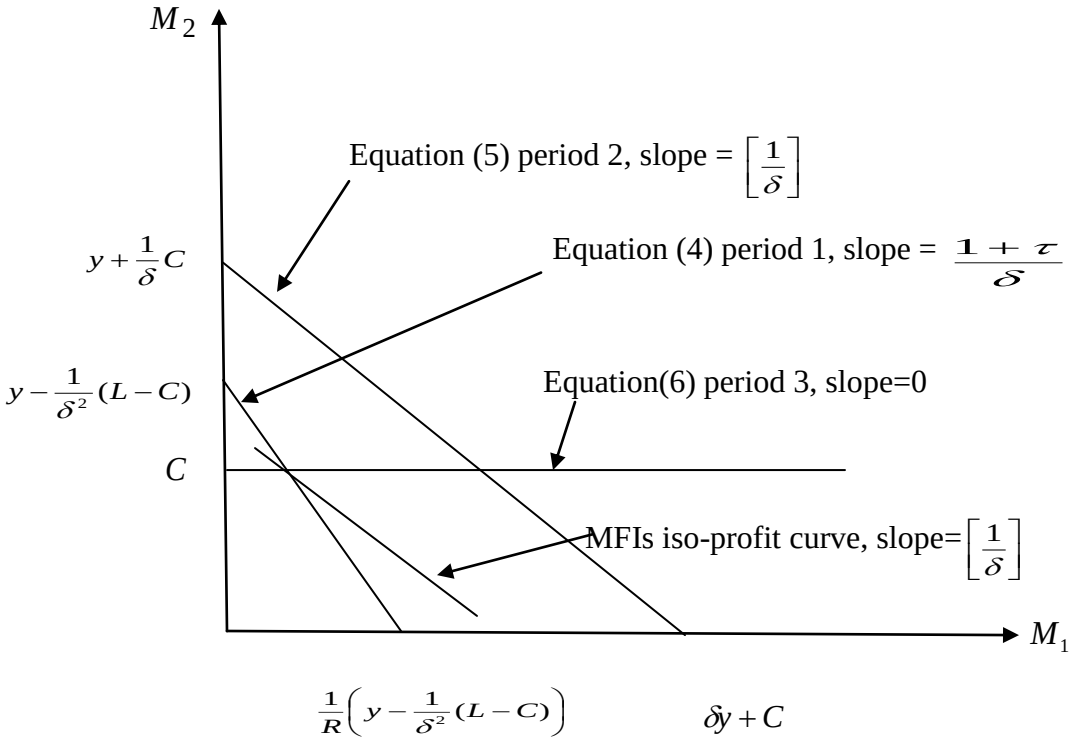

Fig.2: Two instalment repayment, borrowing both from MFIs and money lender.

Possibility II: A Corner Solution

Under this possibility, the only constraint in period 3 (equation 6) is binding if:

$$C < y - \frac{1}{\delta^2}(L - C) \Rightarrow y > \frac{1}{\delta^2}L + \left(1 - \frac{1}{\delta^2}\right)C$$

As **Fig.3** shows there may be a corner solution on the vertical intercept of constraint in period 3. So, in equilibrium, $M_2 = C$ and $M_1 = 0$ implies that borrower does not need to borrow from money lender as there is only one instalment in period 3 and MFI's total return is, $M_2 = C$ which is not feasible for lender under the assumption that $L > C$. However, MFIs can lend only to those borrowers who satisfy the condition $C > L$ which reduces the total number of eligible borrowers and money lenders are excluded from the market.

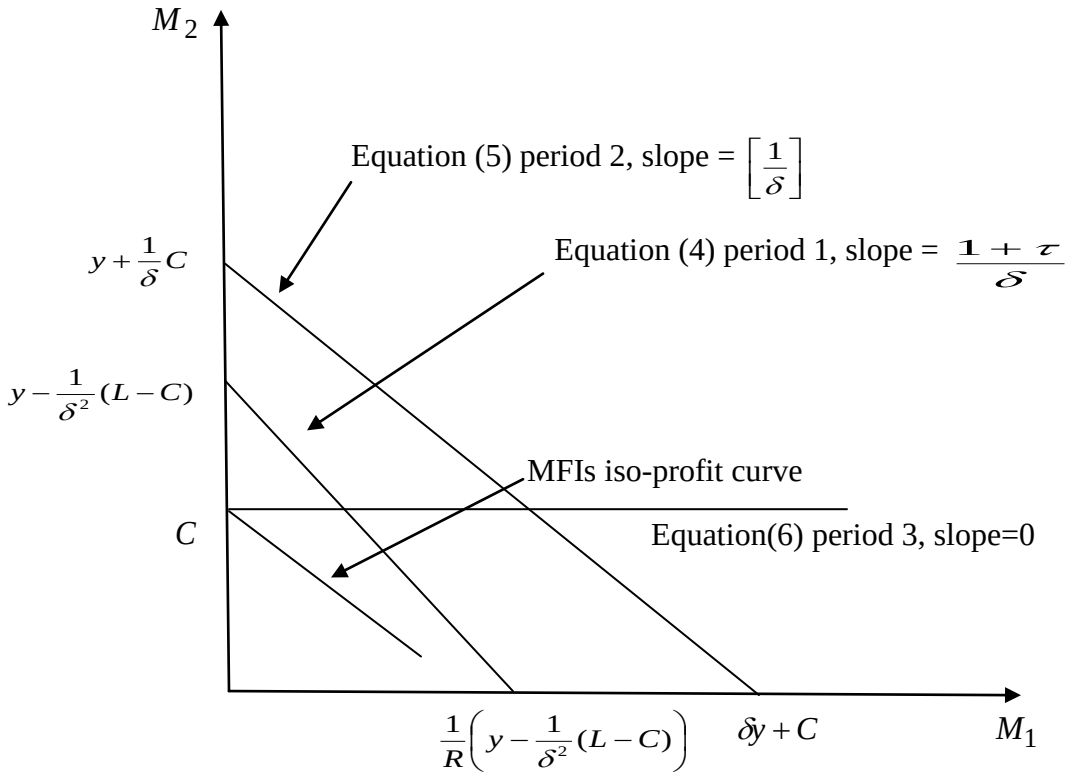

Fig.3: Two instalment repayment, borrowing both from MFIs and money lender.

Analysis of both single instalment repayment and two instalment repayment under different possibilities breed the following two important propositions:

Proposition I: *If the return from the investment is zero during first instalment of the loan, single instalment repayment loan is not feasible for MFIs under the assumption that* $L > C$ *because the*

maximum repayment incentive compatible return to MFIs, $M_2 = C$ is lower than the amount of the loan, L.

Proposition II: *In the presence of very powerful money lender $(\alpha = 1)$, the monopolist MFIs can extract more $(M_1 + M_2 > C)$ from two instalment repayment loan through inclusion of the money lender in the market, which is mutually beneficial both for the MFIs and informal money lender compared to a single instalment repayment loan, but the borrower needs to pay more in total, $(RM_1 + M_2)$.*

Both of these propositions remain valid under the assumption that $0 < \alpha < 1$.(See Appendix)

3.3. Extension of the Basic Model

In this section we relax one of the main assumptions of our model that a microfinance institution (MFIs) is a profit maximizing monopolist. The main goal of the MFIs was not to earn profit but to alleviate or reduce poverty by increasing the income of poor households. To address this fact, now we assume that MFI's objective is not only profiting but also increasing the welfare of the poor borrower which is reflected in the MFI's objective function in the following manner:

$$\theta\left(\delta M_1 + \delta^2 M_2 - L\right) + (1-\theta)\left[y - \left(\delta R M_1 + \delta^2 M_2\right)\right] \qquad (9)$$

Where, $0 < \theta < 1$ is the weight that MFIs assign on its net return and $(1-\theta)$ is the weight that MFIs assign on borrower's net return. The main purpose of this section is to analyze the impact of altruistic objective of the MFIs on the findings of the basic model in the previous section. This altruistic objective of the MFIs does not have any effects on the incentive compatibility constraints of the borrower.

The slope of the MFIs objective function (equation 9) is: $\frac{dM_2}{dM_1} = \frac{R - \theta(1+R)}{(2\theta - 1)\delta}$

Different Possibilities of Equilibrium:

Possibility I: Constraint in period 1 and period 3 are binding

We can have the same results as in **Possibility I** in the previous section if the following two conditions hold along with the condition in section 3.2:

1. If the slope of the MFIs objective function is lower than the slope of the constraint in period 1:

$$\frac{R-\theta(1+R)}{(2\theta-1)\delta} < R \quad \Rightarrow \theta > \left(\frac{R(1+\delta)}{1+R(1+2\delta)}\right) \quad \text{and}$$

2. If the slope of the MFIs objective function is higher than the slope of the constraint in period 3

$$\frac{R-\theta(1+R)}{(2\theta-1)\delta} > 0 \quad \Rightarrow \theta < \left[\frac{R}{(1+R)}\right]$$

So, **Possibility I** is still valid if:

$$\left(\frac{R(1+\delta)}{1+R(1+2\delta)}\right) < \theta < \left[\frac{R}{1+R}\right] \text{ and } C < y - \frac{1}{\delta^2}(L-C) \Rightarrow y > \frac{1}{\delta^2}L + \left(1-\frac{1}{\delta^2}\right)C \text{ as in } \textbf{Fig. 4.}$$

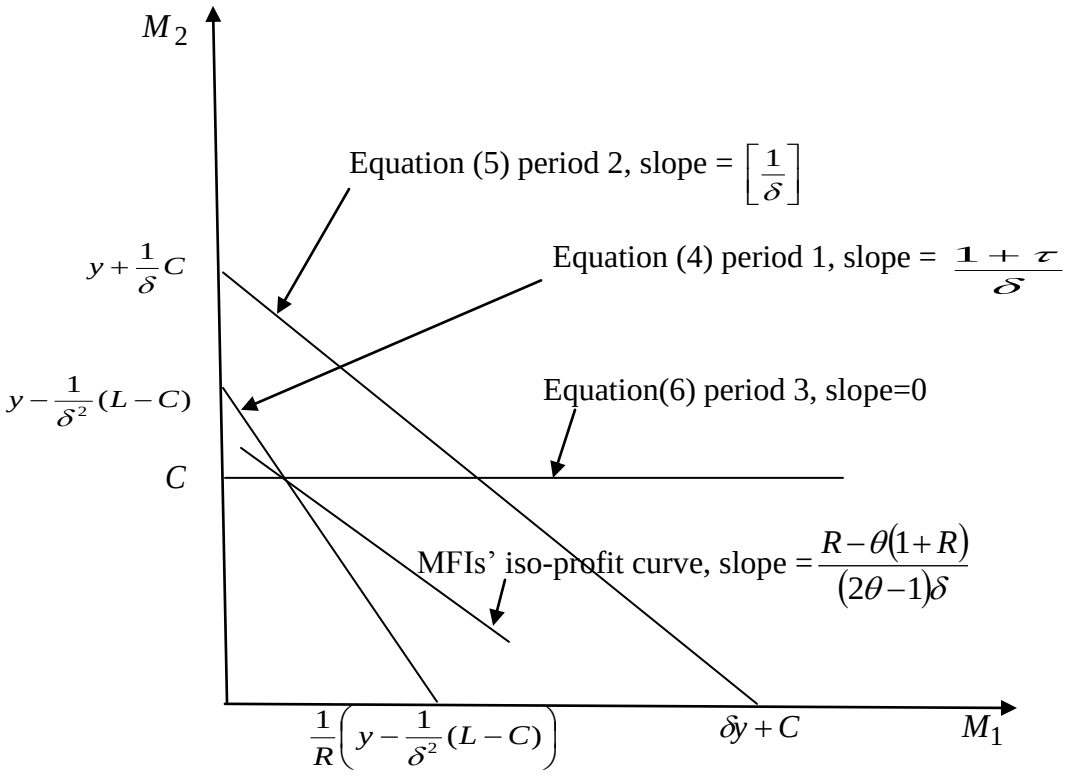

Fig.4: Two instalment repayment, borrowing both from MFIs and money lender.

Possibility II: A Corner Solution

A corner solution is feasible if the following condition holds along with the condition in section 3.2:

If the slope of the MFIs objective function is higher than the slope of the constraint in period 3

$$\frac{R-\theta(1+R)}{(2\theta-1)\delta}>0 \quad \Rightarrow \theta<\left[\frac{R}{1+R}\right]$$

So, both **Possibility I** and **Possibility II** remain valid if the following conditions hold:

$$\left(\frac{R(1+\delta)}{1+R(1+2\delta)}\right)<\theta<\left[\frac{R}{1+R}\right] \text{ and } C<\ y-\frac{1}{\delta^2}(L-C) \ \Rightarrow y>\frac{1}{\delta^2}L+\left(1-\frac{1}{\delta^2}\right)C \qquad (10)$$

This analysis demonstrates that if the MFI's objective is not only profit maximization but also to reduce poverty of the borrower, findings in section 3.2 are still valid under the condition that the value of the weight that MFIs assign on its profit maximizing goal remain within a range as shown in equation10. This implies that multiple instalment repayment loan may still be preferable to MFIs even if it has the altruistic view to the poor borrower.

Proposition III: *For* $\left(\frac{R(1+\delta)}{1+R(1+2\delta)}\right)<\theta<\left[\frac{R}{1+R}\right]$ *is the weight assigned to the profit maximization goal of the MFIs, the multiple instalment repayment loan is preferred to a single instalment repayment loan to reduce strategic default and to increase net return to MFIs through inclusion of the informal money lender in the market.*

This proposition also remains valid under the assumption that $0<\alpha<1$ (See Appendix).

4. The Intuition and Implication of the Findings

Analysis of both single and two instalment repayment loan exhibit that single instalment repayment loan is not feasible for MFIs because of the lower amount of collateral that the poor borrower can provide and due to the incentive of the borrower to commit strategic default. However, MFIs can offer a single instalment repayment loan if following two conditions hold: *First,* if $C>L$. This condition means that MFIs can lend only to those borrowers who have collateral higher than the loan amount which reduces the number of eligible borrowers because poor borrowers are unlikely to have too much collateral. Lending under this condition may create two problems: One, it may reduce the size of the loan and consequently the size of the pie of the MFIs. Two, a large number of poor borrowers will be excluded from this service once more after they are excluded from the mainstream banking system. *Second,* $C>L$ and $\theta<\left[\frac{R}{1+R}\right]$. This condition embroils the degree of profit maximization goal of MFs along with the size of the

collateral. This more restrictive condition implies that if the weight assigned on poverty reduction goal by MFIs exceed certain limit, MFIs allows the borrower to repay in one instalment at the end of period 3 to have more return of the project. But it reduces the total return to MFIs and MFIs lend only if $C > L$ to reduce the strategic default. Under both of these conditions the maximum return to MFIs is same, $M_2 = C$ and informal money lender does not exist in the market. Although this single instalment repayment loan is feasible under the condition that $C > L$ and $\theta < \left[\frac{R}{1+R}\right]$, it is not desirable for any of the three parties involved, namely the MFIs, money lender and borrowers due to the above mentioned problems.

On the other hand, in a two instalment repayment loan both with and without the poverty reduction goal of the MFIs, total return to MFIs is higher than that of from single instalment repayment loan in the presence of powerful moneylender. This condition raises the important question: why MFIs need to include informal money lenders who are less vulnerable to strategic default to make the two instalment repayment more profitable? It may be due to the fact that when borrowers need to borrow from powerful money lender to repay MFIs in period 2, it becomes more difficult for the borrower to commit strategic default comparing to that of from MFIs. As the MFIs know with certainty that borrowers have to borrow from powerful money lender in period 2 because there is no return from project in period 2, it increases the borrower's cost of default both in period 2 and in period 3 which reduces the incentive to commit default by the borrower. So the inclusion of informal money lender works as an insurance to MFIs because it becomes easier for MFIs to avoid strategic default. At the same time, money lender also become interested in the two instalment repayment loan because they would be excluded from the market if MFIs offer single instalment repayment loan. So it is obvious that two instalment repayment loan is mutually beneficial both for the MFIs and for the informal money lender.

In short, the implications of the findings are threefold: *First:* For MFIs, multiple instalment repayment loan increases the total return. It also causes the inclusion of the powerful money lender in the market, which is an incentive to MFIs because inclusion of the moneylender reduces the incentive of the borrower to commit strategic default by increasing the cost of default that implies an increase in the repayment rate. *Second:* For borrowers, multiple instalment repayment loans increase the access to this credit program. However, they need to pay more in

total compared to a single instalment repayment loan. *Third:* For money lender, as multiple instalment repayment loan by MFIs and loan from informal money lender are complement to each other according to our analysis; it creates a larger market for the money lender which would not be possible if MFIs would offer a single instalment repayment loan.

5. Conclusion

An analysis of a three-stage microfinance model that encompasses strategic default, instalment payments and the role of third party lending reveals that single instalment loan is not feasible for the MFIs because of the chances of strategic default and low level of collateral of the poor borrower. Consequently MFIs offers multiple instalment loans in an environment where instalments are due before the borrower realizes the return from the project that force the poor borrower to borrow again from powerful informal money lender to repay MFIs which is a mission-drift by the MFIs because one of the primary goals of the program is freeing the poor borrower from "exploitive" money lender. The results do not change when we consider a “benevolent” MFIs whose objective is not only profiting, but also increasing the income of the borrower. The main finding of this study highlights the multiple instalment loan offered by the MFIs which has a substantial impact on the timing of strategic default and the existence of third party lender.

References:

Angelucci, M., D. Karlan, and J. Zinman (2015): *Microcredit Impacts: Evidence from a Randomized Microcredit Program Placement Experiment by Compartamos Banco.* American Economic Journal: Applied Economics 2015, 7(1): 151–182.

Ashraf, N., D. Karlan, and W. Yin (2006): *Tying Odysseus to the Mast: Evidence from a Commitment Savings Product in the Philippines.* Quarterly Journal of Economics 121 (2): 635–72.

Attanasio, O., B. Augsburg, R. Haas, E. Fitzsimons, and H. Harmgart (2015): *The Impacts of Microfinance: Evidence from Joint-Liability Lending in Mongolia.* American Economic Journal: Applied Economics 2015, 7(1): 90–122.

Augsburg, B., R. Haas, H. Harmgart and C. Meghir (2015): *The Impacts of Microcredit: Evidence from Bosnia and Herzegovina.* American Economic Journal: Applied Economics 2015, 7(1): 183–203.

Banerjee, A., T. Besley, and T. W. Guinnane (1994): *Thy Neighbor's Keeper: The Design of a Credit Cooperative with Theory and a Test*, Quarterly Journal of Economics, 109(2), 491.515.

Banerjee, A., E. Duo, R. Glennerster, and C. Kinnan (2015): *The Miracle of Microfinance? Evidence from a Randomized Evaluation*. American Economic Journal: Applied Economics 2015, 7(1): 22–53.

Banerjee, A., D. Karlan, and J. Zinman (2015): *Six Randomized Evaluations of Microcredit: Introduction and Further Steps.* American Economic Journal: Applied Economics 2015, 7(1): 1–21.

Bauer, M., J. Chytilova, and J. Morduch (2012): *Behavioural Foundations of Microcredit: Experimental and Survey Evidence from Rural India Dataset*. American Economic Review. http://dx.doi.org/10.1257/aer.102.2.1118.

Berg, C. and M. S. Emran (2013): *Does Microfinance Help the Ultra poor Cope with Seasonal Shocks? Evidence from Seasonal Famine (Monga) in Bangladesh.* Working paper, George Washington University.

Bottomley, A (1975): *Interest rate determination in underdeveloped rural areas.* American Journal of Agricultural Economics *57*, 2, 279-291.

Chen, M. A. and E. Dunn (2010): *Household Economic Portfolios. Assessing the Impact of Microenterprise Services*, Management Systems International, Washington, D.C.

Collins, D., M. Jonathan, R. Stuart and R. Orlanda. (2009): *Portfolios of the Poor: How the World's Poor Live on $2 a Day.* Princeton University Press, Princeton, NJ.

Crépon, B., F. Devoto, E. Duflo and W. Parienté (2015): *Estimating the Impact of Microcredit on Those Who Take It Up: Evidence from a Randomized Experiment in Morocco*. American Economic Journal: Applied Economics 2015, 7(1): 123–150.

Field E, R. Pande, J. Papp and YJ. Park (2012): *Repayment Flexibility Can Reduce Financial Stress: A Randomized Control Trial with Microfinance Clients in India*. PLoS ONE 7(9): e45679. doi:10.1371/journal.pone.0045679

Field E., R. Pande, J. Pappa and N. Rigol (2011): *Debt Structure, Entrepreneurship, and Risk: Evidence from microfinance.* Unpublished manuscript.

Field, E., and R. Pande (2008): *Repayment Frequency and Default in Microfinance: Evidence From India,* Journal of the European Economic Association, 6(2-3), 501.509.

Fischer, G. (2010): *Contract Structure, Risk Sharing and Investment Choice*, mimeo.

Fischer, G. and M. Ghatak (2010): *Repayment Frequency in Microfinance Contracts with Present-Biased Borrowers*, London School of Economics.

Ghatak, M. (1999): *Group Lending, Local Information and Peer Selection*, Journal of Development Economics, 60(1), 27.50.

Gine, X., and D. S. Karlan (2009): *Group versus Individual Liability: Long Term Evidence from Philippine Microcredit Lending Groups*, Discussion paper, Yale Economics Department Working Paper No. 61.

Guirkinger, C. (2008): *Understanding the Coexistence of Formal and Informal Credit Markets in Piura*, Peru, World Development, 36 (8), 1436–1452

Jain, S., and G. Mansuri (2003): *A Little at a Time: The Use of Regularly Scheduled Repayments in Microfinance Programs*, Journal of Development Economics, 72(1), 253.279.

Kaboski, J. and R. M. Townsend (2011): *A structural evaluation of a large-scale quasi-experimental microfinance initiative.* Econometrica 79 (5), 1357-1406.

Karlan, D. and J. Zinman (2011): *Microcredit in Theory and Practice: Using Randomized Credit Scoring for Impact Evaluation.* Science 332 (6035), 1278-1284.

Krishnaswamy, K. (2007): *Competition and Multiple Borrowing in the Indian Microfinance Sector*. Working Paper. Institute for Financial Management and Research. Centre for Microfinance.

Mallick, D. (2011): *Microfinance and Moneylender Interest Rate: Evidence from Bangladesh*. World Development, Elsevier, vol. 40(6), pages 1181-1189.

Meier S., Sprenger C. (2010): *Present-Biased Preferences and Credit Card Borrowing.* American Economic Journal: Applied Economics, Vol. 2, No. 1, pp. 193-210.

Mookherjee, D.,Motta, A.(2014): A theory of interactions between MFIs and informal lenders, Journal of Development Economics, http://dx.doi.org/10.1016/j.jdeveco.2014.11.009

Mukherjee, S. (2013): *A Comparative Analysis of Interest rate: Formal Sector Banks, Local Money lenders and Microfinance Institutions*. Journal of Development Entrepreneurship, Vol. 18, No. 1.

Rhyne, E. (2001): *Mainstreaming microfinance: How lending to the poor began, grew, and came of age in Bolivia.* Bloomfield, Connecticut: Kumarian Press.

Stiglitz, J. E. (1990): *Peer Monitoring and Credit Markets,* World Bank Economic Review, 4(3), 351.366.

Tarozzi, A., J. Desai and K. Johnson (2015): *The Impacts of Microcredit: Evidence from Ethiopia*. American Economic Journal: Applied Economics 2015, 7(1): 54–89

Varian, H. R. (1990): *Monitoring Agents with Other Agents*, Journal of Institutional and Theoretical Economics, 146(1), 153.174.

Yunus, M., and A. Jolis (2003): *Banker to the Poor: Micro-lending and the Battle Against World Poverty*. Public Affairs.

Appendix:

We now assume that in a two instalment repayment loan informal money lender can't recover the whole amount RM_1 in case of default by the borrower, but able to recover a fraction of the amount due, which implies that $0 < \alpha < 1$**.** All other assumptions remain same as before.

Scenario II: Two Instalment Repayment

We assume that: i) Borrower's saving is zero in each period ii) $0 < \alpha < 1$, iii) $y_1 = 0$, iv) $0 < \delta < 1$, v) $L > C$, vi) $M_1 > 0$, $M_2 > 0$

These assumptions imply that a borrower must have to borrow M_1 from informal money lender in the period 2 at an interest rate $R > 1$ to repay MFIs. The borrower will repay RM_1 to the money lender in the period 3. And if the borrower wants to abscond in the period 2 with M_1, informal money lender can recover a fraction $0 < \alpha < 1$ of it in period 3 because of her informational advantage.

We assume that τ is the cost of lending each dollar by informal money lender. So, informal money lender will lend if:

$$\delta R M_1 - (1+\tau) M_1 = 0 \Rightarrow R = \frac{1+\tau}{\delta}$$

Period 1:

Borrower invests L in period 1 and repay the loan to MFIs if the present value of the return of investment is greater than or equal to the payoff from not investing and running away with the loan from MFIs.

$$\delta^2 (y - M_2 - M_1 R) \geq L - C$$

$$\Rightarrow M_2 \leq y - M_1 R - \frac{1}{\delta^2}(L - C) \qquad (11)$$

$$\frac{dM_2}{dM_1} = -R = -\frac{1+\tau}{\delta}$$

Period 2:

Borrower borrows from informal money lender and repay to MFIs if:

$$\delta\left(y - M_2 - M_1 R\right) \geq M_1 - C - \delta\alpha R M_1 \quad \Rightarrow M_2 \leq y - \left[R(1-\alpha) + \frac{1}{\delta}\right] M_1 + \frac{1}{\delta} C \tag{12}$$

$$\frac{dM_2}{dM_1} = -\left[R(1-\alpha) + \frac{1}{\delta}\right] = -\left[\frac{1 + (1-\alpha)(1+\tau)}{\delta}\right]$$

Period 3:

The borrower receives the return y and repays both to MFIs and the money lender if:

$$\left(y - M_2 - M_1 R\right) \geq y - \alpha M_1 R - C \quad \Rightarrow M_2 \leq C - (1-\alpha) R M_1 \tag{13}$$

$$\frac{dM_2}{dM_1} = -(1-\alpha)R = -\frac{(1-\alpha)(1+\tau)}{\delta}$$

Different Possibilities of Equilibrium:

Possibility I: Constraint in period 1 and period 3 are binding

Under this possibility, constraint in period 1 and period 3 are binding if the following conditions hold:

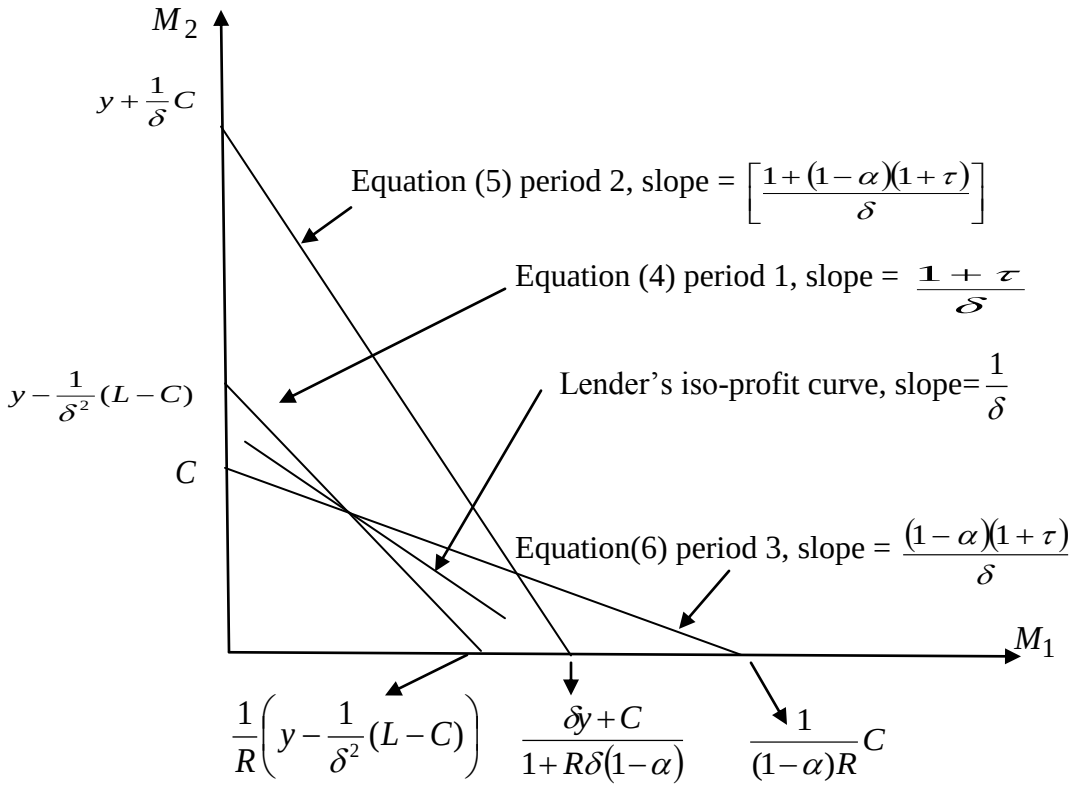

Fig.:5. Two instalment repayment, borrowing both from MFIs and money lender.

1. $C < y - \frac{1}{\delta^2}(L-C) \Rightarrow y_2 > \frac{1}{\delta^2}L + \left(1 - \frac{1}{\delta^2}\right)C$

2. $\frac{\delta y + C}{1 + R\delta(1-\alpha)} > \frac{1}{R}\left(y - \frac{1}{\delta^2}(L-C)\right) \Rightarrow \left[\frac{\delta}{1+R\delta(1-\alpha)} - \frac{1}{R}\right]y > \left(\frac{1}{R\delta^2} - \frac{1}{1+\delta R(1-\alpha)}\right)C - \frac{L}{R\delta^2}$

3. $\frac{1}{(1-\alpha)R}C > \frac{1}{R}\left(y - \frac{1}{\delta^2}(L-C)\right) \Rightarrow y < \frac{L}{\delta^2} - \left(\frac{1}{\delta^2} - \frac{1}{1-\alpha}\right)C$

So in equilibrium:

$C - (1-\alpha)RM_1 = y - M_1 R - \frac{1}{\delta^2}(L-C) \qquad \Rightarrow M_1 = \frac{1}{\alpha R}\left[y - \frac{L}{\delta^2} + \left(\frac{1}{\delta^2} - 1\right)C\right]$ and

$M_2 = \left(\frac{1-\alpha}{\alpha\delta^2}\right)L + \left[1 - \left(\frac{1-\alpha}{\alpha}\right)\left(\frac{1}{\delta^2} - 1\right)\right]C - \left(\frac{1-\alpha}{\alpha}\right)y$

Total return to MFIs:

$$M_1 + M_2 = \left[\frac{1 - R(1-\alpha)}{\alpha R}\right]\left[y_2 - \frac{L}{\delta^2}\right] + \left[\frac{1 - \delta^2 - R(1-\alpha) + R\delta^2}{\alpha\delta^2 R}\right]C \qquad (14)$$

Equation (7) shows that $M_1 + M_2 > C$ for any $\delta \geq \sqrt{\frac{L}{y_2}}$ if

$1 - \delta^2 - R(1-\alpha) + R\delta^2 > \alpha\delta^2 R$

$\Rightarrow (1-\delta^2)[1 - R(1-\alpha)] > 0 \Rightarrow [1 - R(1-\alpha)] > 0 \Rightarrow \alpha > \left(1 - \frac{1}{R}\right) \Rightarrow \alpha > \left(1 - \frac{\delta}{1+\tau}\right)$

Possibility II: Constraint in period 2 and period 3 are binding

Under this possibility, constraint in period 2 and period 3 will be binding if the following conditions hold:

1. $C < y + \frac{1}{\delta}C \Rightarrow y > C\left(1 - \frac{1}{\delta}\right)$

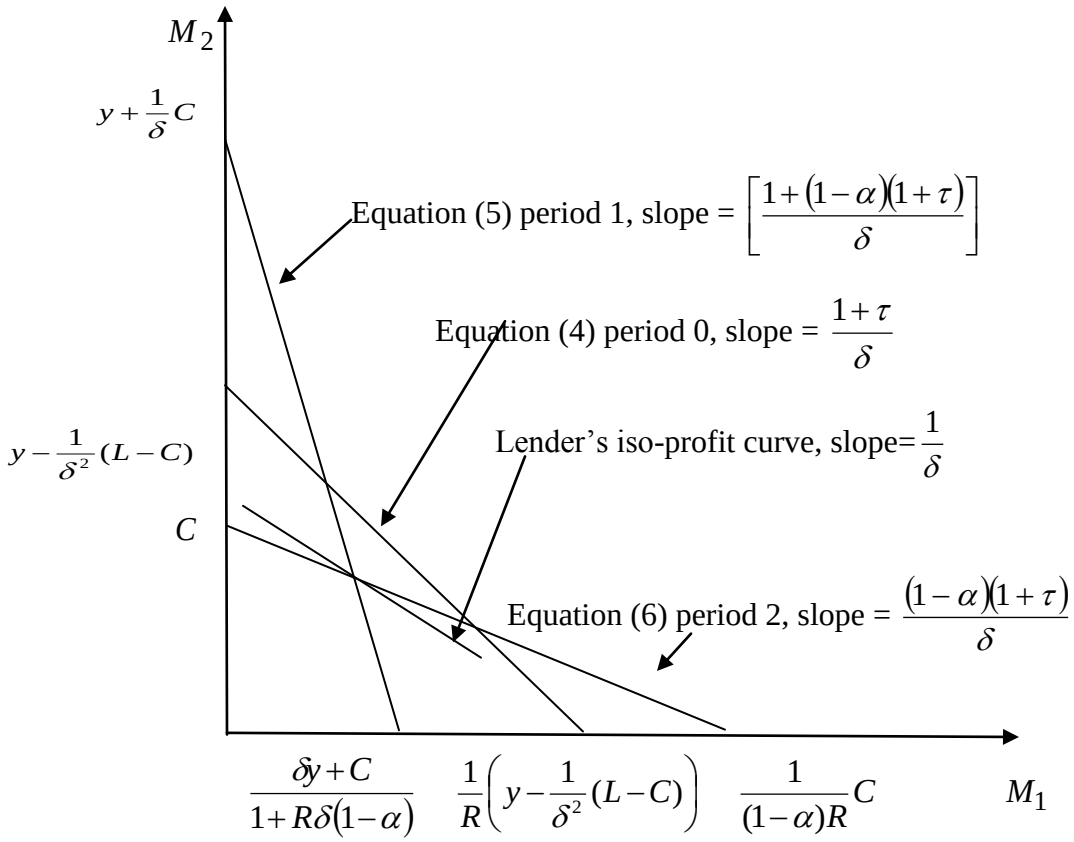

Fig.6: Two instalment repayment, borrowing both from MFIs and money lender.

2. $\frac{1}{R}\left(y-\frac{1}{\delta^2}(L-C)\right)>\frac{\delta y+C}{1+R\delta(1-\alpha)} \Rightarrow \left[\frac{1}{R}-\frac{\delta}{1+\delta R(1-\alpha)}\right]y>\frac{L}{R\delta^2}-\left(\frac{1}{R\delta^2}-\frac{1}{1+\delta R(1-\alpha)}\right)C$

3. $\frac{1}{(1-\alpha)R}C>\frac{\delta y+C}{1+R\delta(1-\alpha)} \Rightarrow y<C\left[1+\frac{1}{\delta R(1-\alpha)}-\frac{1}{\delta}\right]$

So in equilibrium:

$$y-\left[R(1-\alpha)+\frac{1}{\delta}\right]M_1+\frac{1}{\delta}C=C-(1-\alpha)RM_1$$

$\Rightarrow M_1=\delta y+C(1-\delta)$ and

$M_2=C[1-R(1-\alpha)(1-\delta)]-R\delta(1-\alpha)y$

Total return to MFIs:

$M_1+M_2=\delta y+C(1-\delta)+C[1-R(1-\alpha)(1-\delta)]-R\delta(1-\alpha)y$

$$\Rightarrow M_1 + M_2 = \delta y\left[1 - R(1-\alpha)\right] + C\left[1 + 1 - \delta - R(1-\alpha)(1-\delta)\right]$$

$$\Rightarrow M_1 + M_2 = \delta y\left[1 - R(1-\alpha)\right] + C\left[1 + (1-\delta)(1 - R(1-\alpha))\right] \qquad (15)$$

Equation (5) shows that $M_1 + M_2 > C$ for any $0 < \delta < 1$ if

$$\left[(1-\delta)(1-R(1-\alpha))\right] > 0 \Rightarrow \alpha > \left(1 - \frac{1}{R}\right)$$

Possibility III: A Corner Solution

Under this possibility, the only constraint in period 3 (equation 3) will be binding if:

1. $C < y_2 - \frac{1}{\delta^2}(L - C)$ 2. $\frac{1}{(1-\alpha)R}C < \frac{\delta y + C}{1 + R\delta(1-\alpha)}$

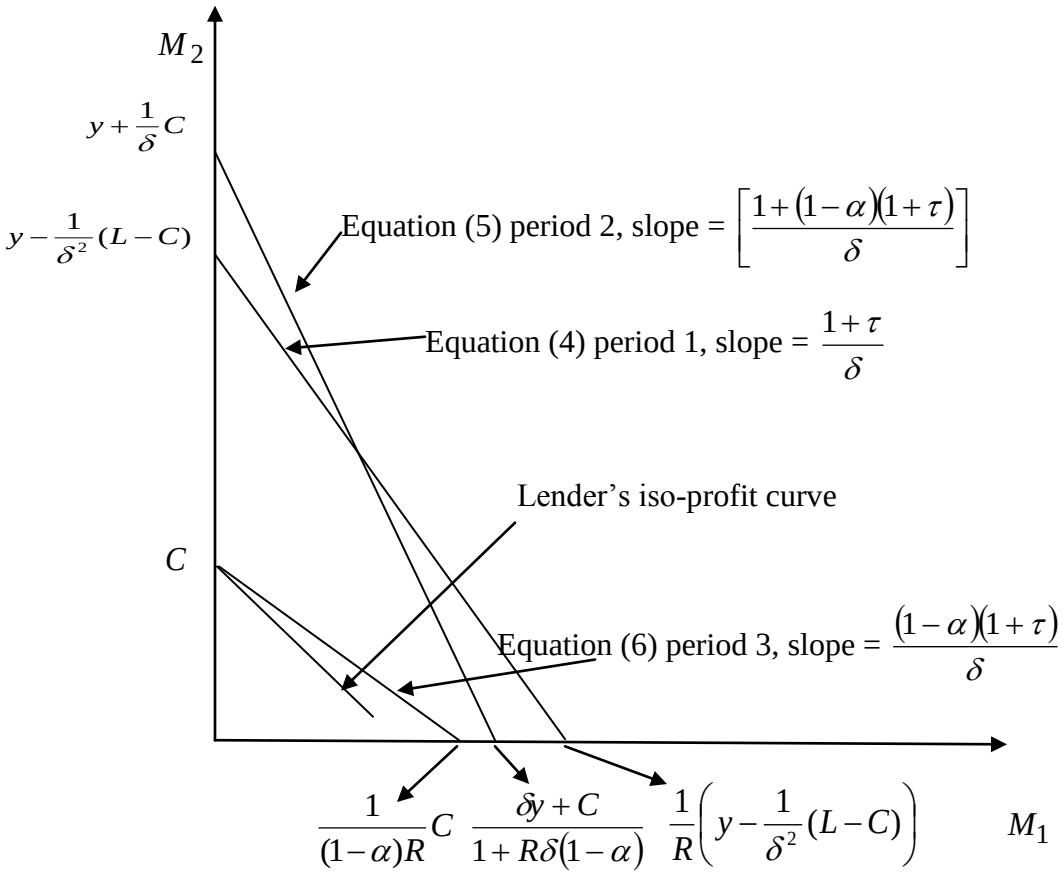

Fig.7: Two instalment repayment, borrowing both from MFIs and money lender.

As **Fig.3** shows there may be a corner solution on the vertical intercept of constraint in period 3 if: $C > \frac{1}{(1-\alpha)R}C \Rightarrow \alpha < 1 - \frac{1}{R}$

So, in equilibrium, $M_2 = C$ and $M_1 = 0$ implies that borrower does not need to borrow from money lender as there is only one instalment in period 3 and MFIs get $M_2 = C$ which is not feasible for lender when $L > C$. However, when money lender is not so powerful ($\alpha < 1 - \frac{1}{R}$), MFIs can lend only to those borrowers who satisfy the condition $C > L$ that reduces the total number of eligible borrowers and money lenders are excluded from the market.

Analysis of both single instalment repayment and two instalment repayments under different possibilities breed the following two important propositions:

Proposition I: *If the return from the investment is zero during first instalment of the loan, single instalment repayment loan is not feasible for MFIs under the assumption that* $L > C$ *because the maximum return to MFIs,* $M_2 = C$ *is lower than the amount lent,* L.

Proposition II: *In the presence of powerful money lender* $\left(\alpha > 1 - \frac{1}{R}\right)$, *the monopolist MFIs can extract more* $(M_1 + M_2 > C)$ *from two instalment repayment loan through inclusion of the money lender in the market, which is mutually beneficial both for the MFIs and informal money lender compared to a single instalment repayment loan, but the borrower needs to pay more in total,* $(RM_1 + M_2)$.

3.3. Extension of the Basic Model

In this section we relax one of the main assumptions of our model that microfinance institutions (MFIs) is a profit maximizing monopolist. The main goal of the MFIs was not to earn profit but to alleviate or reduce poverty by increasing the income of the poor household. To address this fact, now we assume that MFI's objective is not only profit maximization but also increasing the welfare of the poor borrower by increasing net return of the borrower which is reflected in the MFI's objective function in the following manner:

$$\theta\left(\delta M_1 + \delta^2 M_2 - L\right) + (1-\theta)\left[y - \left(\delta R M_1 + \delta^2 M_2\right)\right] \tag{16}$$

Where, $0 < \theta < 1$ is the weight that MFIs assign on its own net return and $(1-\theta)$ is the weight that MFIs assign on borrower's net return. The main purpose of this section is to analyze if this

altruistic view of the MFIs has any impact on the findings of the basic model in previous sections.

The slope of the objective function (equation 6) is: $\frac{dM_2}{dM_1} = \frac{R-\theta(1+R)}{(2\theta-1)\delta}$

Different Possibilities of Equilibrium:

Possibility I: Constraint in period 1 and period 3 are binding

We can have the same results as in **Possibility I** in the previous section if the following two conditions hold along with the conditions in section 3.2:

1. If the slope of the MFIs objective function is lower than the slope of the constraint in period 1:

$$\frac{R-\theta(1+R)}{(2\theta-1)\delta} < R \quad \Rightarrow \theta > \left(\frac{R(1+\delta)}{1+R(1+2\delta)}\right) \text{ and}$$

2. If the slope of the MFIs objective function is higher than the slope of the constraint in period 3

$$\frac{R-\theta(1+R)}{(2\theta-1)\delta} > (1-\alpha)R \quad \Rightarrow \theta < \left[\frac{R[1+\delta(1-\alpha)]}{(R+3)[R\delta(1-\alpha)]}\right]$$

So, **Possibility I** is still valid if:

$$\left(\frac{R(1+\delta)}{1+R(1+2\delta)}\right) < \theta < \left[\frac{R[1+\delta(1-\alpha)]}{(R+3)[R\delta(1-\alpha)]}\right]$$

Possibility II: Constraint in period 2 and period 3 are binding

This possibility is still feasible if following two conditions hold along with the conditions in section 3.2:

1. If the slope of the MFIs objective function is higher than the slope of the constraint in period 3

$$\frac{R-\theta(1+R)}{(2\theta-1)\delta} > (1-\alpha)R \quad \Rightarrow \theta < \left[\frac{R[1+\delta(1-\alpha)]}{(R+3)[R\delta(1-\alpha)]}\right] \quad \text{and}$$

2. If the slope of the MFIs objective function is less than the slope of the constraint in period 2

$$\frac{R-\theta(1+R)}{(2\theta-1)\delta} < R(1-\alpha)+\frac{1}{\delta} \quad \Rightarrow \theta > \left(\frac{(1+R)+R\delta(1-\alpha)}{3+R+2R\delta(1-\alpha)}\right)$$

So, **Possibility II** is still valid if:

$$\left(\frac{(1+R)+R\delta(1-\alpha)}{3+R+2R\delta(1-\alpha)}\right)<\theta<\left[\frac{R[1+\delta(1-\alpha)]}{(R+3)[R\delta(1-\alpha)]}\right]$$

Possibility III: A Corner Solution

A corner solution is feasible if the following conditions hold along with the conditions in section 3.2:

1. If the slope of the MFIs objective function is less than the slope of the constraint in period 3

$$\frac{R-\theta(1+R)}{(2\theta-1)\delta}<(1-\alpha)R \quad \Rightarrow \theta>\left[\frac{R[1+\delta(1-\alpha)]}{(R+3)[R\delta(1-\alpha)]}\right]$$

which is shown in Fig.3 in section 3.2.

Or

1. If the slope of the MFIs objective function is higher than the slope of the constraint in period 3

$$\frac{R-\theta(1+R)}{(2\theta-1)\delta}>(1-\alpha)R \quad \Rightarrow \theta<\left[\frac{R[1+\delta(1-\alpha)]}{(R+3)[R\delta(1-\alpha)]}\right]$$

2. If the slope of the MFIs objective function is less than the slope of the constraint in period 2

$$\frac{R-\theta(1+R)}{(2\theta-1)\delta}<R(1-\alpha)+\frac{1}{\delta} \quad \Rightarrow \theta>\left(\frac{(1+R)+R\delta(1-\alpha)}{3+R+2R\delta(1-\alpha)}\right)$$

So, **Possibility III** is still valid as shown in Fig.4 if following condition holds along with the condition in section 3.2:

$$\left(\frac{(1+R)+R\delta(1-\alpha)}{3+R+2R\delta(1-\alpha)}\right)<\theta<\left[\frac{R[1+\delta(1-\alpha)]}{(R+3)[R\delta(1-\alpha)]}\right]$$

Corner solution on the horizontal intercept of constraint in period 3 is not feasible because in equilibrium:

$M_1=\frac{C}{(1-\alpha)R}<C$. For any $R>1$ and $0<\alpha<1$ this implies that, $M_1<L$ because $L>C$, which is not feasible.

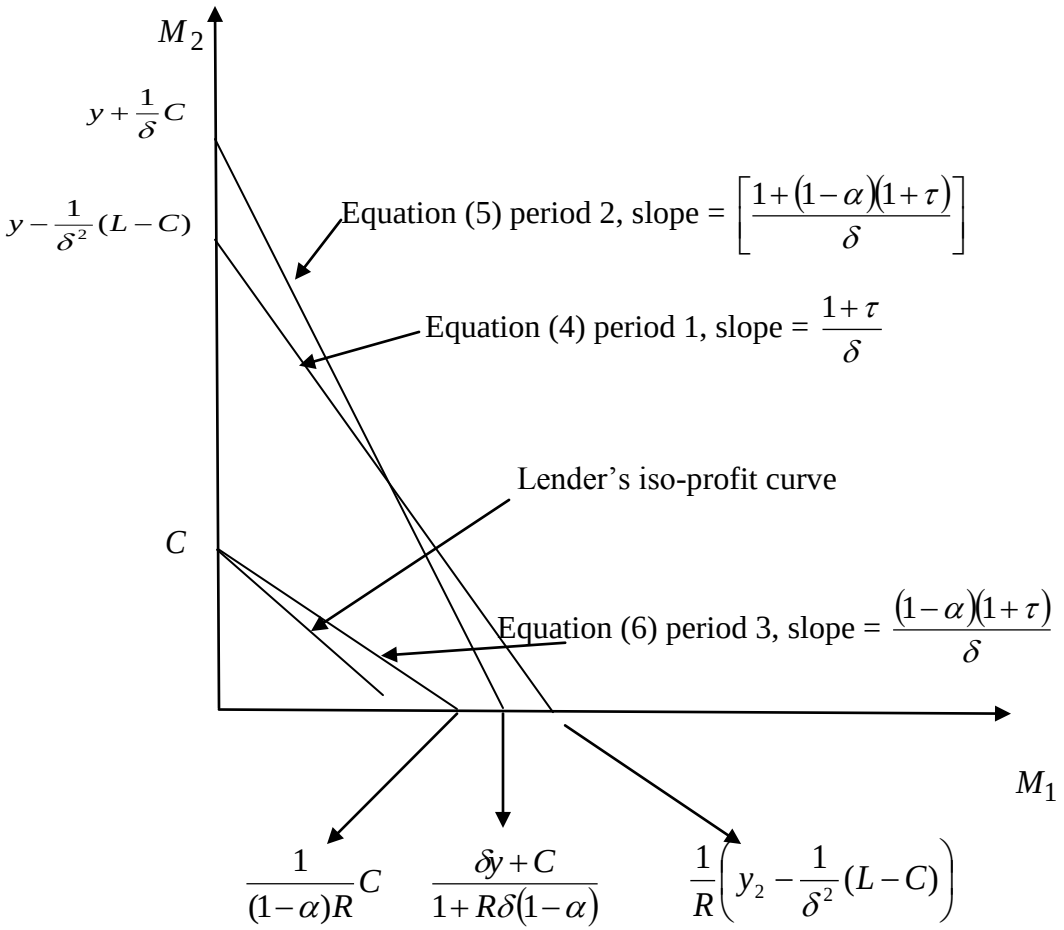

Fig.8: Two instalment repayment, borrowing both from MFIs and money lender

This analysis demonstrates that if the MFI's objective is not only profit maximization but also to reduce poverty of the borrower, findings in section 3.2 are still valid under the condition that the value of the weight that MFIs assign on its profit maximizing goal remain within a range. This implies that multiple instalment repayment loan may still be preferable to MFIs even if it has the altruistic view to the poor borrower.

Proposition III: *For* $\left(\frac{R(1+\delta)}{1+R(1+2\delta)}\right)<\theta<\left[\frac{R[1+\delta(1-\alpha)]}{(R+3)[R\delta(1-\alpha)]}\right]$ *is the weight assigned to the profit maximization goal of the MFIs, the multiple instalment repayment loan is preferred to a single instalment repayment loan to reduce strategic default and to increase net return to MFIs through inclusion of the informal money lender in the market.*