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SAVINGS, LENDING RATE AND SKILL IMPROVEMENT IN MICRO FINANCE OPERATING THROUGH PUBLIC PRIVATE COOPERATION

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Abstract:

In this paper, micro-finance programme through joint liability credit contract is explained with the help of two-stage game when the programme is operated by a non-motivated NGO with the help of commercial bank and government. We find that even in the presence of public-private cooperation and back ended subsidy provided by the government, both individual sanction as well as social sanction plays an important role of security against credit for proper functioning of the programme. Non-homogeneity among the group members may allow the socially powerful member to force her less powerful co-member to repay her debt with interest and enjoy free ride after taking the advantage of joint liability. We have also proved that the non-motivated NGO who itself plays the function of the self-help group can offer credit to the group members at lowest possible rate of interest and can arrange sufficient training for the group members for skill improvement after group formation if and only if it gets sufficient financial support from the government in the initial period and if the linked commercial bank choose low lending rate to the group in credit-linkage programme. This will also encourage each group member to enhance compulsory savings at maximum amount in each installment in her respective group in both the periods, which ultimately will help her to get higher amount of credit in each period to improve consumption of the member household progressively.

JEL Classification number: G21, G38, E21, E22, R28

Key words: Micro Savings, Micro Credit, Self-Help Group, SGSY Scheme, Public-Private Cooperation, Non Motivated NGO, Simultaneous Financing, Lending Rate, Social Sanction, Individual Sanction.

SAVINGS, LENDING RATE AND SKILL IMPROVEMENT IN MICRO FINANCE OPERATING THROUGH PUBLIC PRIVATE COOPERATION

Micro-finance is emerging as a powerful instrument for poverty alleviation programme in the developing countries. This is actually a bank linkage program aimed at a cost effective mechanism for providing financial services to the untreated poor. This financial system enables the poor to generate savings habit. Growing amount of savings can improve the confidence among the participants of micro-finance programme in investing and expanding the income-generating activity as well as household income. Micro-credit contract under joint liability has received a lot of attention in recent years. Borrowers linked by joint liability have to help through repaying the debt of her co-member if she fails to repay that. The group lending system induces the borrowers to monitor each other mainly in a costless way. The success of the Grameen Bank in Bangladesh has raised hopes that group-lending schemes can be used as an instrument of channeling formal sector credit to the rural poor with very high rate of repayment compared to other schemes that lend to the poor. Hossein (1998) argued that Grameen Bank of Bangladesh has a repayment rate more than 95%. Similar figure was obtained by Morduch (1999). This has prompted other countries and NGOs to adopt similar types of scheme.

There have been several important contributions that seek to explain the success of such micro-finance scheme. Stiglitz (1990) and Varian (1990) gave explanations on the basis of peer monitoring. They argued that group members have better information about their co members compared to the lenders. So peer monitoring is relatively cheaper compared to bank monitoring, which ultimately leads to greater monitoring and greater rates of repayment. Ghatak (1999) argued that joint liability and self-selection mechanism will always club together safe-borrowers at the time of group formation and risky borrowers with no assets and individuals coming from ultra poor section are totally ignored. So the repayment rate is very high. Van Tassel (1999), Ghatak and Gunnane (1999) analyzed; moral hazard problems in-group lending can be checked through social sanction. Roy Chowdrury (2005) proved that though monitoring is cheap, ordinary group lending becomes infeasible even in the presence of joint liability. He had shown that ordinary group-lending scheme involved either sequential financing or a combination of lender monitoring and joint liability. He also said in the presence of severe problem of under monitoring, the joint liability might not ensure the feasibility of group lending scheme. He has also shown that in the presence of involuntary default the group-lending scheme with sequential financing but without joint-liability may be feasible (Roy Chowdhury 2007).

In India, micro-finance program under joint liability system is operating through formation of Self-Help Group which is a small voluntary association of poor people preferably from the same socio economic

background. Government of India has promoted micro-finance program under SGSY scheme which is gradually becoming very much popular in India. District Rural Development Authority (DRDA) of the state government sometimes from their own initiative or sometimes with the help of a NGO operates it after forming self-help group in this SGSY scheme. So in that type of micro-finance programme we observe the presence of government, bank and NGO. The United Interagency Committee on Integrated Rural Development for Asia and the Pacific (1992) (henceforth UNICIRD) mentioned six features of a NGO such as: they are voluntary, non-profit, service and development oriented, autonomous, highly motivated and committed and operate under some form of formal registration (see also Besley and Ghatak (1999)). In India, most of the NGOs still now confine themselves at the time of group formation and nurturing of the group. Direct loans are provided to the group by the banks after he gains confidence about the viability of lending to the group. Now large number of Self-Help Groups is required to be linked by small number of Commercial Banks. Following NABARD, it is now become more convenient for a bank to give more responsibilities to the NGO. So apart from bearing the above responsibilities the NGO also have to manage the fund granted in the name of a Self-Help Group (SHG) by the government and the bank as facilitating agency. It also has to arrange skill-improvement training programme for the group members. Roy and Roy Chowdhury (2007) proved that full involvement of a NGO in a micro-credit programme under joint liability is optimal when the village is either relatively too rich or relatively too poor. In this model we consider the microfinance programme under SGSY scheme when the group members are mainly belongs to economically backward class. Most of the group members are housewives, living in a same locality and have very little chance to migrate to other places. The elected group leader of each SHG has to synchronize all the financial activities of the group members. Sometimes it is difficult for her to do that. In this situation NGO can play the leading role. It can do all the duties, which the group leader has to do for her group. A NGO is formed mainly through non-profit route.ⁱ But in actual practice, the NGO itself is not a motivated one but a risk averse. Due to this the NGO charges very high rate of interest against loan to the group membersⁱⁱ which may dampen the possibility of any significant economic improvement of the rural poor. It also raises the question about the sustainability of the group. In this paper we want to derive the conditions at which a self-help group can sustain and the group members can improve their consumption progressively when the group is running with the help of NGO and financial assistance from the government through DRDA. So a micro-finance programme has become under public-private cooperation where the private agent is the profit maximizer NGO and the public agencies are bank and government. Besley and Coates (1995) and Bond and Rai (2008) had shown the importance of both social sanction and individual sanction as instruments to enforce repayment in the presence of joint liability. But following Morduch (2005), using social sanction as collateral has limitations. According to him social sanction involves excluding defaulted borrowers from privileged

access to input supplies, from further trade, credit, from social and religious events and from day to day courtesies. But in this model the cost of social sanction for the voluntary defaulters will be much higher because they will be deprived from getting any future economic benefit of the government through local panchayet. This paper will re-establish the importance of social punishment as collateral for proper functioning of the government supported micro-finance programme. In Besley and Coates and Bond and Rai models nothing was told about the savings of individual group members. This paper wants to investigate how maximum savings can be generated among the members and with this we shall also have to find out the way at which the NGO can arrange high skill training for the members.

Initially we assume that two homogeneous members belong to the same village community form self-help group on the basis of joint liability only for two periods. The group is formed through the initiative of a N.G.O. whose basic activities are (i) motivating local housewives to form self-help group, (ii) collecting savings (contribution) from them in each instalment and give them technical knowledge for the skill improvement of the participants at the initial stage (iii), bridge the gap between the group and the bank as well as the government, (iv) maintain the group corpus, (v) collect subsidy as well as cash credit from the District Rural Development Agency and Bank respectively (vi) disbursed credit simultaneously to both the members and recover credit from the members and obviously (vii) to generate few profit after performing all those activities at the end of second period. So the NGO is here non-motivated who actually wants to improve the economic condition of both the members in a symmetric way and want to earn few profits after performing it's duties. Here, equal amount of loan is sanctioned simultaneously to both the members. The group loan is symmetric and both agents receive a cosigned loan (when both are cosigners). Initially we ignore the possibility of weaker borrower and stronger borrower in the same group as developed by Bond and Rai (2008) rather following Kundu (2008) we assume that both the group members are economically and socially homogeneous during the time of group formation. In this model we also assume that the NGO is getting financial assistance from the government directly in the first stage and indirectly in the second stage. But the contribution from the government to the group through the NGO in the second stage of the model depends on the performance of the group in the first stage. The NGO in this model can take any among the two following possible actions.

1. During the time of group formation it totally ignores the importance of social sanction in the micro-finance programme. So the NGO does not give any credible threat to both the group members about social punishment after voluntary default in any stage of the game.
2. It cautions the group members about social punishment. Actually if it is detected that any group member or both the group member voluntarily defaults in any of the two periods then the NGO will report against her to local Panchayet and the defaulted members will be deprived from getting any type of assistance from the Panchayet or any household of the community in which she belongs.

entire amount of credit at the end of stage 1. Now at this stage she fails to earn such an amount so that she can also repay her partner's entire loan with interest apart from repaying her own loan. So she is asked by the NGO to pay extra 'k' amount when $k < X(1 + \hat{r})$ and in return she can withdraw her entire savings done in the first period with interest. For the simplicity of our model we assume that both the borrowing and lending rate of the commercial bank is identical and that is 'i' which is given in our entire model. So the consumption level of the non-defaulter group member household after the end of the first stage will become

$$C_m^{1BR} = W + \theta X - X(1 + \hat{r}) - k + 2Xi \dots \dots \dots (\text{Eq.3}) \text{ when } C_m^{1BR} \geq 0 \text{ for } m \in \{1,2\}$$

A group member may depart her group just after getting first credit either assuming that her co-member will repay few part of her loan or her co-member will also follow her footsteps. The consumption level of the group member households in both the situations can be expressed as C_m^{1GD} and C_m^{1BD} respectively when $m \in \{1,2\}$. But the group member(s) who defaults voluntarily just after getting credit, can never recover her savings done before getting first credit. The group will enjoy government subsidy and credit-linkage of the linked commercial bank only if the repayment rate is 100%. Now the consumption level of the voluntarily defaulted household after the end of the first stage of our game in absence of social sanction will be

$$C_m^{1GD} = C_m^{1BD} = W + \theta X - X \dots \dots \dots (\text{Eq. 4}) \text{ when } m \in \{1,2\}$$

The consumption matrix of both the players in the first stage of the game is narrated in Table-1

Table-1

		Member-2	
		Repay	Default
Member-1	Repay	Earn C_1^{1GR} & C_2^{1GR} each and move into second stage	C_1^{1BR} C_2^{1GD}
	Default	C_1^{1GD}, C_2^{1BR}	C_1^{1BD}, C_2^{1BD}

.....(Eq.5)

Now the group can get cash credit from the commercial bank and subsidy from the government at the beginning of the second stage of our model as proportion of group corpus of that group accumulated after the end of first stage. The NGO who is working on behalf of SHG deposits the entire saving done by the members after getting first credit in the commercial bank which cannot be withdrawn. The total accumulated savings of the group if both the group members repay their loan individually will be $4X(1 + i) - 2X = 2X(1 + 2i) = 2X\hat{i}$ where $(1 + 2i) = \hat{i}$. Again total earnings of the group from

recovery of loan will be $2X\hat{r}$. So total group corpus of the grade-1 passed group after the end of 1st stage of our model will be $2X(\hat{i} + \hat{r})$(Eq.6)

From Eq.6 it is clear that ‘X’, ‘i’ and ‘r’ all play a significant positive role during the time of calculating group corpus of the group.

In that situation the net earnings of the non-motivated NGO will be

$$I_1 = G - \varphi(\theta) + 2X\hat{r}.....(Eq.7)$$

when the cost of skill training incurred by the NGO for both the members in the first stage is expressed as $\varphi(\theta)$ when $\varphi' > 0$ and $\varphi'' > 0$.

If we assume that $X(\hat{i} + \hat{r})$ amount is sanctioned by the government to group as non-returnable back-ended subsidy and the linked commercial bank sanctioned $X(\hat{i} + \hat{r})$ amount of loan for the group against rate of interest ‘i’ due to credit linkage programme, then total revolving fund of the group at the beginning of the second period will be $4X(\hat{i} + \hat{r})$.

Now the entire sanctioned amount is collected by the NGO on behalf of the group. But the NGO does not disburse the entire amount as loan to both the group members. Rather decides to disburse ‘a $\varepsilon(0,1)$ ’ fraction of the revolving fund (which is administered) as loan to both the group members equally and keep the remaining (1-a) portion in the commercial bank. So amount of credit sanctioned for each group member is $2aX(\hat{i} + \hat{r})$.

Both the group members here also invest the entire amount of credit for income generating activity from which the income is totally verifiable. We also assume that both the group members have already earned few experiences for operating the same income generating activity done in the first stage, which also makes their individual skill double in the second stage. So the income of a representative group member from her income generating activity in the second stage of our model will be

$$Y_m = 4\theta aX(\hat{i} + \hat{r}) \text{ when } m \in \{1,2\}.....(Eq.8).$$

Total amount each group member has to repay at the end of the second stage against rate of interest ‘r’ will be $2aX(\hat{i} + \hat{r})(1 + r)$.

In the second stage of our model, the non-defaulter group member is capable enough to repay not only her own loan but also her partner’s loan with interest. As the game will end after the second stage, the NGO announces that an honest non defaulter group member can recover her entire savings with few bonus amounts at the end of the second stage just after repayment of loan. So the total reward announced by the NGO to each member as a prize of her honesty will be

$$\beta[\{Xi + X(1 + i)\}(1 + i) + 2X(1 + i)] = 2bX \text{ where } b = \beta\tilde{i}(2\tilde{i} + 1), \tilde{i} = (1 + i) \ \& \ b > 1 \dots\dots (Eq. 9) .$$

We have four possible amount of consumption of a group member household and these are as follows.

If both the group members repay their loan individually at the end of second stage of our game then the consumption level of a member household will be

$$C_m^{2GR} = W + 4\theta aX(\hat{i} + \hat{r}) - 2aX(\hat{i} + \hat{r})(1 + r) + 2bX - 2X \text{ for } m \in \{1,2\} \dots \dots \text{(Eq. 10)}$$

If one member defaults voluntarily then following the condition of joint liability the other member has to repay her entire credit with interest. But here the NGO as reward not only returns her the entire saving with bonus but also the savings deposit of her partner. Then her consumption will be

$$C_m^{2BR} = W + 4\theta aX(\hat{i} + \hat{r}) - 4aX(\hat{i} + \hat{r})(1 + r) + 2bX + X\hat{i} - 2X \text{ for } m \in \{1,2\} \dots \dots \dots \text{(Eq. 11)}$$

A member can voluntarily default just after getting credit for the second time. If that situation happens then the consumption level of the group member will be

$$C_m^{2GD} = W + 4\theta aX(\hat{i} + \hat{r}) \text{ for } m \in \{1,2\} \dots \dots \dots \text{(Eq. 12)}$$

Now we consider the following assumptions:

Assumption-1: $2\theta > (1 + r)$

Assumption-2: $b > 2$

Assumption- 3: $X\hat{r} + k > 2Xi$

Proposition: 1 If $b > a(\hat{i} + \hat{r})(1 + r) + 1$ holds i.e. the announced reward against one unit of savings done in the first period after repayment of loan at the end of the second stage of the game is more than the marginal expense an honest group member has to incur to repay her loan with interest then even in total absence of both social and individual sanction both members will repay their loan individually at the end of the second stage of our game

Proof:

If it is observed that both the group members leave the group just after receiving loan for the second time, then in absence of any punishment the consumption level of any group member will be

$$C_m^{2BD} = W + 4\theta aX(\hat{i} + \hat{r}) \text{ for } m \in \{1,2\} \dots \dots \dots \text{(Eq. 13)}$$

So in absence of social and individual sanction from the village community, after voluntary default we have

$$C_m^{2GD} = C_m^{2BD} \text{ for } m \in \{1,2\}$$

So the game in the second stage can be written in the following way

		Member-2	
		Repay	Default
Member-1	Repay	$(C_1^{1GR} + C_1^{2GR}),$ $(C_2^{1GR} + C_2^{2GR})$	$(C_1^{1GR} + C_1^{2BR}),$ $(C_2^{1GR} + C_2^{2GD})$
	Default	$(C_1^{1GR} + C_1^{2GD}),$ $(C_2^{1GR} + C_2^{2BR})$	$(C_1^{1GR} + C_1^{2BD}),$ $(C_2^{1GR} + C_2^{2BD})$

As $b > a(\hat{i} + \hat{r})(1 + r) + 1$ and $2b + \tilde{i}\hat{i} > 2a(\hat{i} + \hat{r})(1 + r) + 1$ (which actually supports the initial condition) holds then $(Repay, Repay)$ will be the unique Nash Equilibrium at the second stage of our game.

As we want to solve the two stage game through backward induction method, the consumption matrix of both the member households the first stage can be written as follows

Member-1		Member-2	
		Repay	Default
Member-1	Repay	$(C_1^{1GR} + C_1^{2GR}),$ $(C_2^{1GR} + C_2^{2GR})$	C_1^{1BR}, C_2^{1GD}
	Default	C_1^{1GD}, C_2^{1BR}	C_1^{1BD}, C_2^{1BD}

If $W + 2aX(\hat{i} + \hat{r})(2\theta - 1 - r) + 2X(b - 2) > X + X(1 + \hat{r})$ when the assumptions 1,2,3 holds, then we have two sub game perfect Nash Equilibrium of this two stage game and those are $(Repay, Repay)$ and $(Default, Default)$.

So if the net income of the non-defaulter group member in the second stage is higher than the total expenses she has to incur as loan repayment and compulsory savings after taking 1st loan from the group then $(Repay, Repay)$ will be the sub game perfect Nash equilibrium in this two stage game and the group sustains for both the periods. But if aggregate of interest payment and payment for joint liability is more than her return from savings deposit at the end of the first stage after the break down of the group then the group will not survive and $(Default, Default)$ will be the only sub game perfect Nash equilibrium. So in absence of *any social threat*, there exists uncertainty about the sustainability of the group for both the periods.

Again if we look at the income profile of the NGO, it is observed that in the first sub game perfect Nash equilibrium the income of the NGO in the first phase was $I_1 = G - \varphi(\theta) + 2X\hat{r}$ and at the end of the second stage that was $I_2 = 4X[(1 - a)(\hat{i} + \hat{r})\tilde{i} + a(\hat{i} + \hat{r})r - b + \tilde{i}]$. But if we observed second sub game perfect Nash Equilibrium then $\tilde{I}_1 = G - \varphi(\theta)$ and $\tilde{I}_2 = 0$. As it is clear that $I_1 > \tilde{I}_1$ and $I_2 > \tilde{I}_2$ the NGO to remove the possibility of breakdown of a self-help group in the middle of the game, will give credible threat to both the member households about social punishment after voluntary default which becomes essential.

So both the member households should be very much cautious before taking any decision on voluntary default. Hence in the next section we shall include both social and individual sanction at the time of measuring consumption level of the group member households. A member will face social sanction if she

defaults voluntarily and face individual sanction from her fellow group member who has to repay her loan with interest.

Section-2

Assumption- 4: $b \in (a(\hat{i} + \hat{r})(1 + r) + 1, (1 - a)(\hat{i} + \hat{r})\hat{i}) + a(\hat{i} + \hat{r})r + \tilde{\pi}$

NGO warns both the group members that if both of them jointly default voluntarily in any stage, then that will be reported to local panchayet and both will face severe social sanction like being deprived from getting benefit from different government supported programmes. Like previous section the earning of a member in the second stage of our model is capable enough to repay the entire loan of her fellow dishonest member apart from her own loan. If that situation appears then the honest member can impose individual sanction on her dishonest co-member but as the earning of the NGO is unaffected, the dishonest member will not face any social sanction. Here we assume that in the second stage the social position of both the members are not same. One has become more powerful and the other is less. In this situation, the value of individual sanction faced by less socially powerful member from her socially more powerful member after voluntary default is more than the value of individual sanction faced by socially more powerful member from her less socially powerful co-member in the same situation. So some consumption level of both the members in different situations will be changed. In the 1st stage of our model C_m^{1GR} and C_m^{1BR} for $m \in \{1,2\}$ remains unchanged. Let S_1 be the present discounted value of social sanction faced by both the members if and only if both defaults voluntarily at the end of second stage. So

$$C_m^{1GD} = C_m^{1BD} = W + \theta X - X - S_{1..} \dots \dots \dots \text{for } m \in \{1,2\} \dots \dots \dots \text{(Eq. 14)}$$

In the second stage C_m^{2GR} and C_m^{2BR} for $m \in \{1,2\}$ remains unchanged. If S_{21} is the present discounted value of loss faced by the voluntarily defaulted 1st member after facing individual sanction from her fellow member then her consumption at the end of second period will be

$$C_1^{2GD} = W + 4\theta aX(\hat{i} + \hat{r}) - S_{21} \dots \dots \dots \text{(Eq. 15)}$$

Similarly if S_{12} is the present discounted value of loss faced by the defaulted 2nd member from 1st member then the consumption of the second member at the end of the second stage of the game will be

$$C_2^{2GD} = W + 4\theta aX(\hat{i} + \hat{r}) - S_{12} \dots \dots \dots \text{(Eq. 16)}$$

If $S_{21} > S_{12}$ then we can claim that 2nd member is socially more powerful than the 1st member but only in the second stage of our game.

If it is observed that both the members default voluntarily in the second stage then their consumption remains unchanged and that will be $C_m^{2BD} = W + 4\theta aX(\hat{i} + \hat{r}) - S_1 \dots \dots \dots \text{(Eq. 17)}$

So the consumption matrix in the second stage of our model can be written as

	Member-2		
Member-1		Repay	Default
	Repay	$(C_1^{1GR} + C_1^{2GR}),$ $(C_2^{1GR} + C_2^{2GR})$	$(C_1^{1GR} + C_1^{2BR}),$ $(C_2^{1GR} + C_2^{2GD})$
	Default	$(C_1^{1GR} + C_1^{2GD}),$ $(C_2^{1GR} + C_2^{2BR})$	$(C_1^{1GR} + C_1^{2BD}),$ $(C_2^{1GR} + C_2^{2BD})$

Assumption 5:

$$S_1 > S_{21} > 2aX(\hat{i} + \hat{r})(1 + r) - 2bX + 2X > S_{12} \text{ and } \hat{i}^2 > a(\hat{i} + \hat{r})(1 + r)$$

Following the above assumption we can say *(Repay, Default)* will be the only Nash Equilibrium in the second stage of our game. So we can say that socially powerful group member taking the advantage of joint liability defaults voluntarily after shifting the entire burden of loan on the shoulder of her fellow socially less powerful member and ignore to recover her savings deposit with .

Now following back ward induction method the consumption matrix in the first stage of our game will be

		Member-2	
Member-1		Repay	Default
	Repay	$(C_1^{1GR} + C_1^{2BR}),$ $(C_2^{1GR} + C_2^{2GD})$	C_1^{1BR}, C_2^{1GD}
	Default	C_1^{1GD}, C_2^{1BR}	C_1^{1BD}, C_2^{1BD}

.....(Eq.19)

Now if S_1 is very high then from equation (14) we can say $C_m^{1GD} = C_m^{1BD} < 0$ for $m \in \{1,2\}$. So *(Repay, Repay)* will be the only sub game perfect Nash Equilibrium of this game, i.e. in the presence of high social punishment for the group members after voluntary default, both will behave co-operatively in stage-1 so that the game can be proceeded in to the next stage.

Again as $4aX(\hat{i} + \hat{r})(1 + r) > 2X(b - 1) + X\tilde{\pi}$ we can say total burden a non defaulter group member has to face for repayment of loan is more the net gain a member can earn to follow the condition of joint liability. So ultimately, total amount of consumption of the non defaulter as well as socially less powerful group member is less than the total amount of consumption of the dishonest socially more powerful member from this two stages government supported micro-finance programme i.e. $C_1^{1GR} + C_1^{2BR} < C_2^{1GR} + C_2^{2GD}$. So if we want to improve the consumption pattern of both the individuals simultaneously in

a symmetric way through this micro-finance programme then it will be better if both the members should not become socially powerful in unequal way even in the second stage of our game. If that situation happens then obviously $S_{12} = S_{21}$. For the simplicity of our model we shall now make the following assumption.

Assumption-6 : $S_{12} = S_{21} = 0$.

On the basis of the above assumptions, in the next section we shall have to derive the conditions at which both can improve their economic conditions in a symmetric way.

Section-3

In total absence of individual sanction, there will be no change in the consumption pattern of the participants in the first stage of the game as mentioned in the equations (2), (3), (4) and (14). Similarly in the second stage C_m^{2GR} and C_m^{2BR} for $m \in \{1,2\}$ also remains unchanged as mentioned in equations (10) and (11). Now only change will be observed in C_m^{2GD} and C_m^{2BD} when $m \in \{1,2\}$. We have already assumed the domain of 'b'.

Now if $S_1 > 2X\{2a(2\hat{i} + \hat{r})(1 + r) - b - \hat{i}^2 + 1\}$ holds (Repay, Repay) will be the only Nash equilibrium in the second stage of our game. So *high value of social sanction* is playing a significant role to force the group members to repay their loan individually.

As we want to solve the game through backward induction method, (Repay, Repay) will be the only sub game perfect Nash Equilibrium in our model when due to high S_1 the values of both C_m^{1GD} and C_m^{1BD} become negative. It is also observed that total consumption of both the players individually becomes maximum and equal and the consumption of the member household at the end of the second stage is more than that of the first stage. In this situation the income of the NGO after the end of second stage will be

$$I_2 = 4(1 - a)X(\hat{i} + \hat{r})\hat{i} + 4aX(\hat{i} + \hat{r})r - 4bX + 4X\hat{i} \dots\dots\dots(\text{Eq.20})$$

Following assumption-4, $I_2 > 0$.

Section-4:

So we already have derived the conditions on the basis of which we can claim in this two stage game both the self-help group members in government subsidized and credit-linked micro finance programme is benefited equally after the end of second stage and the NGO in both the periods earn positive profit. We have also noticed that both 'X' and 'r' play an important role at the time of determining group corpus of the group after the end of first stage. In this model, 'x' is decided by the group member and 'r' is decided by the NGO on behalf of the group. If both the representative group member and the NGO are risk averse then we have to decide how the group corpus can be improved in the first stage at low borrowing rate but

higher amount of compulsory savings in each instalment. We consider quasi linear utility function of the representative group member household who wants to maximize utility through optimizing 'x' when both 'r' and 'i' are given to him and $\theta = \bar{\theta}$.

The objective function of the representative group member will be

$$U(X) = C_1^\alpha + C_2 = \{W + \bar{\theta}X - 2X - X(1 + \hat{r})\}^\alpha + W + 4\bar{\theta}aX(\hat{i} + \hat{r}) - 2aX(\hat{i} + \hat{r})(1 + r) + 2X(b - 2)$$

$$\text{Subject to } 2X\{2a(\hat{i} + \hat{r})(1 + r) - b - \hat{r}^2 + 1\} < S_1 \quad \text{and } 2X < W \dots \dots \dots \text{ (Eq. 21), when } \alpha \in (0,1)$$

Proposition -2: *Each group member wants to save maximum amount in each installment.*

Proof:

In the presence of two inequality constraint, the above optimization problem will be an unconstrained optimization problem when the choice variable of a member is only 'x' when $tx = X$. The first order condition will give

$$U'(x) = \alpha C_1^{\alpha-1} \{\bar{\theta} - 3 - \hat{r}\} + 4\bar{\theta}a(\hat{i} + \hat{r}) - 2a(\hat{i} + \hat{r})(1 + r) + 2(b - 2) = 0 \dots \dots \dots \text{ (Eq. 21)}$$

The equation expressed in (21) will give the optimum value of 'x' say 'x*'.
 Second order condition will give $U''(x) = \alpha(\alpha - 1)C_1^{\alpha-2} \{\bar{\theta} - 3 - \hat{r}\}^2 < 0$ as $0 < \alpha < 1 \dots \dots \dots$ (Eq. 22)

$$\text{It is observed that } x^* = x^*(r, \bar{\theta}, i) \text{ when } a \text{ is given. A rural household will participate in micro-finance programme after forming self-help group provided } U\{x(\bar{\theta}, r, i)\} > W^\alpha + W \dots \dots \dots \text{ (Eq. 23).}$$

This is a participating constraint and it is written in inequality form to make the problem interesting.

Assumption-6: $(\bar{\theta} - 3 - \hat{r}) < 0$

Proposition-3: *High skill training will always encourage the self-help group members to save more in each installment at given 'r' and 'i'.*

Proof: From equation (22) and on the basis of Assumption-6 we have

$$\frac{\partial x^*}{\partial \bar{\theta}} = \frac{-\alpha(\alpha - 1)C_1^{\alpha-2}X(\bar{\theta} - 3 - \hat{r}) - \alpha C_1^{\alpha-1} - 4a(2\hat{i} + \hat{r})}{U''(X)} > 0 \dots \dots \dots \text{ (Eq. 24)}$$

Proposition-4 : *High borrowing rate discourages the self-help group members to save more in each installment when $\theta = \bar{\theta}$ and 'i' is kept undisturbed*

Proof: Again from equation (22) and on the basis of Assumption-6 we have

$$\frac{\partial x^*}{\partial r} = \frac{\alpha C_1^{\alpha-1} + \alpha(\alpha - 1)C_1^{\alpha-2}(\bar{\theta} - 3 - \hat{r}) - a\{2\theta - 2(2\hat{i} + \hat{r}) - (1 + r)\}}{2U''(X)} < 0 \dots \dots \dots \text{ (Eq. 25)}$$

Again at $\theta = \bar{\theta}$ and given 'r', we also have

$$\frac{\partial x^*}{\partial i} = - \frac{\{8\bar{\theta} a - 4a(1 + r) + \beta(3 + 2i) + 2\beta(1 + i)\}}{U''(x)} > 0 \dots \dots \dots \text{ (Eq. 26)}$$

So we can say $x^* = x(\bar{\theta}, r, i)$ when $x_\theta > 0$, $x_r < 0$ and $x_i > 0$ which shows that to enhance savings of each group member in each installment low 'r' and high 'i' and 'i' is always desirable. But as 'r' is decided by the Non-motivated NGO it is obvious that both θ and 'i' will also influence 'r'.

Proposition -5 : A non-motivated NGO will always want to keep 'r' at maximum level.

Proof. We shall consider the utility function of the NGO is also quasi linear when $c \in (0,1)$.

$$V(r, \bar{\theta}, i) = I_1^c + I_2 = [G - \varphi(\bar{\theta}) + X(r, \bar{\theta}, i)(r + i)]^c + 4X(\bar{\theta}, r, i)[(1 - a)(\hat{i} + \hat{r})\hat{i} + (\hat{i} + \hat{r})r - b - \hat{r}\hat{i}]$$

The Non motivated NGO at the time of maximizing utility has to consider the following two constraints

- (1) The participation constraint expressed as $U\{X(\bar{\theta}, r, i)\} \geq W^\alpha + W$
- (2) Incentive constraint expressed through (22)
- (3) And third constraint $a(\hat{i} + \hat{r})(1 + r) + 1 < b$

If we consider the participation constraint is not binding then the above optimization problem will again become an unconstrained optimization problem. So the first order condition (keeping $\theta = \bar{\theta}$ and i undisturbed) will give

$$V'(r, \bar{\theta}, i) = cI_1^{c-1}\{X^* + X_r\} + 4X_r^*\{(1 - a)(2\hat{i} + \hat{r})\hat{i} + (\hat{i} + \hat{r})r - b - \hat{r}\hat{i}\} + 4X^* \left\{ \frac{(1 - a)\hat{i}}{2} + (\hat{i} + \hat{r}) + \frac{r}{2} \right\} = 0 \dots \dots \dots \text{(Eq. 27)}$$

We can also show that $V''(r, \bar{\theta}, i) < 0$ provided $X_{rr} < 0$

So following (Eq.27) we can say that the non-motivated NGO will always want to keep the lending rate at maximum level

Proposition-6: If the NGO wants to arrange higher and more efficient skill training for both the members, then it will have to charge higher lending rate at given 'i'.

Proof: The Eq.27 also gives

$$cI_1^{c-1}\{X_{\bar{\theta}} + X_{r\bar{\theta}}\}d\bar{\theta} + c(c - 1)I_1^{c-2}\{X^*(\bar{\theta}, r) + X_r\}\{X_{\bar{\theta}r} - \varphi'(\bar{\theta})\}d\bar{\theta} + 4X_{r\bar{\theta}}\{(1 - a)(\hat{i} + \hat{r})\hat{i} + i + rr - b - \hat{i}d\theta + 4X\theta(1 - a)2 + i + r + r^2d\theta + V''rdr^* = 0$$

If we consider $|X^*| > X_r$, $|X_{r\bar{\theta}}| > \varphi'(\bar{\theta})$ and $X_{r\bar{\theta}} > 0$ then we can say

$$\frac{\partial r^*}{\partial \bar{\theta}} > 0 \dots \dots \dots \text{(Eq. 28)}$$

Proposition-7: The NGO can charge comparatively low lending rate at given $\theta = \bar{\theta}$ and unchanged 'i' provided it gets sufficient government grant at the initial period.

Proof: From Eq. 27 we have,

$$\frac{\partial r^*}{\partial G} = \frac{-c(c-1)I_1^{c-2}(X^* + X_r)}{V''(r)} < 0 \dots \dots \dots \text{(Eq. 29)}$$

As $r > i$ we for the authenticity of our model we can consider that $\frac{\partial r^*}{\partial i} > 0 \dots \dots \dots \text{(29a)}$

So ultimately we have $r^* = r(\bar{\theta}, G, i)$ when $r_1 > 0, r_2 < 0$ and $r_3 > 0 \dots \dots \dots \text{(Eq. 30)}$.

Again maximum amount of savings done by each member in each instalment can now be expressed as

$$x^* = x^*(r, \bar{\theta}, i) = x^*\{r^*(\bar{\theta}, G, i), \bar{\theta}, i\} \dots \dots \dots \text{(Eq. 31)}$$

From the above relation we can conclude that the savings decision done by the representative group member in each instalment in both the stages is influenced by the rate of interest charged by the NGO against credit, the financial support the NGO can gain in the first stage of our model from government, the quality of skill training she can get from the NGO after joining micro-finance programme and lending as well as the borrowing rate of the commercial bank.

Proposition-8: Higher government grant to the NGO in the first stage will encourage the group members to save more in each instalment when $\theta = \bar{\theta}$:

Proof:

$$\frac{dx^*}{dG} = \frac{\partial x^*}{\partial r^*} \frac{\partial r^*}{\partial G} > 0 \dots \dots \dots \text{(Eq. 32)}$$

Suppose, in our model ‘G’ is increased to \tilde{G} and with this from (29) r drops to $\tilde{r} < r^*$ and ‘x’ rises to $\tilde{x} > x^*$. High ‘G’ will also encourage the NGO to spend more on skill development of both the group members.

Proposition-9: High and more efficient skill training will discourage the group member to save larger amount in each installment in her group at given ‘i’.

Proof:

$$\frac{d\tilde{x}}{d\theta} = \frac{\partial \tilde{x}}{\partial \tilde{r}} \frac{\partial \tilde{r}}{\partial \theta} + \frac{\partial \tilde{x}}{\partial \theta} < 0 \dots \dots \dots \text{(Eq. 33)}$$

The first term of the above expression is negative and the second term is positive. High θ at one-side increases ‘x’ and on the other side decreases that due to increase of ‘r’. If the negative effect is stronger than the positive effect then the resultant of the above expression will be negative. θ can be improved such a level that the new value of ‘x’ say \tilde{x} again reduced to x^* and \tilde{r} increase to r^* . So each group member can get higher and improved skill-training from the NGO without increasing compulsory savings and at unchanged borrowing rate.

Micro finance programme under SGSY scheme permits 10% of the accumulated funds to be given to the NGOs for the formation of groups and for nurturing them. The release of grants to NGO is tied to gradations of the SHG in various stages. The failure to make gradation, results in the non-release of funds

to NGO which further weakening the SHGs financially and the ultimate break-up of the SHGs since the NGO has no money to continue to hire the service provider for training the self-help group members. So it is observed that most of the group members of the self-help groups under SGSY scheme are not getting adequate skill training from the NGOs (Kundu 2008). The NGOs also complain that they do not have sufficient grant to arrange skill training for the group members after formation. But this paper establishes the fact that initial sanction of higher amount of grant to the NGO is necessary if we want to arrange good and efficient skill training for the participants of the micro finance programme. This will also increase the consumption level of both the participants progressively without forcing the group members to save larger amount in each instalment. Besides that the NGO can prevent itself from charging higher lending rate to both the borrowers.

Proposition 14: Linked commercial bank should keep both the lending and borrowing rate at minimum level in self-help group bank linkage programme.

Initially we consider $\theta = \hat{\theta} > \bar{\theta}$ and $\widehat{G} > G$. But $x = x^*$ and $r = r^*$ when $x^* = x^*\{r^*(\hat{\theta}, \widehat{G}, i), \hat{\theta}, i\}$. So

$$\frac{dx^*}{di} = \frac{\partial x^*}{\partial r^*} \frac{\partial r^*}{\partial i} + \frac{\partial x^*}{\partial i} < 0 \dots \dots \dots (34)$$

Here also the first term is negative and the second term is positive. If the group member gives more importance on ‘r’ then the negative effect will be stronger than the positive effect and the resultant is negative. So low lending and borrowing rate charged by the linked commercial bank help the NGO to charge low lending rate to both the group members which ultimately will encourage them to save larger amount in each instalment. We know that in the group lending method, total monitoring to the group member is done by the assigned NGO which ultimately keeps the transaction cost of the linked commercial bank at low level. Low ‘i’ and high ‘G’ will help the NGO to keep ‘ θ ’ at high level but ‘r’ at low level. As at the time of joining micro-finance scheme each prospective member initially gives more importance on ‘r’, low ‘r’ will encourage him to save more amounts in each instalment.

Concluding observations:

This paper narrates public-private participation in micro-finance programme. The paper re-establishes the fact that even in the presence of government subsidy in micro-credit programme under joint liability through forming self-help group, social sanction or depriving the members from enjoying further benefits from the government still plays an important role of security at the time of repayment of loan. It is also proved that if the group members are not equally powerful in the society then in the second stage of the game, the powerful member applying her social influence and taking the advantage of joint liability may force the less-powerful member to repay her loan with interest and enjoy free ride. So positive assortative matching both from the economic as well as from the social point of view is necessary at the time of

group formation and that should be maintained in both the periods to keep repayment rate 100%. Here the NGO, who is working on behalf of the group is risk averse but it wants to maximize its utility only after improving the economic conditions of the group members. This paper also shows that, the non-motivated NGO can offer credit to the group members at lowest possible rate of interest and can arrange good skill-training programme for both of them provided it gets sufficient financial assistance from the government at the time of group formation. That also encourages each group member to save maximum amount in each instalment (compulsory savings) to get higher amount of credit at lowest possible rate of interest in future. Higher size of credit will also help them to earn higher level of income after the end of the second stage, which ultimately will help them to remove poverty.

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ⁱ Here NGO is a motivated agent who pursues goals because he perceives intrinsic benefit from doing that (Besley and Ghatak 2005).

ⁱⁱ According to NABARD, the rate of interest for SHGs should be market related. But following Srinivasan (2002), the final rate of interest on micro credit turn out to be in the range of 24% to 36% per annum. The reason for such high rate of interest is actually due to the margins charged by the bank, NGO and the SHG.

ⁱⁱⁱ Micro savings is compulsory in any micro-finance programme both under individual liability and under joint liability. But how much amount each group member can save in each instalment is decided solely by her. The earning of the member household is not the only factor which decides compulsory savings but also what she will get after joining this programme. Here the borrowing rate and intensity of skill development are the two important decision making factors of compulsory savings. Actually through compulsory savings each member sacrifices the present for benefit of the future.

^{iv} For the simplicity of our model we assume that the rate of interest changed against saving deposit by the linked commercial bank is uniform in the entire time period.

^v Here loan is sanctioned for half of the year and so $2\hat{r} = r$.

^{vi} Here following the condition of micro-credit programme after forming group, each group member has to save in installment continuously up to the end of first period. Suppose after taking credit both the group members have to save same amount in same number of installments

^{vii} Here it is assumed that the borrower belongs to self-help group does not spend any amount for monitoring her co-member as well as co-borrower. So following Roy Chowdhury (2005), we here assumes total absence of peer monitoring among the group members.