Entry of Formal Lenders and the Size of the Informal Credit Market

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Abstract

This paper considers the effects of entry of formal lenders on the size of the informal credit market in terms of a model consisting of *m* ILs and *n* FLs. Each IL enjoys local monopoly power, on account of his informational advantage, over a group of entrepreneurs (e), and would not lend outside his known group of entrepreneurs. The FLs however do not enjoy any such informational advantage with regard to particular groups and are willing to lend to borrowers from any group. All the agents are risk neutral and are interested in maximising their expected profits. The FLs optimally choose the number of loans, given the administered rate of interest. In case of project failure, the FLs acquire the collateral. Unlike the FLs the ILs are unregulated and optimally choose both the interest rate and the collateral. It is shown that at a high administered interest rate entry is less effective in reducing size of informal credit market. Entry of FLs cannot eliminate the informal credit market altogether, although it will be relatively more effective compared to deregulation of the interest rate.

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1. Introduction

The past decade has witnessed a revival of the debate on state intervention versus non-intervention as the optimal credit policy, especially in the context of developing countries.[1] Initially it was believed, that state intervention through nationalisation and regulation of commercial banks would help to mitigate the financial dualism that infested the credit markets in most developing countries. That the policy was a partial success is evidenced by several independent studies, which contradict the official claim that the growth of formal credit has put the informal lender (IL) "in place". The studies reveal that small borrowers (less wealthy or collateral poor) both in the agricultural and the industrial sectors continue to depend heavily on informal credit as most often they are denied access to formal credit.[2]

The shift in policy in favour of government non- intervention in the wake of the financial repression resulting from interventionist approach has also been subject to debate. The issue at stake is that, given the credit market imperfections, whether non-intervention in the conventional sense of financial liberalisation would lower the informal interest rate and curb informal lending.

More recently, the debate on financial liberalisation has led to a departure from the conventional notion of state intervention (and non-intervention). One approach is to encourage informal lending and induce competition among the ILs through the establishment of vertical formal-informal links. Hoff and Stiglitz(1997), Bose(1997), Floro and Ray(1997) provide important insights into the possible effects , which is likely to be mixed. Another recent approach has been that of microfinance, which takes advantage of available local information by designing credit organisations based on peer monitoring (Stiglitz ,1990).Thus the new credit policies leave scope for state intervention without direct regulation of the FLs.
Another major strand of the literature on informal credit consists of empirical studies and the theoretical explanations[3] of the various structural features of the informal credit markets. The studies also reveal that FLs and ILs have various structural differences such that either of them have advantages vis-à-vis the other in certain aspects and disadvantages in others. This explains their co-existence.

In chapter 3 we have / Mallik (2000) has analysed the effect of financial liberalisation on the size of the informal credit market by focusing on one aspect of liberalisation , viz. deregulation of formal interest rate. It reaches the conclusion that if the financial repression is not very severe deregulation need not necessarily lead to a contraction in the size of the informal credit market. In chapter 4, we consider / This paper considers the other aspect, viz. allowing free entry of private sector banks into the formal credit market. It is shown that at a high, administered interest rate entry is less effective in reducing size of informal credit market. Entry of FLs cannot eliminate the informal credit market altogether, although it will be relatively more effective compared to deregulation of the interest rate.

Any meaningful model of financial liberalisation in the context of developing countries must take into consideration the strategic interaction between the formal and the informal credit markets. In chapter 3 / Mallik (2000) the interaction between the FL and the IL is modeled as a sequential move game between two players, viz. a FL and an IL. The FL moves first and the

[1] For a detailed discussion of the issues and a reference list refer to chapter 1 /chapter 3 / Mallik (2000).
[2] For a discussion of the causes of failure of formal credit in reaching out to the poor *op.cit.*
[3] For references in this area *op.cit.*

IL moves after observing the FL. The contracts (C,r) offered by the lenders are collateralised debt contracts. Here r represents the gross interest on loans which are of unit size by assumption. C denotes the size of collateral. The simultaneous choice of C and r is made by the players sequentially in a deregulated environment. Prior to deregulation the FLs choice of r is restricted by the interest rate ceiling. The IL however, is free to choose r. The sequence of moves reflects a fundamental structural difference between a FL and an IL. The FL being subject to various regulatory and procedural norms cannot alter his offers quickly, unlike the IL who can react instantaneously. Hence, it is more likely that the IL reacts to the FL's move and that the FL takes that into consideration when designing its contract, rather than considering the IL's move as given.

Again restricting the game to just two players, i.e. just one FL and one IL is based on the observation that the ILs normally enjoy a local monopoly. Entry into informal lending is not free or easy due to the existence of personal knowledge about borrowers on part of the lender, large resources required for incurring screening costs, giving loans etc. Thus we assume that there exists only one IL in a locality. Moreover since the focus of chapter 3 / the paper is on deregulation rather than entry, consideration of just one FL is not restrictive. Neither is it unrealistic if we base our analysis on a local market.

In this chapter / paper the strategic interaction occurs at two levels. The paper analyses the impact of an expansion in the number of FLs on the size of the formal and informal credit markets measured in terms of their market shares. In our model therefore, we consider a credit market with n FLs and m ILs. Thus not only does it consider the formal–informal interaction as in chapter 3 / Mallik (2000) but it also considers the interaction among the n FLs. This is modeled as a two-stage game in which the n FLs move simultaneously in stage 1. The m ILs move in stage 2, after observing the formal contract. The strategic interaction here involves both simultaneous and sequential decision-making. Each of the n FLs must take into consideration the strategic behaviour of the ILs as also the behaviour of the other FLs. The strategic interaction among the m ILs does not arise since each of the ILs is a local monopolist. This makes ILs' markets separated, unlike the FLs who face the same pool of borrowers.

The plan of this chapter / the paper is as follows. Section 2 states the assumptions regarding the basic framework and briefly discusses credit market equilibrium with m ILs. Sections 3 and 4 lay out the model and characterise credit market equilibrium in the presence of FLs. Section 3 considers credit market equilibrium with n FLs only. This section highlights how the FL's problem gets differentiated from that of the IL, due to the strategic interaction among the FLs and the presence of information asymmetry between the entrepreneur and the FL. Section 3A describes the nature of competition and specifies the payoff functions. The existence and nature of equilibrium is analysed in section 3B.Finally in section 4, the case of strategic interaction between m informed ILs and n uninformed FLs has been discussed. Here, the discussion in section 3 is carried a step further. It shows how the FL's problem gets further modified if the FL takes into account the strategic behaviour of the ILs. Section 4A discusses the IL's decision problem in stage 2. The consequences for credit market equilibrium and free entry of FLs is analysed in section 4B and 4B.1. Finally section 5 presents the conclusions.

2. Assumptions

We consider a situation where there is free entry and exit in the credit market by FLs. We consider a model in which there are *n* FLs and *m* ILs. Each IL enjoys local monopoly power, on account of his informational advantage, over a group of entrepreneurs (e), and would not lend outside his known group of entrepreneurs. The FLs however do not enjoy any such informational advantage with regard to particular groups and are willing to lend to borrowers from any group.

The entrepreneurs in each group are uniformly distributed over the interval $[0,\overline{C}]$, according to their capacity to pay collateral C_j, which is divisible. The production conditions are the same as in chapter 3 / Mallik(2000). Each entrepreneur has access to a project whose size is fixed at unity, yielding a random return of q with probability p, and zero with probability $(1-p)$. The entrepreneurs must borrow the investment good from the lenders in order to undertake the project as they do not have any endowments of their own. The contracts are collateralised debt contracts. Thus the entrepreneurs either pay r, which is the gross interest on loans when the project is successful. In case the project fails they part with the collateral C, as specified in the contract. The contracts also involve a fixed transaction cost of T per borrower. To keep the notation simple we assume that T is inclusive of the principal or the amount of loan which by assumption is unity. Thus $T > 1$. All the agents are risk neutral and are interested in maximising their expected profits.

The structural difference between the FL and the IL is also reflected in the degree of information asymmetry they face. The IL can observe the output q from the project. Hence the possibility of strategic default by the entrepreneurs on informal loans does not arise. In other words the ILs would always receive r with probability p and C with probability $(1-p)$ whether the value of $C \in [0,\overline{C}]$ chosen by the IL is greater or less than the r chosen by him. The FL however faces the problem of moral hazard as it cannot observe q and thus must rely on collateral for avoiding strategic default by the entrepreneur as is discussed in section 3.A. below.

In order to ease our understanding we first consider credit market equilibrium in the absence of FLs, i.e. when there are *m* ILs only. Thus we have *m* identical but separated markets. This situation is therefore an m th order replication of the case of one IL discussed in chapter 3 / Mallik(2000). The equilibrium in this case would consist of each IL giving clean advances, i.e. choosing $C = 0$ and fixing the rate of interest so as to take away the entire surplus from the projects, i.e. choosing $r = q$. Since the IL does not face the possibility of strategic default by the entrepreneur therefore he need not ask for collateral. This would also give him access to the whole market. Moreover being a monopolist the IL would take away the entire surplus.

3.Strategic interaction among Formal Lenders

3A. The Model

We want to analyse credit market equilibrium in the presence of FLs. However before considering the strategic interaction between FLs and ILs, we analyse credit market equilibrium with n FLs only. With m ILs, there were m identical but separated local markets. With n FLs however, such separation is not possible as the FLs cannot distinguish between borrowers from different groups. Hence each FL faces the aggregate group (same pool) of borrowers. This implies that one must take into consideration the strategic interaction among the FLs when analysing credit market equilibrium with n FLs only.

In order to highlight the effects of entry we assume that the formal rate of interest is administered, $\bar{r} < q$. We further assume that the FLs engage in quantity competition, i.e. they compete in the number of loans[4] (loan size is fixed at unity by assumption).The value of collateral in the formal sector C_F is then determined accordingly from the loan market clearing condition which requires that

$$L^s = \sum_i L_i = L^d. \qquad (1)$$

Here L_i is the total loan supplied by the ith FL and L^d is the aggregate demand for loans faced by the FL as specified below in equation (2).

$$L^d = \frac{(\bar{C} - C_F)m}{\bar{C}} \qquad (2a)$$

This is because given C_F, all the entrepreneurs belonging to the m different groups with collateral greater than C_F qualify for loans.

From equation (2) the loan demand function in inverse form may be obtained as,

$$C_F = \frac{\bar{C}(m - L^d)}{m} \qquad (2b)$$

Now in order to specify the payoff function of the ith FL we must note that, unlike the IL, the FLs cannot observe whether the project has been successful or not. This gives rise to the possibility of strategic default by the entrepreneur. Hence the FLs' profit per borrower will depend on whether the market clearing value of collateral satisfies the incentive compatibility constraint or not.

So, according as the market clearing value of collateral C_F is $\geq \bar{r}$ or $< \bar{r}$, the entrepreneurs will or will not have the incentive to repay $\bar{r}$, when the project is successful. In the latter case, strategic default by the entrepreneurs is bound to occur. This would imply that the FL receives only C_F irrespective of whether the project is successful or not. On the other hand, when $C_F \geq \bar{r}$, the entrepreneurs would prefer paying $\bar{r}$ if the project is successful, and would part with C_F, only if the project fails. Thus given $\bar{r}$ the market clearing value of collateral affects the FLs' profit per borrower in two ways. It not only affects the return to the

[4] Competition in terms of size of collateral would have given the standard Bertrand result which is less intersting.

lender when the project fails, but it also affects the lender's earning from a loan when the corresponding projects are successful.

We may now state the payoff function of the *i*th FL as follows. The aggregate profit of the *i*th FL is,

$$\Pi_{li} = (\bar{r}p + C_F(1-p) - T)L_i \qquad \forall \quad C_F \geq \bar{r} \qquad (3a)$$

$$= (C_F - T)L_i \qquad \forall \quad C_F < \bar{r} \qquad (3b)$$

where $C_F = \dfrac{\overline{C}(m - \sum L_i)}{m}$ is the market clearing value of collateral, obtained from equations (1) and (2) above.

3B.Equilibrium

3B.1 Existence

In order to find out the equilibrium loan supply by the *i*th lender we need to compute the Nash equilibrium in L_i's. We assume that the FLs are faced with a given administered rate of interest $\bar{r} < q$. The size of the formal credit market n is also, for now, given.

Let $\bar{r} > T$[1].

Let $\bar{L}_i$ be such that, for $L_i \leq \bar{L}_i$, $C_F \geq \bar{r}$ and for $L_i > \bar{L}_i$, $C_F < \bar{r}$. To solve for L_i we substitute nL_i for $\sum_i L_i$ in (1) and set $C_F = \bar{r}$ in (2) yielding

$$\bar{L}_i = \frac{m}{n}\frac{(\bar{C} - \bar{r})}{\bar{C}}. \quad (4)$$

Now given $\bar{r}$ and n, L_i must belong to either of the two intervals $[0, \bar{L}_i]$ or $\left(\bar{L}_i, \frac{(\bar{C} - T)m}{\bar{C}}\right]$.

Note that $\bar{L}_i < \frac{(\bar{C} - T)m}{\bar{C}}$ for $\bar{r} > T$. Hence in order to find out the equilibrium loan supply, we need to check for the existence of and find the Nash equilibrium in loan supply in the intervals $[0, \bar{L}_i]$ and $\left(\bar{L}_i, \frac{(\bar{C} - T)m}{\bar{C}}\right]$.

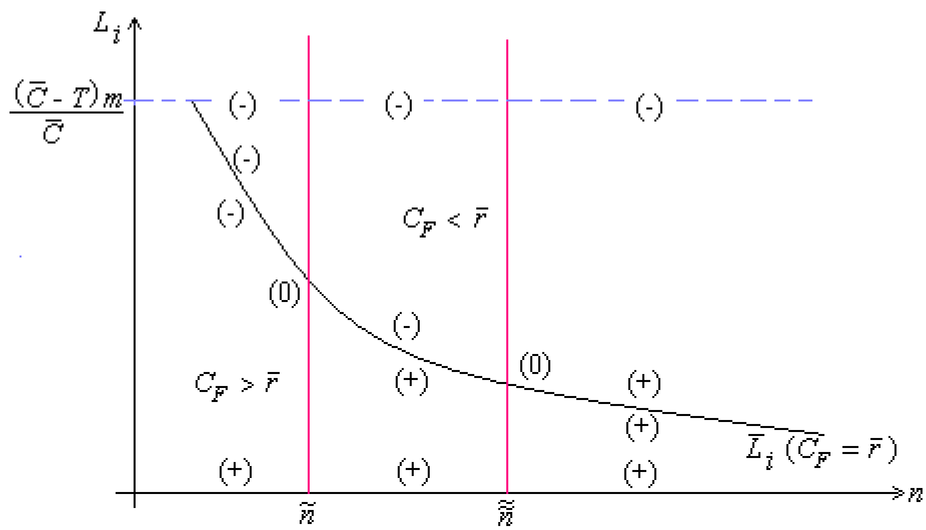

FIG.1

[1] For $\bar{r} < T$, the incentive compatibility constraint is no longer binding. The FLs' profit per borrower and hence their aggregate profits are reduced to zero at $C_F > \bar{r}$.

Now suppose all the FLs choose the same $L_i \in [0, \overline{L}_i]$. We want to check whether there exists an $L_i \in [0, \overline{L}_i]$ such that L_i is Nash equilibrium. Then from the definition of $\overline{L}_i$ it would follow that the payoff to the i th FL is given by equation (3a). Differentiating (3a) with regard to L_i yields,

$$\frac{\partial \Pi_{li}}{\partial L_i} = \bar{r}p + C_F(1-p) - T - L_i \frac{\partial C_F}{\partial L_i}$$

Substituting for C_F and $\frac{\partial C_F}{\partial L_i}$ yields,

$$\frac{\partial \Pi_{li}}{\partial L_i} = \bar{r}p - T + \frac{\overline{C}(1-p)(m - nL_i)}{m} - L_i \frac{\overline{C}}{m}$$

$$= \bar{r}p - T + \overline{C}(1-p) - \frac{\overline{C}}{m} L_i[n(1-p)+1] \tag{5a}$$

The necessary condition for Nash equilibrium requires that the expression in (5a) should be equal to zero.

Now at $L_i = 0$, $\frac{\partial \Pi_{li}}{\partial L_i} = \bar{r}p + \overline{C}(1-p) - T > 0$ for all n. (5b)

At $L_i = \overline{L}_i > 0$, $\frac{\partial \Pi_{li}}{\partial L_i} = \left[\frac{\bar{r} - T}{\overline{C} - \bar{r}} - \frac{(1-p)}{n}\right](\overline{C} - \bar{r}) \; \substack{\leq \\ >} \; 0$

according as $n \; \substack{< \\ >} \; \frac{(\overline{C} - \bar{r})(1-p)}{\bar{r} - T} = \tilde{n}$.[2] (5c)

Further the expression for the derivative in (5a) is continuous in L_i. Therefore by intermediate value theorem, it would follow that for $n < \tilde{n}$ there exists $L_i^* \in (0, \overline{L}_i)$ such that $\frac{\partial \Pi_{li}}{\partial L_i} = 0$ at $L_i = L_i^*$. Hence we have the following:

Remark 1: There exist Nash equilibrium in loan supplies in the interval $\left(0, \overline{L}_i\right)$ for $n < \tilde{n}$.

Note that the second order condition for a maximum, is satisfied since further differentiation of the derivative in (5a) yields,

$$\frac{\partial^2 \Pi_{li}}{\partial L_i^2} = -\frac{2\overline{C}(1-p)}{m} < 0 \tag{5d}$$

However for $n \geq \tilde{n}$, there does not exist $L_i \in (0, \overline{L}_i)$ such that $\frac{\partial \Pi_{li}}{\partial L_i} = 0$ for all i. Hence there

[2] Note that the derivatives in (5b) and (5c) are the right hand derivative and the left-hand derivative respectively of the payoff function in (3a), as 0 and $\overline{L}_i$ are boundary points of the domain for the payoff function in (3a).

does not exist Nash equilibrium in loan supplies in the interval $\left(0,\overline{L}_i\right)$ for $n \geq \tilde{n}$ (details follow).

Figure 1 summarises the above discussion. For any given n, the points lying on or below the $\overline{L}_i$ curve represent the L_i's that would yield a payoff to the lenders given by equation (3a). The plus and minus signs within parentheses, below the $\overline{L}_i$ curve represent the sign of the derivative of the profit function in (3a), as given by (5a). The zero within brackets means that the value of the derivative is zero. The (+) signs lying close to the horizontal axis show that the derivative of the profit function in (3a) is positive, at $L_i = 0$ for all n. The signs within brackets lying just below the $\overline{L}_i$ curve show the sign of the derivative at $L_i = \overline{L}_i$, for different ranges of values of n, as given by (5c). For $n < \tilde{n}$, the derivative changes sign as L_i increases from zero to $\overline{L}_i$. Thus for $n < \tilde{n}$, there must be some $L_i \in (0, \overline{L}_i)$ where the value of the derivative must become equal to zero. For $n \geq \tilde{n}$ however , this does not hold as the value of the derivative is positive over the entire range of values of L_i in the interval $(0, \overline{L}_i)$. Note that at $n = \tilde{n}$, the value of the derivative is zero at $\overline{L}_i$.

Now suppose all the FLs choose the same $L_i \in \left(\overline{L}_i, \dfrac{(\overline{C}-T)m}{\overline{C}}\right]$. Once again we want to check whether there exists $L_i \in \left(\overline{L}_i, \dfrac{(\overline{C}-T)m}{\overline{C}}\right]$ such that L_i is Nash equilibrium. From the definition of $\overline{L}_i$ it would follow that the payoff to the i th FL is given by equation (3b). Differentiating Π_{li} with regard to L_i yields,

$$\frac{\partial \Pi_{li}}{\partial L_i} = (C_F - T) + L_i \frac{\partial C_F}{\partial L_i}$$

Substituting for C_F and $\dfrac{\partial C_F}{\partial L_i}$ we have,

$$\frac{\partial \Pi_{li}}{\partial L_i} = \frac{\overline{C}(m - nL_i)}{m} - T - L_i \frac{\overline{C}}{m}$$

$$= \overline{C} - T - (1+n)\frac{\overline{C}}{m} L_i \tag{6a}$$

Now at $L_i = \overline{L}_i$, the derivative in (6a) is ,

$$\frac{\partial \Pi_{li}}{\partial L_i} = \left[\frac{\bar{r} - T}{\overline{C} - \bar{r}} - \frac{1}{n}\right](\overline{C} - \bar{r}) \;\begin{matrix}<\\>\end{matrix}\; 0 \quad \text{according as } n \;\begin{matrix}<\\>\end{matrix}\; \frac{\overline{C} - \bar{r}}{\bar{r} - T} = \tilde{\tilde{n}} \tag{6b}$$

At $L_i = \frac{(\overline{C} - T)m}{\overline{C}}$, the derivative in (6a) is $\frac{\partial \Pi_{li}}{\partial L_i} = n(T - \overline{C}) < 0$ for all n. [3] (6c)

Hence for $n \leq \tilde{\tilde{n}}$, $\frac{\partial \Pi_{li}}{\partial L_i} < 0$ at all $L_i \in \left(\overline{L}_i , \frac{(\overline{C} - T)m}{\overline{C}} \right]$. The necessary condition for existence of Nash equilibrium in loan supplies requires that $\frac{\partial \Pi_{li}}{\partial L_i} = 0$. So for $n \leq \tilde{\tilde{n}}$, $L_i \in \left(\overline{L}_i , \frac{(\overline{C} - T)m}{\overline{C}} \right]$ can not constitute Nash equilibrium (more about this follow).

Now the expression for $\frac{\partial \Pi_{li}}{\partial L_i}$ in (6a) is continuous in L_i. Further for $n > \tilde{\tilde{n}}$, $\frac{\partial \Pi_{li}}{\partial L_i} < 0$ at $L_i = \frac{(\overline{C} - T)m}{\overline{C}}$ and $\frac{\partial \Pi_{li}}{\partial L_i} > 0$ at $L_i = \overline{L}_i$. Therefore by intermediate value theorem for $n > \tilde{\tilde{n}}$, there exists some $L_i^{**} \in \left(\overline{L}_i , \frac{(\overline{C} - T)m}{\overline{C}} \right)$ such that the value of the derivative is zero. Hence again we have the following:

Remark 2: There exist Nash equilibrium in loan supplies in the interval $\left(\overline{L}_i , \frac{(\overline{C} - T)m}{\overline{C}} \right)$ for $n > \tilde{\tilde{n}}$.

The second order condition for a maximum is satisfied, since further differentiation of the derivative in (6a) yields,

$$\frac{\partial^2 \Pi_{li}}{\partial L_i^2} = -\frac{2\overline{C}}{m} < 0 \tag{6d}$$

Referring to figure 1, for loan supplies represented by points lying above the $\overline{L}_i$ curve, the corresponding payoff function is given by equation (3b). The signs within parentheses lying above the curve represent the sign of the derivative $\frac{\partial \Pi_{li}}{\partial L_i}$ of the profit function in (3b), as given by (6a). The (-) signs along the dotted/broken line indicates that the derivative of the profit

[3] Once again the derivatives in (6b) and (6c) are the right hand and left hand derivatives respectively, at $\overline{L}_i$ and $\frac{(\overline{C} - T)m}{\overline{C}}$ as these are the boundary points of the payoff function in (3b). Note that the expressions for the left-hand derivative and the right hand derivative of the payoff function at $L_i = \overline{L}_i$, given by (5b) and (6c), are different. However the value of the payoff function in (3a) and (3b) is the same at $L_i = \overline{L}_i$. Hence the payoff function is continuous but non-differentiable at $\overline{L}_i$.

function in (3b) is positive, at $L_i = \frac{(\overline{C}-T)m}{\overline{C}}$ for all n. The signs within brackets lying just above the $\overline{L}_i$ curve show the sign of the derivative at $L_i = \overline{L}_i$, for different ranges of values of n, as given by (6b). For $n > \tilde{\tilde{n}}$, the derivative changes sign as L_i increases from $\overline{L}_i$ to $\frac{(\overline{C}-T)m}{\overline{C}}$. Thus there must be some $L_i \in \left(\overline{L}_i, \frac{(\overline{C}-T)m}{\overline{C}}\right)$ where the value of the derivative must become equal to zero. On the other hand for $n \le \tilde{\tilde{n}}$, there can be no L_i in the interval mentioned above at which the derivative will be zero, as the derivative has a negative sign over the entire range. Again note that at $n = \tilde{\tilde{n}}$, the value of the derivative is zero at $\overline{L}_i$.

Comparing (5c) and (6b) we find that $\tilde{n} < \tilde{\tilde{n}}$. We will now investigate what will be the Nash equilibrium value of loan supply when $n \in [\tilde{n}, \tilde{\tilde{n}}]$, given $\bar{r}$.

Let us consider $n \in [\tilde{n}, \tilde{\tilde{n}}]$ and $L_i = \overline{L}_i$. At $n = \tilde{\tilde{n}}$ the derivative in (6b) is zero. At $n = \tilde{n}$ the derivative in (5c) is zero. Hence $\overline{L}_i$ constitutes Nash equilibrium in loan supplies at $n = \tilde{n}$ and $n = \tilde{\tilde{n}}$. For $n \in (\tilde{n}, \tilde{\tilde{n}})$, the derivatives in (5c) and (6b) which are left-hand derivative and right hand derivative of the payoff function at $L_i = \overline{L}_i$, are of opposite signs, although the values of the payoff functions in (3a) and (3b) are the same. This means that the payoff function is continuous but non-differentiable at $L_i = \overline{L}_i$. However from our earlier discussion[4] we know that for $n \in (\tilde{n}, \tilde{\tilde{n}})$, the function is increasing in L_i at $L_i < \overline{L}_i$ and decreasing in L_i at $L_i > \overline{L}_i$. Therefore by continuity a maximum is ensured at $L_i = \overline{L}_i$, (with a kinked graph) for $n \in (\tilde{n}, \tilde{\tilde{n}})$. Hence we have the following remark:

*Remark 3: F*or $\bar{r} > T$ and $n \in [\tilde{n}, \tilde{\tilde{n}}]$, $\overline{L}_i$ constitutes a Nash equilibrium in loan supplies.

3B.2 Optimal Loan Supplies

So far we have focussed on only the existence of Nash equilibrium in loan supplies, for different ranges of n. We will now find out what the equilibrium loan supplies are and check whether they satisfy the feasibility and participation constraints.

Setting (5a) equal to zero yields the optimal number of loan supply, when $n < \tilde{n}$.

$$L_i^* = \frac{L^{s*}}{n} = \frac{m}{n+1} \frac{\{\bar{r}p + \overline{C}(1-p) - T\}}{\overline{C}(1-p)} \tag{7}$$

[4] Note that the value of the derivative in (5a) is negative at $L_i > \overline{L}_i$ and the value of the derivative in (6a) positive at $L_i < \overline{L}_i$.

The market-clearing value of the collateral in the formal credit market may be obtained from equation (2a) as,

$$C_F{}^* = \frac{\overline{C}(m - L^{s*})}{m}$$

$$= \overline{C}\ [1 - \frac{n}{n+1} \frac{\{\bar{r}p + \overline{C}(1-p) - T\}}{\overline{C}(1-p)}] \tag{8a}$$

Interestingly, C_F^* is independent of *m*. C_F^* is however sensitive to $\overline{C}$, and hence to the distribution or average collateral endowment of borrowers. The presence of richer borrowers will cause C_F^* to increase and make borrowing by the poor more difficult as (6b) shows. As there is no supply constraint on the part of the FLs and there are no interactions among borrowers and ILs in different markets it does not signify how many markets (m) there are. It is only the borrowing power or the ability to pay or produce collateral of the borrowers that determine the optimal value of collateral.[5]

Comparative statics yields,

$$\frac{\partial C_F^*}{\partial \overline{C}} = \frac{1}{n+1} > 0 \tag{8b}$$

$$\frac{\partial C_F^*}{\partial \bar{r}} = -\frac{np}{(n+1)(1-p)} < 0 \tag{8c}$$

$$\frac{\partial C_F^*}{\partial n} = -\frac{\bar{r}p + \overline{C}(1-p) - T}{(1-p)} \frac{1}{(n+1)^2} < 0 \tag{8d}$$

From (8c) and (8d) it follows that the market-clearing value of collateral in formal credit market varies inversely both with the administered rate of interest and the number of FLs. In other words with entry in formal credit market and increase in the administered rate of interest, the size of the formal credit market will increase as borrowers with relatively smaller amounts of collateral become eligible for formal loans.

Let us now check the feasibility of the optimisation programme. The payoff function in (3a) is valid only if $C_F^* \geq \bar{r}$. In addition to the incentive compatibility condition, stated in (3a) we have the following feasibility constraints on C_F^*:

$$C_F^* \in [0, \overline{C}] \tag{3'a}$$

[5] Consideration of m ILs keeps the analysis sufficiently general. The separation of the ILs markets seems in keeping with the observed features of the credit markets in developing countries. The analysis doesn't change much, except for changes in loan supplies, if we set $m = 1$.

$$\pi_1(C_F^*, \bar{r}) = \bar{r}p + C_F^*(1-p) - T \geq 0 \qquad (3'b)$$
$$\pi_e(C_F^*, \bar{r}) = pq - \bar{r}p - C_F^*(1-p) \geq 0 \qquad (3'c)$$

We need not elaborate on $(3'a)$. $(3'b)$ and $(3'c)$ represent the participation constraints of the FLs and the entrepreneurs respectively. Here π_l represents the FLs profit per borrower and π_e represents the entrepreneurs profit.

$C_F^* \leq \overline{C}$, for all $\bar{r} \in [0, q]$ and all n since $T < \overline{C}(1-p)$ by assumption. Further, C_F^* satisfies (3'b) and (3'c) for all $\bar{r} \in [0, q]$ and all n, with the equality sign holding in (3'b) as $n \to \infty$. These follow, from the assumptions $T < \overline{C}(1-p)$ and $\overline{C}(1-p) < pq - T$ respectively.
We now check whether C_F^* satisfies the incentive compatibility constraint or not. Once again we ignore the case where $\bar{r} \leq T$. For $\bar{r} > T$, substituting (8a) into the incentive compatibility condition yields a critical value of n given by $\tilde{n}$ such that the incentive compatibility condition is satisfied for all $n \leq \tilde{n}$, for a given $\bar{r}$.
Now note that $\tilde{n} < 1$ for $\bar{r} > \hat{r}$ where $\hat{r} = \dfrac{\overline{C}(1-p)+T}{2-p} \in (T, pq)$[6]. This means that for $\bar{r} > \hat{r}$ the C_F^* does not satisfy the incentive compatibility condition for any $n \geq 1$. Hence for $\bar{r} > \hat{r}$, L_i^* cannot be equilibrium loan supply.

We next consider the case where the Nash equilibrium in loan supplies is given by $L_i^{**} \in \left(\overline{L}_i, \dfrac{(\overline{C}-T)m}{\overline{C}} \right)$. Again setting the derivative in (6a) equal to zero yields the optimal number of loans for the FLs when $n > \tilde{\tilde{n}}$, given by

$$L_i^{**} = \frac{L^{s**}}{n} = \frac{m}{n+1} \frac{\{\overline{C} - T\}}{\overline{C}} \qquad (9)$$

The market-clearing value of the collateral in the formal credit market may be obtained from equation (2a) as before:

$$\begin{aligned} C_F^{**} &= \frac{\overline{C}(m - L^{s**})}{m} \\ &= \frac{\overline{C} + nT}{n+1} \end{aligned} \qquad (10)$$

As in the earlier case, C_F^{**} is independent of *m*, varies directly with $\overline{C}$, and inversely with n. That C_F^{**} is independent of $\bar{r}$ is not surprising given (3b). Further $C_F^{**} \to T$ as $n \to \infty$;

[6] In fact $\hat{r} \in (T, T/p)$ where $T/p < pq$ assuming $\overline{C}/2 < T/p$.

$C_F^{**} = \dfrac{\overline{C}+T}{2}$ at $n=1$. It follows that for $n \geq 1$, $C_F^{**} \in \left(T, \dfrac{\overline{C}+T}{2}\right]$. Hence note that $C_F^{**} < pq$ since by assumption $\dfrac{\overline{C}}{2} < pq - T \Leftrightarrow \dfrac{\overline{C}+T}{2} < pq$.

Now , the fact that $C_F^{**} \to T$ as $n \to \infty$ is intuitively clear as FLs' profit per borrower will become negative if C_F^{**} fell below T. In fact as $n \to \infty$, $L_i^{**} \to 0$. In other words when the number of FLs become very large, individual loan supplies become very small so as to keep $C_F^{**} > T$.

Once again we check for the feasibility of the optimisation programme when the objective is given by (3b). The payoff function in (3b) is valid when the market clearing value of C_F satisfies $C_F^{**} < \bar{r}$. In addition to the condition, stated in (3b), we have the following feasibility constraints on C_F^{**}:

$$C_F^{**} \in [0, \overline{C}] \qquad (3''\text{a})$$
$$\pi_1(C_F^{**}, \bar{r}) = C_F^{**} - T \geq 0 \qquad (3''\text{b})$$
$$\pi_e(C_F^{*}, \bar{r}) = pq - C_F^{**} \geq 0 \qquad (3''\text{c})$$

(3"a) is the same as before; (3"b) and (3"c) represent the participation constraints of the FLs and the entrepreneurs respectively, when strategic default is inevitable. Since for $n \geq 1$, $C_F^{**} \in (T, pq)$ therefore C_F^{**} satisfies (3"a) ,(3"b) and (3"c) for all $\bar{r} \in [0, q]$ and all $n \geq 1$.

Now substituting (10) in the inequality $C_F^{**} < \bar{r}$ yields a value of $n = \tilde{\tilde{n}}$, such that the condition is satisfied for all $n \geq \tilde{\tilde{n}}$, for a given $\bar{r}$.

We already noted that for $n \geq 1$, $C_F^{**} \in (T, pq)$. Hence for $\bar{r} \leq T$, C_F^{**} does not satisfy $C_F^{**} < \bar{r}$, for any n. It follows that for $\bar{r} \leq T$, L_i^{**} cannot be equilibrium loan supply. It also follows that for $\bar{r} \geq pq$, C_F^{**} satisfies $C_F^{**} < \bar{r}$, for all $n \geq 1$. This is in keeping with the fact that $\tilde{\tilde{n}} < 1$ for $\bar{r} \geq pq$. Thus for $\bar{r} \geq pq$, L_i^{**} constitutes Nash equilibrium for all $n \geq 1$.

The following proposition summarises the discussion in this section:

Proposition 1: *Consider a credit market with n FLs facing an administered rate of interest $\bar{r} \in [0, q]$ and competing in the number of loans L_i.*

(I) *Let $\bar{r} \in (T, \hat{r})$. Then the optimal loan supply of the ith FL (using the Nash equilibrium concept) (L_E) and the market clearing value of collateral (C_{FE}) is given by the following* *equations for different ranges of values of n, as determined by* $\tilde{n} \equiv \dfrac{(\overline{C}-\bar{r})(1-p)}{\bar{r}-T}$ *and* $\tilde{\tilde{n}} \equiv \dfrac{\overline{C}-\bar{r}}{\bar{r}-T}$.

a)For $n < \tilde{n}$, $L_i^* = \dfrac{m}{n+1}\dfrac{\{\bar{r}p+\overline{C}(1-p)-T\}}{\overline{C}(1-p)}$, $C_F^* = \overline{C}\ [1-\dfrac{n}{n+1}\dfrac{\{\bar{r}p+\overline{C}(1-p)-T\}}{\overline{C}(1-p)}]$.

b)For $n > \tilde{\tilde{n}}$, $L_i^{**} = \dfrac{L^{s**}}{n} = \dfrac{m}{n+1}\dfrac{\{\overline{C}-T\}}{\overline{C}}$, $C_F^{**} == \dfrac{\overline{C}+nT}{n+1}$

c)For $n \in [\tilde{n}, \tilde{\tilde{n}}]$, $\overline{L}_i = \dfrac{m}{n}\dfrac{(\overline{C}-\bar{r})}{\overline{C}}$, $C_F = \bar{r}$.

(II) *For* $\bar{r} \in [0,T]$ *the equilibrium loan supply and value of collateral is given by* L_i^* *and* C_F^* *respectively, for all* n .

(III) *For* $\bar{r} \in \left[\hat{r}, \dfrac{\overline{C}+T}{2}\right)$ *the equilibrium loan supply and value of collateral is given by* $\overline{L}_i$ *and* $\vec{r}$ *respectively, for* $n \in (1, \tilde{\tilde{n}}]$ *and given by* L_i^{**} *and* C_F^{**} *for* $n > \tilde{\tilde{n}}$.

(IV) *For* $\bar{r} \in \left[\dfrac{\overline{C}+T}{2}, q\right]$ *the equilibrium loan supply and value of collateral is given by* L_i^{**} *and* C_F^{**} *for all* $n \geq 1$ *(here* $\tilde{\tilde{n}} < 1$*).*

The results stated in the above proposition for the interesting case $\bar{r} \in (T, \hat{r})$ are discussed below:

The size of the formal credit market here refers to the number of borrowers who have access to formal credit. In other words it refers to the number of entrepreneurs who can offer collateral at least as large as C_F or entrepreneurs with $C_j \in [C_F, \overline{C}]$. Thus the size of the formal credit market increases with a decrease in market clearing C_F.

Here we are considering a credit market with n FLs facing an administered rate of interest $\bar{r}$ and competing in the number of loans. Then it is shown that there exist an $\tilde{n} \equiv \dfrac{(\overline{C} - \bar{r})(1-p)}{\bar{r} - T}$ and $\tilde{\tilde{n}} \equiv \dfrac{\overline{C} - \bar{r}}{\bar{r} - T}$ such that ,

a) for $n \le \tilde{n}$, the size of the formal credit market increases as the number of FLs increase. The maximum size is attained when $n = \tilde{n}$ with FLs giving loans to all entrepreneurs who can offer collateral at least as large as $\bar{r}$. (In other words in equilibrium the FLs will not offer loans to entrepreneurs who do not satisfy the incentive compatibility condition.) This is also the maximum size of the formal credit market for $n \le \tilde{\tilde{n}}$, where $\tilde{\tilde{n}} > \tilde{n}$.

b) For $n \ge \tilde{\tilde{n}}$, as the number of FLs increase, the size of the formal credit market increases with the market clearing value of collateral falling below $\bar{r}$. In the limit as $n \to \infty$ the equilibrium value of C_F approaches T. This is natural since the FLs will never choose to supply a number of loans large enough to make the market clearing value of collateral fall short of T, which will make strategic default is inevitable. With $C_F < \bar{r}$, it would make the FLs return per borrower $(C_F - T)$ negative.

c) For every $n \in [\tilde{n}, \tilde{\tilde{n}}]$ the size of the formal credit market is constant at the size corresponding to $\tilde{n}$. Thus as n increases from $\tilde{n}$ to $\tilde{\tilde{n}}$ the size of the formal credit market remains unchanged with the market clearing value of C_F being just equal to $\bar{r}$.

Hence an increase in the number of FLs does not necessarily imply greater / higher credit access in terms of collateral poor borrowers being eligible for formal loans. If initially $n \in (\tilde{n}, \tilde{\tilde{n}})$ then further increase in the number of FLs to $n < \tilde{\tilde{n}}$ is ineffective as it will not relax the credit constraint for the collateral poor borrowers. In fact by reducing the number of FLs to $\tilde{n}$ the same size of the market could be achieved by fewer FLs in operation. This is depicted in fig.2b, with fig.2a showing the number of loans supplied by the each FL in equilibrium.

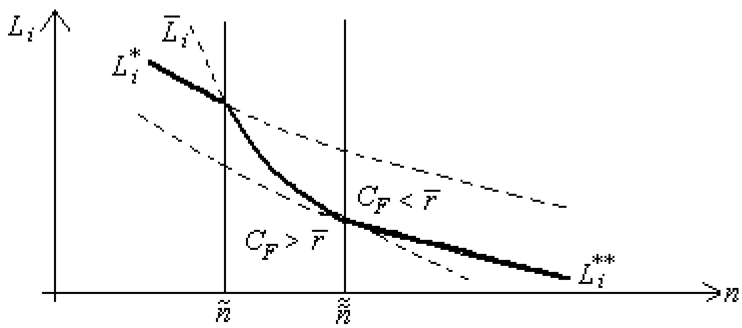

FIG. 2a

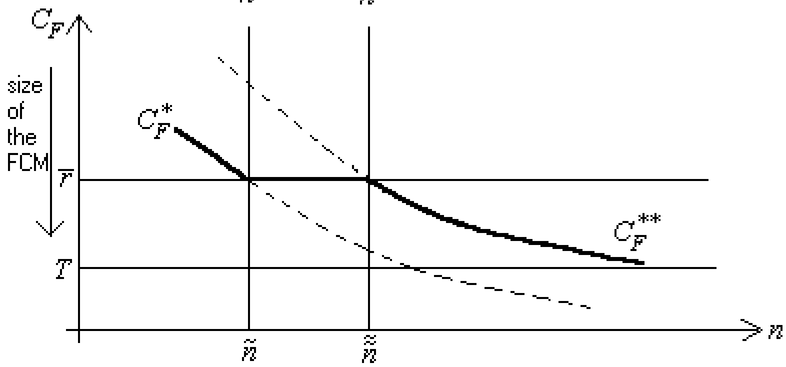

FIG.2b

When the number of FLs exceeds $\tilde{\tilde{n}}$, the size of the formal credit market increases further with entrepreneurs having collateral less than $\bar{r}$ qualifying for loans. In other words when there are a large $(n > \tilde{\tilde{n}})$, and there is further increase in their number the FLs find it optimal to allow for strategic default (and take the collateral) rather than shrinking the loan supply.

For $\tilde{n} < n < \tilde{\tilde{n}}$, contracting loan supply along L_i^* would lead to an excess supply of loans. This would cause the market clearing C_F to be lower than $\bar{r}$, making strategic default inevitable. Hence choosing loan supply along L_i^* is no longer optimal. Under the circumstances as their number increases, the FLs adjust their individual loan supplies in a manner so that aggregate loan supply remains constant and equals the aggregate loan demand at $C_F = \bar{r}$. In other words they reduce their individual loan supplies so that the market clearing C_F remains at $\bar{r}$. Recall that this is the zone ($n \in (\tilde{n}, \tilde{\tilde{n}})$) in which the objective function in (3) reaches its maximum at a point at which it is continuous but non-differentiable.

4. Strategic Interaction between Formal Lenders and Informal Lenders

We will now consider the interesting case of strategic interaction between m informed ILs and n uninformed FLs.The formal-informal interaction here involves both simultaneous and sequential decision-making. The n FLs move simultaneously (choose their loan supplies.)The m ILs move after observing the formal contract. As in chapter 3 / Mallik(2000) the sequence of moves reflects a structural difference between FLs and ILs.. The FL being subject to regulatory constraints, can not alter his offers quickly unlike the IL who can observe the actions of the FL and react instantaneously. Since our objective is to analyse the effect of free entry of FLs we continue assuming that the formal rate of interest is administered. As in the previous section the FLs engage in quantity competition. The value of collateral in the formal sector is then determined accordingly from the loan market clearing condition.

The ILs make their offer after observing the formal contract. Unlike the FLs the ILs are unregulated and optimally choose both r and C. The IL's problem does not differ from that discussed in chapter 3 / Mallik (2000). This is because each of the m ILs is only one of his type in his local market and they do not have to face competition from other ILs when choosing their strategy. Moreover, the IL being virtually a monopolist in the residual local market (the only source of credit for the borrowers in his locality who get rationed in the formal credit market) choosing the size of collateral is equivalent to choosing the number of loans. Hence effectively, there does not exist any difference between price and quantity competition, for the IL. Modeling the IL’s problem in terms of the number of loans would ensure symmetry in the notation for FL and the IL, but effectively nothing changes if we solve the IL’s problem in terms of C.

As mentioned above the formal-informal interaction involves sequential decision making with n FLs choosing their loan supplies in stage 1 and the m ILs choosing their contracts in stage 2. Thus in order to obtain the solution (sub-game perfect Nash equilibrium) to the above gave we solve it by backward induction. Hence we begin by considering the IL’s choice problem in stage 2.

4A. Informal lenders’ decision problem in stage two:

From our discussion in Chapter 3, we know that given the contract offered by the FLs, the ILs face the option of either segmenting the market or competing with the FLs

Figure3 below reproduces figure 2 of chapter 3 with slight modifications in the legends.

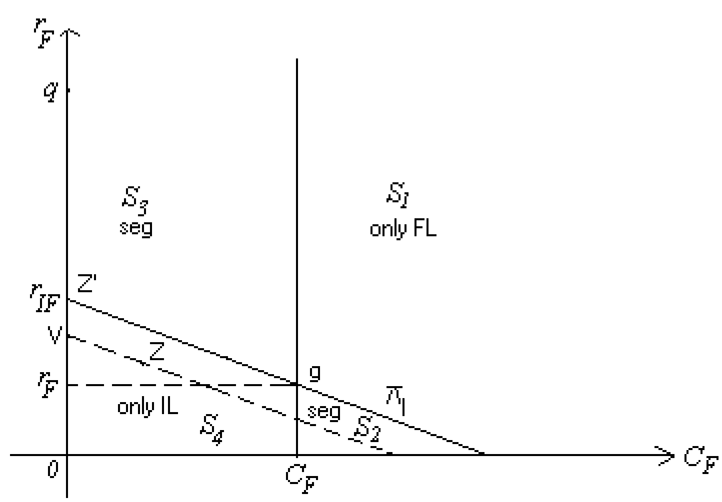

FIG 3.

Given the formal contract (C_F, r_F) with $C_F > r_F$, the IL would choose either the contract $(0,q)$ and segment the market or he would choose $(0, r_{IF})$ and compete for borrowers, with the FL. The profits earned by the FL and the IL, when the IL chooses to segment the market or compete are stated below in (11a) and (12a). Since the FL faces an administered rate of interest therefore $r_F = \bar{r}$. C_F is the market clearing value of collateral for the formal sector, determined from equations (1) and (2).

If the market clearing value of collateral in the formal sector C_F happens to be less than $\bar{r}$, then the contract chosen by the IL, if he decides to segment the market will be $(0,q)$. On the other hand if the IL decides to compete then he would choose $\left(0, \frac{C_F}{p}\right)$. When $C_F < \bar{r}$, then the return to the entrepreneurs from the formal contract is $(pq - C_F)$. Hence to compete the IL must offer a contract, that would yield a profit to the entrepreneurs at least as large as $(pq - C_F)$. This means that the IL can earn at most $(C_F - T)$ per borrower since total surplus is $(pq - T)$. Thus the IL must choose (C, r) such that his profit per borrower is $rp + C(1-p) - T = C_F - T$. However by making clean advances, that is choosing $C = 0$ and $r = \frac{C_F}{p}$, the IL is able to get access to the entire market as well, while earning $(C_F - T)$ per borrower. We may now state the ILs' profit from segmentation and competition given $(C_F, \bar{r})$.

If the IL chooses to segment the market, then the maximum profit that he can earn, is

$$\Pi_{seg} = \frac{C_F}{\bar{C}}(pq - T) \tag{11a}$$

The corresponding payoff to the FL in this case would be

$$\Pi_{lF} = \pi_l(C_F, r_F)\frac{\bar{C} - C_F}{\bar{C}} \tag{11b}$$

On the other hand if the ILs choose to compete, then the maximum profit he can earn is

$$\Pi_{comp} = \bar{r}p + C_F(1-p) - T \qquad C_F \geq \bar{r} \tag{12a}$$

$$= C_F - T \qquad C_F < \bar{r} \tag{12b}$$

The corresponding payoff in this case to the FL would be zero.

Given the formal contract, the IL would choose to segment the market or to compete depending upon which strategy is more profitable.

Comparison of (11a) and (12a) yields that, given $\bar{r}$ and n, and $C_F \geq \bar{r}$, $\Pi_{seg} \gtrless \Pi_{comp}$, according as $C_F \gtrless \frac{(\bar{r}p - T)\bar{C}}{(pq - T) - (1-p)\bar{C}} = C_0$. However note that, since the function in

(12a) above is defined only for $C_F \geq \bar{r}$, therefore C_0 will exist (i.e. $C_0(\bar{r}) \geq \bar{r}$) iff $\bar{r} \geq \dfrac{T\overline{C}}{(\overline{C}-pq)+T} \equiv \bar{\bar{r}} \in \left(\dfrac{T}{p}, pq\right)$. Alternatively, the slope of the Π_{seg} function as obtained from (11a) is $\dfrac{pq-T}{\overline{C}}$. This is greater than $(1-p)$, which is the slope of the Π_{comp} function in (12a). Therefore C_0 will exist (i.e. $C_0(\bar{r}) \geq \bar{r}$) iff $\Pi_{comp} \geq \Pi_{seg}$ at $C_F = \bar{r} \;\Rightarrow\; \bar{r} - T \geq \dfrac{\bar{r}}{\overline{C}}(pq-T) \Rightarrow\; \bar{r} \geq \bar{\bar{r}}$. This is illustrated in figure 4, by the segments of Π_{comp} and Π_{seg} curves that lie to the right of the dotted line corresponding to $C_F = \bar{r}$. To the right of $\bar{r}$, the Π_{seg} curve is steeper than the Π_{comp} curve. Further at $C_F = \bar{r}$, $\Pi_{comp} \geq \Pi_{seg}$ for $\bar{r} > \bar{\bar{r}}$. Hence Π_{seg} curve intersects the Π_{comp} curve from below. Finally note that C_0 is increasing in $\bar{r}$, since $\dfrac{\partial C_0}{\partial \bar{r}} = \dfrac{p\overline{C}}{(pq-T)-\overline{C}(1-p)} > 1$ as $pq - T < \overline{C}$ by assumption. This is illustrated in figure 5 by the line segment FH.

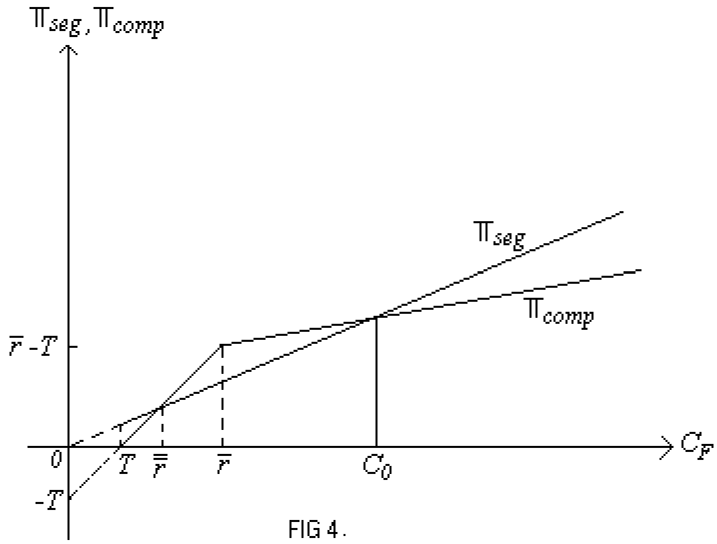

FIG 4.

For $C_F < \bar{r}$, the IL's profit from competition is given by equation (12b). Hence using equations (11a) and (12b), we get that given $\bar{r}$ and n, and $C_F < \bar{r}$, $\Pi_{seg} \gtrless \Pi_{comp}$, according as $C_F \lessgtr \dfrac{T\overline{C}}{(\overline{C}-pq)+T} \equiv \bar{\bar{r}}$. For $C_F < \bar{r}$, the slope of the Π_{comp} curve is T which is greater than the slope of the Π_{seg} curve. Also note that at $C_F = T$, Π_{comp} is zero while $\Pi_{seg} > 0$. Therefore $\Pi_{seg} \gtrless \Pi_{comp}$, according as $C_F \lessgtr \bar{\bar{r}}$.

This is illustrated in figure 4, by the segments of the curves corresponding to $C_F \in [T, \bar{r})$. The segments of the curves lying to the left of T are not relevant since C_F cannot be less than T.

4B:Effects of Entry of Formal lenders on the Size of the Informal Credit Market:

From the preceding analysis we know that if the IL chooses to compete with the FL, after observing the formal contract $(C_F, \bar{r})$, then the FLs' profit would be zero. Now in stage1, when choosing their optimal loan supplies, the FLs would take into consideration, the optimal response of the IL consequent upon its actions. Note that in stage1, the FLs' equilibrium loan supply and hence the market clearing value of collateral in the formal sector depends on both $\bar{r}$ and n. This means that given $\bar{r}$, the formal contract $\left(C_F(\bar{r}, n),\ \bar{r}\right)$ essentially depends on n, the number of FLs operating in the market. This in turn means that given $\bar{r}$, whether the IL wishes to segment the market or to compete will depend on n. If given $\bar{r}$, n is such that the ILs find it profitable to compete then the FLs are driven out of the market and only the ILs survive.

Figure 5 illustrates possible credit market equilibria for different values of $\bar{r}$ and n. In figure 5, the vertical line segment $\mathrm{AA'}$ at $C_F = T$ indicates that in the limit $C_F \to T$ as $n \to \infty$.

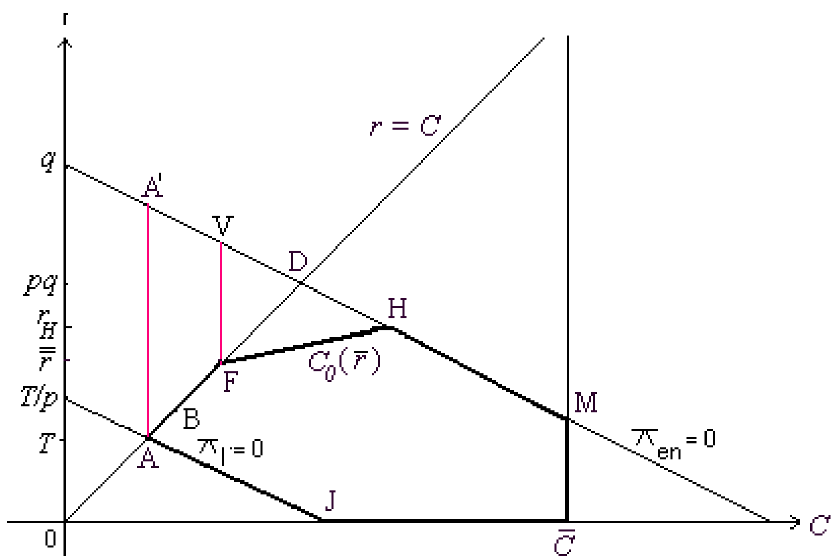

FIG 5.

The line segment FH represents the $C_0(\bar{r})$ curve as defined in the previous section. Thus for all formal contracts that satisfy the incentive compatibility constraint (i.e. $C_F \geq \bar{r}$) and that lie to the right of or below the line segment FH, the ILs would find it profitable to segment the market. On the other hand if the formal contract happens to satisfy the incentive compatibility constraint and lies to the left of line segment FH, then the ILs would find it profitable to compete and drive the FLs out of the market.

For formal contracts that lie to the left of the $r = C$ line, $C_F = \bar{\bar{r}}$ (defined in the previous section), is the critical value of C_F, at which the ILs are indifferent between segmentation and competition. The vertical line segment FV at $C_F = \bar{\bar{r}}$ demarcates the two zones. For formal contracts that lie to the left of the incentive compatibility constraint and also lie to the left of or on the segment FV the ILs would prefer to segment the market. If they happen to lie to the right of the line segment FV, then the ILs would compete.

__4B.1.Free entry of Formal Lenders:__

What happens if we allow for free entry of private sector banks into the formal sector? We first consider the situation where $\bar{r} \in [T, \bar{r}]$. We ignore the case where $\bar{r} < T$ as this is not interesting. For $\bar{r} \in [T, \bar{r}]$, the ILs would always prefer segmenting the market, whatever be the market clearing value of collateral in the formal sector. Given $\bar{r} \in [T, \bar{r}]$, as the number of FLs increase, C_F will keep falling till the incentive compatibility constraint becomes binding. This happens when $n = \tilde{n}$ (defined in section 3). However as the FLs continue to earn positive profits entry will continue to take place. But in this zone entry will not affect C_F till n reaches $\tilde{n}$. Entry beyond $\tilde{\tilde{n}}$ will once again cause C_F to fall further, below $\bar{r}$. As $n \to \infty$, $C_F \to T$ and the FLs profits will tend to zero. Thus free entry of FLs will cause the size of the formal credit market to increase and the informal credit market to shrink. The FLs will give loans to all borrowers with collateral at least as large as T. Note that for $n > \tilde{\tilde{n}}$, strategic default becomes inevitable in the formal sector. The ILs would segment the market giving loans to borrowers with collateral $C \in [0, T)$.

If $\bar{r} \in (T, r_H)$, entry will continue till $C_F = C_0 > \bar{r}$. Further entry of FLs will not take place as this would induce the ILs to compete and drive the FLs out of the market. Thus allowing entry will not be very effective in reducing the size of the informal credit market. Finally note that for $\bar{r} > r_H$, the formal credit market will cease to exist.

It is however interesting to note that free entry of FLs cannot eliminate the informal credit altogether. The credit market will remain segmented. The FLs will give loans to all entrepreneurs with collateral endowment at least as large as C_F. The ILs will give loans to all entrepreneurs who get rationed in the formal credit market and will behave as monopolist in the residual market. Thus the ILs would choose $r = q$.

__4C. Deregulation of interest rate vs free entry__

The debate on state intervention versus non-intervention in the context of the credit markets in LDCs centers on the issue, that given the credit market imperfections whether financial liberalisation can lower informal interest rates and curb informal lending. In chapter 3 we looked into the effect of deregulation of the formal interest rate, on the size of the informal credit market. This chapter investigates the effect of allowing free entry of private sector banks into the formal sector, on the size of the informal credit market. It would now be interesting to compare the two alternative instruments of financial liberalisation in terms of their effectiveness in curbing informal lending.

Suppose to start with there is one FL and one IL in a locality. The FL faces an administered rate of interest $\bar{r}$. Now if the government decides to deregulate the interest rate, then the equilibrium contract of the FL would be given by some point on the $r = C$ curve, above $r_{ic} = \dfrac{\overline{C}(1-p)+T}{2-p}$ and at or below $\bar{\bar{r}}$ [1]. Diagrammatically (figure 5), the formal contract would lie on the segment BF (excluding point B), of the $r = C$ curve. Therefore with interest rate deregulation and absence of free entry, the size of the formal credit market is restricted by the incentive compatibility constraint, with $C_F = r_F \in (r_{ic}, \bar{\bar{r}})$. Depending on what the administered rate of interest was initially, interest rate deregulation would cause the size of the formal credit market to increase or decrease relative to its initial size.

Now suppose instead of deregulating $\bar{r}$, the government allows free entry of private sector banks into the formal credit market / free entry into formal lending. For $\bar{r} \in [T, \bar{\bar{r}}]$, free entry causes the size of the formal credit market to expand to $C_F = T < r_{ic}$. Thus diagrammatically, the vertical line segment AA' restricts the size of the formal credit market. We may therefore conclude that for $\bar{r} \in [T, \bar{\bar{r}}]$, entry is more effective than deregulation of interest rate, in curbing informal lending.

If the administered rate of interest in the formal sector is initially high ($\bar{r} > \bar{\bar{r}}$), then we know that, expansion of the formal credit market through entry of FLs is limited by $C_0(\bar{r}) > \bar{\bar{r}}$ .In figure 5, the line segment FH indicates the limit to the expansion of the formal credit market with free entry. Hence we may conclude that, interest rate deregulation in the absence of free entry, would be more effective in curbing informal lending than holding the formal rate of interest fixed at $\bar{r} > \bar{\bar{r}}$ and allowing free entry.

We may summarise the discussion of this section in the following proposition.

Proposition 2 *:* (a) Free entry of FLs is less effective in reducing the size of the informal credit market, at a high administered rate of interest ($\bar{r} \in (\bar{\bar{r}}, r_H)$) than at a low administered rate of interest ($\bar{r} \in [T, \bar{\bar{r}}]$). For $\bar{r} > r_H$ the formal credit market will cease to exist.

(b) For $\bar{r} \in [T, \bar{\bar{r}}]$ entry will cause the size of the formal credit market to increase till $C_F = T$. The FLs merely give loans in return for collateral, as strategic default becomes inevitable ($C_F < \bar{r}$).

(c) However free entry of FLs cannot eliminate the informal credit market altogether, although it will be relatively more effective compared to deregulation of the interest rate.

<u>5. Conclusion:</u>

This chapter / paper considers the effects of entry of formal lenders on the size of the informal credit market in terms of a market consisting of *m* ILs and *n* FLs. The strategic

[1] Note that $\bar{\bar{r}} = \tilde{r}_0$. Refer to chapter 3 for definition of $\tilde{r}_0$.

interaction among the FLs and between the FLs and the ILs has been modeled in terms of a game that involves both simultaneous and sequential decision making. The FLs move simultaneously. The ILs move after observing the formal contract which is the outcome of FLs' action. The ILs enjoy local monopoly power, on account of their informational advantage, over a group of entrepreneurs (e), and would not lend outside their known group of entrepreneurs. The FLs however do not enjoy any such informational advantage with regard to particular groups and are willing to lend to borrowers from any group. All the agents are risk neutral and are interested in maximising their expected profits. The FLs optimally choose the number of loans, given the administered rate of interest. In case of project failure, the FLs acquire the collateral. Unlike the FLs the ILs are unregulated and optimally choose both the interest rate and the collateral. We establish the existence of a market equilibrium under such conditions and explicitly compute the optimal loan size as the solution to a two stage game between the FLs and the ILs. It is shown that at a high administered interest rate entry of FLs is less effective in reducing size of informal credit market than for lower rates. Entry of FLs cannot eliminate the informal credit market altogether, although it will be relatively more effective compared to deregulation of the interest rate.

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