Capital Accumulation in the Presence of Informal Credit Contract : Does Incentive Mechanism Work Better than Credit Rationing Under Asymmetric Information?

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Credit markets with asymmetric information often prefer credit rationing as a profit maximizing device. This paper asks whether the presence of informal credit markets reduces the cost of credit rationing, that is whether it can alleviate the impact of asymmetric information based on the available information. We used a dynamic general equilibrium model with heterogenous agents to assess this. Using Indian credit market data our study shows that the presence of informal credit market can reduce the cost of credit rationing by separating high risk firms from the low risk firms based on their available information. But even after this improvement, the steady state capital accumulation is still much lower as compared to incentive based market clearing rates. Through voluntary disclosure of each firm’s type, based on the incentive mechanism, banks can diversify their risk by achieving a separating equilibrium in the loan market. Incentive mechanism helps banks to maximize profit by charging lower rates and lending relatively higher amount to the less risky firms. This, in turn, leads to higher capital accumulation in the long run.

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1 Introduction:

When formal credit markets are imperfect due to asymmetric information, credit rationing is the most common practice to minimize bank’s exposure to risk. But experience from different developing countries reveals that credit rationing in the formal credit market leads to the steady growth of informal credit market. In this paper, we specify a dynamic general equilibrium model with heterogenous borrowers and informal credit market to answer the following two questions: First, does rationing in the formal credit market create a recurrence of low capital accumulation under asymmetric information even in the presence of informal credit market? Second, is market clearing loan rate less efficient for higher capital accumulation when investment projects experience different probabilities of success?

Our study shows that the presence of informal credit market can reduce the cost of credit rationing by separating high risk firms from the low risk firms based on their available information. But even after this improvement, the steady state capital accumulation is still much lower as compared to incentive based market clearing rates. Through voluntary disclosure of each firm’s type, based on the incentive mechanism, banks can diversify their risk by achieving a separating equilibrium in the loan market. Incentive mechanism helps banks to maximize profit by charging lower rates and lending relatively higher amount to the less risky firms. This, in turn, leads to higher capital accumulation in the long run.

The two key features of this paper are that, first, capital accumulation can be intermediated through either bank or informal credit market. Second, is the assumption of heterogenous firms defined on the basis of degree of risk involved in the production process. Informal credit channel is composed of households and informal moneylenders like traders or landlords. Households provide loan to their low risk relatives or friends only when they are rejected by the bank due to rationing. We consider in our model that households have resource constraints and due to that they cannot cater all the rejected low risk borrowers from formal sector.

Moneylenders serve as the final source of funds in this market and assumed to have enough funds to cater to the borrowers rejected by formal sector and households. As a result of the credit rationing in the formal sector and resource constraint in households sector they
face a pool of high risk and low risk borrowers. In order to glean the available information to separate each firms based on their risk type moneylenders are needed to incur certain information cost.

The existing literature on credit market imperfection lacks unanimity on how financial development should take place. The critical aspects of the early analysis (Stiglitz and Weiss (1981)) justifies credit rationing in many ways. According to them the lender’s expected profit will decline with an increase in the interest rate under some circumstances. This leads to an excess demand and loan rationing. In Juffe-Russel (1976), honest borrowers cannot be distinguished from economically rational borrowers. Rationing occurs in this case because of restricted loan sizes and the excess demand in this case cause lower fraction of default. Williamson (1986, 1987a, 1987b) has illustrated how debt contracts and credit rationing can arise, even in the absence of asymmetric information. According to him credit rationing occurs if the lenders must incur costs to monitor borrowers.

However, the major criticism against this credit rationing approach is that the informal credit market is the outcome of credit rationing in the formal credit markets. In this market, the lenders often combine credit with trading in crops and selling general merchandize (Bell (1990), Siamwalla et al (1990)). According to this view, the growth of informal market is the upshot of easy availability of funds and low default rates. The policy prescriptions made by economists in this regard is to expand formal credit in order to provide credit at cheaper rate to those who need it “..to put the moneylenders in their place” (AU India Rural Credit Survey).

Bester (1985) provides an alternative theoretical view against credit rationing. According to this view, if banks compete by choosing collateral requirements and differentiated interest rates (separating equilibrium) simultaneously then credit rationing will not occur. He further added that it is possible to use different contracts as a self-selection mechanism. Preferences for low interest and high collateral or vice versa lead to this self-selection.

But Bester’s proposal of separating equilibrium, based on collateral, is also not always viable. If the separation is not done costlessly it produces inefficient outcomes. Against this view of using collateral as a sorting device, Besanko and Thakor (1987) find that it is valid
only when there is no collateral constraint. When collateral constraint is binding lenders cannot sort borrowers out based on collateral and rationing is the only solution.

Our model differs from these approaches in several respects. First, in earlier works (Stiglitz and Weiss (1981), Jaffe and Russel (1976)), the formal market is considered to be the only source of credit and the rejected borrowers do not have any other source of external funds. In contrast, we introduce an informal credit channel as an alternative source of funds. The introduction of this extra source of funds, though very expensive, reduces the social cost of credit rationing and leads to higher level of capital accumulation. Second, Bester(1985), Besanko and Thakor (1987) have pointed out theoretically that separating equilibrium can lead to better outcome compared to credit rationing if collateral is used as a sorting devise. But if the borrowers face collateral constraints (Besanko and Thakor(1987)) then this sorting devise does not hold and in that case, rationing is the only solution. Our model shows that the separating equilibrium can be achieved through direct revelation or self selection based on price incentive costlessly and no collateral is required. Moreover, this endogenous pricing can ensure hedging against risk by charging higher price and offering less to the high risk firms as compared to the low risk firms. And this price differential can be considered as the risk premium.

Our study is organized in five sections. Apart from introduction, section-1 encompasses the background literature as well as contribution of this paper. Section-2 discusses the base line model with heterogenous agents. Section-3 deals with the equilibrium analysis under steady state while Section-4 deals with the quantification of our model through calibration and estimation of some parameter values. Last section concludes.

2 The Base Line Model

The economy consists of four types of decision makers: firms, banks, households and informal money lenders. There are two types of firms - low risk and high risk. Both types of firms have same expected return which makes them inseparable to the banks. But their probability of success are different and that information is unknown to the banks. Firms produce their
own capital which they obtain by taking loans either from banks or from informal markets. Both of these loans are assumed to be perfectly substitute to each other. Firms prefer to borrow from the formal sector because there is a wedge between the interest rate charged by informal moneylenders and the banks.

Banks offer deposit contracts, maturing in the end of the period. They also sell shares in the financial market to diversify their risks. Banks convert this deposits and stocks into loans without any cost and extend them to the firms.

Households maximize their life time utility from consumption and providing altruistic loans to the low risk relatives and friends for production purpose. But due to resource constraint households cannot satisfy the entire demand of low risk loans from the friends or relative. This encourages the low risk borrowers to go for formal sector loans first instead of going for the household sector loan. They receive wage at the end of the previous period from supplying one unit of labor. Households also receive the principal and interest from their deposit and stocks kept in the bank. They do not participate in the informal loan market with a profit motive. Households only extend loans to the low risk firms on the basis of the following criteria:

- They know the owner of the firms from very close circuit like friend or family members and
- The projects taken up by these firms are less risky.
- Extending loan only to the rejected low risk firms gives the household positive utility. This is because when low risk firms are rejected by the formal sector due to credit rationing, the only source of fund available is the informal money lenders who charge exorbitantly higher interest rates. Households, by extending a very low rate (equivalent to zero) loan, protects the family members or friends and, thus, maximizes utility. If households find the projects risky then they do not offer loan contracts and in that case the risky firms prefer to have loans from the money lenders at a higher rate than not having anything.

Informal money lenders are risk neutral and lend in the informal market when excess
demand for loan spills over from the formal market because of credit rationing. This real-locative effect of credit rationing induces the informal money lenders to offer more loans in the informal market instead of investing their savings with banks.

Another important feature of our model is the assumption that these money lenders face an information cost. Households resource constraint leads some low risk firms to take loans from the moneylenders after being rejected by banks. To screen the low risk from the high risk firms moneylenders incur such cost. This assumption is justified because as we see from the data available in the context of India, that there is wedge between the formal and informal market loan rates.

Finally, we assume that population is constant so there is no aggregation bias with treating average quantities as aggregate quantities.

2.1 Model Specification: Firms

As mentioned earlier, firms production process is composed of two stages. In the first stage firms convert their borrowing into capital. In the second stage firms utilize their capital to produce a single consumption good as final product. Firms can borrow from either banks or from households/moneylenders and consider the same amount of loan taken from each sector as perfect substitutes to each other. Given this backdrop the two stages of production process can be written as:

Stage 1: Firms produce their own capital. Firms do not have any initial wealth. So, they have to borrow in order to produce their capital. Firms produce capital using the following linear function:

\[ K_t = L_t + H_{i,t} \]

where \( K_t \) is the total amount of capital produced. \( L_t \) and \( H_{i,t} \) represent amount of loan taken from banks and from households/moneylenders respectively in period \( t \). All of them are assumed to be in real terms.

Stage 2: In this stage firms convert their capital into a consumption good. In our model we assume return on the \( i \)th firm’s project is a random outcome. All projects yield the same return. When the firms are successful irrespective of their type, they achieve a \( \psi_t \) percent
more output above mean level. Output is zero when they fail. Only difference is in their rate of success.\(^1\) We defined the firms with higher success rate as the low risk firms (LR) and firms with lower rate of success as the high risk firms. With corresponding rate of success \((\phi_i)\) the expected production can be written as:

\[
E_t[f(k_t)] = \gamma_{i,t}[A k_t^m]
\]  

(2)

where,

\[
\gamma_{i,t} = \phi_i (1 + \psi_t)
\]  

(3)

The equation of motion for capital takes the following form:

\[
k_{t+1} = (1 - \delta)k_t + i_t
\]  

(4)

where \(i_t\) is investment and \(k_t\) is the per capita capital stock in period \(t\). We assume no technological difference between these two types of firms. Given the above production functions the profit functions for the \(i^{th}\) firm, \((\pi_i)\) can be written as:

\[
E[\pi_{i,t}] = \begin{cases} 
\gamma_{i,t}A(L_{i,t})^m - (1 + l_{i,t})L_{i,t} & \text{when gets formal sector loan} \\
\gamma_{i,t}A(H_{i,t})^m - (1 + h_{i,t})H_{i,t} & \text{when does not get formal loan}
\end{cases}
\]  

(5)

where \(i = \text{High risk (HR)}\) or, \(\text{Low risk (LR)}\), \(L_{i,t}\) and \(H_{i,t}\) are the amount of loans taken from formal and informal sectors respectively by the \(i^{th}\) firm in period \(t\).

Maximizing profit for the \(i^{th}\) firm with respect to \(L_{i,t}\) and \(H_{i,t}\), we get the corresponding unconstrained demand functions as follows:

For \(i^{th}\) firm:

\[
L_{i,t}^{D^*} = \left(\frac{\gamma_{i,t} Am}{1 + l_{i,t}}\right)^{\frac{1}{1-m}} \text{ when loan is available from formal sector}
\]

(6)

\[
H_{i,t}^{D^*} = \left(\frac{\gamma_{i,t} Am}{1 + h_{i,t}}\right)^{\frac{1}{1-m}} \text{ when loan is not available from formal sector}
\]

(7)

\(^1\)see De Meza and Webb (1987), pp. 282 for similar assumption
And since $\phi_{LR} > \phi_{HR}$, therefore, between the two types of firms

$$\gamma_{LR,t} > \gamma_{HR,t}$$  \hspace{1cm} (8)

Now from the above equation, we can say that, $\gamma_{LR,t}$ being greater than $\gamma_{HR,t}$ due to higher value of $\phi_{LR}$, the demand for loan of the low risk firms is greater than that of the high risk firms at any price. But since the value of $\phi_i$ for different groups are unknown to the banks, they can not differentiate between the firms on the basis of differences in demand.

\section*{2.2 Banks}

we addressed bank’s problem by assuming that there are two possible types of regimes.

\subsection*{2.2.1 Credit Rationing Regime: Pooling Equilibrium}

In this case we assume that banks are price takers both in the loan market as well as in the deposit and stock markets. They have a uniform loan rate, $\overline{l}_t$, predetermined by the central bank. In this situation banks face a pooled demand from both types of firms. Let us assume that the proportion of high risk firms be $\rho$ and that of low risk firms be $(1 - \rho)$. Since banks do not have this information and the information regarding the type of each firms, banks ration credit. They decide to cater a fraction of the market demand and this fraction is endogenously determined so as to maximize profit. Through rationing banks turn down some of the borrowers’ demand for loan even if the borrowers are willing to pay the price as well as the non price element.

Let $\alpha$ be the proportion of loan demanded that banks supply under credit rationing regime. If the firm is rationed out then it goes to the informal market. So, with probability $(1 - \alpha)$, firms go to the informal market to get loans. This implies that, if the total demand for loan revealed is $L^D_t$ in the formal sector, then banks supply only $\alpha L^D_t$. The pool will be identical because the high demand firms will take the guise of the low demand firms for the formal loan. In this way high demand firms can reap the benefit of certain amount of surplus if they operate on the lower demand curve in the guise of low demand firms. They
fulfil their extra demand from the informal market supply. Let us consider

$$L_{t}^{FD} = \rho \left( \frac{\gamma_{HR,t}Am}{1 + l_t} \right)^{\frac{1}{1-m}} + (1 - \rho) \left( \frac{\gamma_{LR,t}Am}{1 + l_t} \right)^{\frac{1}{1-m}}$$

(9)

be the actual demand generated from both high risk and low risk firms. But total demand revealed in the formal market from the identical pool will be

$$L_{t}^{D} = \left( \frac{\gamma_{HR,t}Am}{1 + l_t} \right)^{\frac{1}{1-m}}$$

In that case total supply of formal loan will be

$$L_{t}^{S} = \alpha \left( \frac{\gamma_{HR,t}Am}{1 + l_t} \right)^{\frac{1}{1-m}}$$

(10)

Now, the part of total demand for loan that is hidden from the formal sector by the low risk firms to maintain an identical pool is

$$\rho \left( \frac{\gamma_{HR,t}Am}{1 + l_t} \right)^{\frac{1}{1-m}} + (1 - \rho) \left( \frac{\gamma_{LR,t}Am}{1 + l_t} \right)^{\frac{1}{1-m}} - \left( \frac{\gamma_{HR,t}Am}{1 + l_t} \right)^{\frac{1}{1-m}}$$

(11)

or,

$$(1 - \rho) \left[ \left( \frac{\gamma_{LR,t}Am}{1 + l_t} \right)^{\frac{1}{1-m}} - \left( \frac{\gamma_{HR,t}Am}{1 + l_t} \right)^{\frac{1}{1-m}} \right]$$

(12)

This makes a spill over of demand for informal loan is

$$\sum T_{i,t} = (1 - \alpha) \left( \frac{\gamma_{HR,t}Am}{1 + l_t} \right)^{\frac{1}{1-m}} + (1 - \rho) \left[ \left( \frac{\gamma_{LR,t}Am}{1 + l_t} \right)^{\frac{1}{1-m}} - \left( \frac{\gamma_{HR,t}Am}{1 + l_t} \right)^{\frac{1}{1-m}} \right]$$

(13)

where $\sum T_{i,t}$ is the total demand for informal loan. If we assume $\eta$ as the proportion of high risk firms in the informal demand mix then demand from the high risk firms that goes to the moneylenders is

$$M_{HR,t} = \eta (1 - \alpha) \left( \frac{\gamma_{HR,t}Am}{1 + l_t} \right)^{\frac{1}{1-m}}$$

(14)

Now, suppose households having a capacity constraint, cater only a fraction, $\lambda$ of the less risky firms at a very low (in the equilibrium it is zero) interest rate. In that case supply of household sector loan will be

$$H_{LR,t} = \lambda \left( \frac{Am}{1 + l_t} \right)^{\frac{1}{1-m}} \left[ \gamma_{HR,t}^{\frac{1}{1-m}} (\rho + \eta - \alpha) + (1 - \rho) \gamma_{LR,t}^{\frac{1}{1-m}} \right]$$

(15)
and rest of the demand from residual low risk firms goes to the moneylenders. Therefore, demand for moneylenders loan from low risk firms will be

\[
M_{LR,t} = (1 - \lambda) \left( \frac{Am}{1 + l} \right)^{1-\rho} \left[ \frac{1}{\gamma_{HR,t}}(\rho + \eta \alpha - \eta - \alpha) + (1 - \rho) \gamma \frac{1}{\gamma_{LR,t}} \right]
\]  

(16)

Before we set up banks’ profit maximizing problem under credit rationing regime, we want to assume that

i. banks get return only from loan it extends. Rest of the funds it keeps with the central bank as non-interest bearing asset.

ii. banks have sufficient funds to cater to the total demand for loans in the formal market.

In that case, banks’ profit maximization problem can be written as

\[
\max_{L_t, \alpha} E[\pi^B_t] = \alpha \phi_{HR}(l_t) L_t^D - (W_t)(D_t + S_t)
\]

S. T. \( D_t + S_t \geq L_t^D \)  

(17)

(18)

Solving for \( \alpha^* \) from the zero profit condition, we get

\[
\alpha^* = \frac{W_t}{l_t \phi_{HR}}
\]

(19)

### 2.2.2 Self-Revelation Mechanism: Separating Equilibrium

Self revelation mechanism is proposed as an alternative to credit rationing in order to compare relative efficiencies under different regimes. In this regime we assume that banks operate under monopolistic competition where they set prices for differentiated loans. In this case, banks intend to disburse loan to different types of investment projects at different rates instead of single prime lending rate. Loans are intended to be differentiated on the basis of the associated degree of risk. But the problem that arises due to incomplete information in this regard is the inseparability of riskier projects from the projects with low risk. Banks have asymmetric information on each individual’s type. In this situation banks can use some kind of mechanism based on demand such that each firm self-selects itself. If each firm self selects itself then allotting different amounts of loans to different types of firms according to
their demand at differentiated rate, bank can maximize its profit. Let us suppose that banks bound the contracts by using the revelation mechanism\(^2\) (Dutta (1999), Edelberg (2002)). This revelation mechanism should suffice:

**Proposition 1 : Revelation Principle** For any mechanism and an incentive-compatible, individually rational assignment, there is a direct revelation mechanism in which truth telling is incentive-compatible, individually rational, and which produces an identical assignment. Hence, the principal (the bank) can restrict attention to direct revelation mechanisms and truth telling assignments (or, contract) within those mechanism.

The main assumptions in this regard, are:

1. There are two types of firms. High risk firms with lower \(\gamma_{HR}\) operate on a lower demand curve. Therefore, banks set the price in such a way so that it can take way all the surplus from high risk firms. For the high risk firms participation constraint is binding - i.e,

\[
R_{HR,t} = L_{HR,t}(l_{HR,t})
\]

where, \(R_{HR,t}\) is the total revenue from the high risk firms.

2. Low risk firms with higher \((\gamma_{LR,t})\) have incentive to operate on the lower demand curve. Because by doing so it can enjoy a surplus. Therefore, the low risk firms should be bounded by the incentive constraint.

As we see from the two firms demand functions that the willingness to pay for the high risk firm for any given level of loan is

\[
1 + l_{HR,t} = \frac{\gamma_{HR,t}Am}{(L_{HR,t})^{1-m}}
\]

and that for the low risk firm is

\[
1 + l_{LR,t} = \frac{\gamma_{LR,t}Am}{(L_{HR,t})^{1-m}}
\]

\(^2\)The revelation mechanism is one in which the strategy set of the player is simply a report about it’s type. Every report leads to an assignment.
These above two equations imply that the less riskier firm has a \((\gamma_{LR,t} - \gamma_{HR,t})\) times higher willingness to pay for the same amount of loan. In this case, the amount of surplus the low risk or high demand firms enjoy for one unit of loan is

\[ Q_t = \frac{\gamma_{LR,t} Am}{(L_{HR,t})^{1-m}} - \frac{\gamma_{HR,t} Am}{(L_{HR,t})^{1-m}} \]  

(23)

Or,

\[ \frac{Am}{(L_{HR,t})^{1-m}}(\gamma_{LR,t} - \gamma_{HR,t}). \]

(24)

where \(Q_t\) is total surplus. Therefore, the incentive constraint for the high demand or low risk firms to self select themselves is

\[ R_{LR,t} = L_{LR,t}(l_{LR,t}) - [(\gamma_{LR,t} - \gamma_{HR,t})\frac{Am}{(L_{HR,t})^{1-m}}]L_{HR,t} \]  

(25)

where \(R_{LR,t}\) is revenue from low risk firms, \(L_{LR,t}\) and \(L_{HR,t}\) are the loan amount for low risk and high risk firms and \(l_{LR,t}\) is the loan rate for low risk firms. To induce the firms with high demand to disclose their type banks can promise to return the surplus they were enjoying. This way banks can motivate the less riskier firm to demand for \(L_{LR,t}\) amount instead of \(L_{HR,t}\). One important assumption in this regard is that banks do not breach the ex ante contract at the end of the contract period. If they do then self revelation mechanism does not hold inter temporally. Now with \(\rho\) as the fraction of high risk firms and \((1 - \rho)\) as the fraction of low risk firms, assumed earlier in firm’s problem, banks’ profit maximization problem can be written as :

\[ \max_{L_{LR,t},L_{HR,t}} \pi_t^B = [\rho(R_{HR,t}) + (1 - \rho)(R_{LR,t})] - W_t(D_t + S_t) \]  

(26)

S.T. \[ R_{LR,t} = L_{LR,t}(l_{LR,t}) - [(\gamma_{LR,t} - \gamma_{HR,t})\frac{Am}{(L_{HR,t})^{1-m}}]L_{HR,t} \]  

(27)

\[ R_{HR,t} = L_{HR,t}(l_{HR,t}) \]

(28)

\[ D_t + S_t = \rho L_{HR,t} + (1 - \rho)L_{LR,t} \]

(29)

From the F.O.Cs w.r.t \(L_{HR,t}\) and \(L_{LR,t}\) we get :
\[ l_{HR,t}^* = W_t + \frac{(1 - \rho)}{\rho} \frac{Am^2(\gamma_{LR,t} - \gamma_{HR,t})}{(L_{HR,t})^{1-m}} \] \hspace{1cm} (30)

\[ l_{LR,t}^* = W_t \] \hspace{1cm} (31)

These F.O.Cs show that for low risk or high demand firms, banks’ marginal benefit is equal to their marginal cost. Where as for the high risk firms, banks’ marginal benefit is greater than their marginal cost by a positive amount. This extra amount can be considered as the premium that banks charge to the high risk firms to hedge against their vulnerability to default.

### 2.3 Households

In our model we assume that there are large number of identical households who maximize their life time utility from consumption and lending. Lending to the borrowers who are rejected from the formal market gives positive utility to the households. The representative household solves the following maximization problem:

\[
V = \max_{C_t, H_{LR,t}, D_t, S_t} \sum_{t=0}^{\infty} \beta^t \left( C_t + \frac{H_{LR,t}}{e} \right)^{1-\sigma} - 1 \tag{32}
\]

**S. T.:**

\[
C_t + D_t + S_t + H_{LR,t} \leq I_t + (1 + h_{LR,t-1})H_{LR,t-1} + (1 + W_{t-1})(D_{t-1} + S_{t-1}) \tag{33}
\]

where \( D_t \) denotes the quantity of goods deposited with the bank at time \( t \), \( S_t \) is the real amount of stock purchased, \( C_t \) is the real consumption and \( I_t \) is the wage income from one unit of labor offered. \( H_{LR,t} \) is the amount of household sector loan and \( h_{LR,t} \) is the household sector loan rate in real terms, \( e \) is the elasticity of substitution between consumption and loan. \( W_t \) is the weighted average cost of capital (WACC) or the risk adjusted per unit cost of deposit and stock at time \( t \). The discount factor \( \beta \) lies in the open unit interval, \( 0 \leq \beta \leq 1 \). The constant elasticity of substitution parameter \( \sigma \) is strictly positive. In our

\footnote{Detail estimation procedure is given in the Calibration section}
case we assume $\sigma = 1$. Then

The Euler equations with respect to:

\[
D_t : \quad \frac{I_{t+1} + (1 + h_{LR,t}) H_{LR,t} + (1 + W_t)(D_t + S_t) + \frac{H_{LR,t+1}^L}{c_t} - D_t - S_t - H_t}{I_t + (1 + h_{LR,t-1}) H_{LR,t-1} + (1 + W_{t-1})(D_{t-1} + S_{t-1}) + \frac{H_{LR,t-1}^L}{c_t} - D_{t-1} - S_{t-1} - H_{t-1}} = \beta (1 + W_t) \tag{34}
\]

\[
S_t : \quad \frac{I_{t+1} + (1 + h_{LR,t}) H_{LR,t} + (1 + W_t)(D_t + S_t) + \frac{H_{LR,t+1}^L}{c_t} - D_t - S_t - H_t}{I_t + (1 + h_{LR,t-1}) H_{LR,t-1} + (1 + W_{t-1})(D_{t-1} + S_{t-1}) + \frac{H_{LR,t-1}^L}{c_t} - D_{t-1} - S_{t-1} - H_{t-1}} = \beta (1 + W_t) \tag{35}
\]

\[
H_{LR,t} : \quad \frac{I_{t+1} + (1 + h_{LR,t}) H_{LR,t} + (1 + W_t)(D_t + S_t) + \frac{H_{LR,t+1}^L}{c_t} - D_t - S_t - H_t}{I_t + (1 + h_{LR,t-1}) H_{LR,t-1} + (1 + W_{t-1})(D_{t-1} + S_{t-1}) + \frac{H_{LR,t-1}^L}{c_t} - D_{t-1} - S_{t-1} - H_{t-1}} = \beta (1 + h_{LR,t}) \tag{36}
\]

### 2.4 Informal money lenders:

Informal money lenders (henceforth moneylenders) are risk neutral. Money lenders are price setters and decide the price according to the degree of risk. Since the informal market experiences a separating equilibrium (Fig-3) and a fraction of low risk firms goes to the households after being rejected by the formal sector, the money lenders are left with the pool of residual high and low risk firms. Money lenders do not have prior information regarding firms’ type. But since they operate under a small jurisdiction they can glean this information by incurring certain cost. We assume moneylenders have certain market power in setting the price so that they can keep a margin of profit over their cost. This acts as a premium to hedge against risk. Given this backdrop, moneylenders maximize their expected profit in the following way:

\[
\max_{M_{HR,t}, M_{LR,t}} E_t \pi_{m,t} = \phi_{HR}(1 - \alpha) \eta h_{HR,t} M_{HR,t} + \phi_{LR}(1 - \alpha)(1 - \eta)(1 - \lambda) h_{LR,t} M_{LR,t} - \frac{1}{2} (c_{LR} M_{LR,t} + c_{HR} M_{HR,t})^2 \tag{37}
\]

where $M_{i,t}$ is the loan amount offered by the money lenders, $\phi_i$ is the success rate and $c_i$ is the cost coefficient of the $i$th type of firm in the informal sector.

F.O.C with respect to $M_{HR,t}$ and $M_{LR,t}$:

\[
M_{HR,t}^* : \quad h_{HR,t} = \frac{c_{HR} (c_{LR} M_{LR,t} + c_{HR} M_{HR,t})}{(1 - \alpha) \eta \phi_{HR}} \tag{38}
\]

\[
M_{LR,t}^* : \quad h_{LR,t} = \frac{c_{LR} (c_{LR} M_{LR,t} + c_{HR} M_{HR,t})}{(1 - \eta)(1 - \alpha)(1 - \lambda) \phi_{LR}} \tag{39}
\]
3 Equilibrium

1. Given the real rates the allocation and stock of financial assets in the formal and informal sector, household problem can be solved through - [Equation -(32)-(33)].

2. Given the stock of financial asset in formal and informal sectors informal moneylenders optimization can be solved through - [Equation (37)]

3. Through allocation of real assets firms problem can be solved using [Equation -(1) through (7)].

4. Given the stock of financial assets in the formal and informal sector bank’s optimization problem can be solved using [Equation - (17)through (19)] under credit rationing and [Equation (26) through (31)] under self selection mechanism.

5. Goods market equilibrium condition specifies that

\[ C_t + i_t = f(k_t) \].

(40)

6. Loan market equilibrium condition under self selection is

\[ \rho L_{HR,t} + (1 - \rho) L_{LR,t} = D_t + S_t. \]

(41)

3.1 A. Credit Rationing Regime under steady state:

From equation (10) and (19) we get total loan supplied by the formal sector to the firms as

\[ L^{ss} = \left( \frac{\gamma_{HR}Am}{1 + l^{ss}} \right)^{\frac{1}{1-m}} \frac{W^{ss}}{l^{ss} \phi_{HR}} \]

(42)

Solving equations (14) and (19) and (38) for high risk firms and equations (16), (19) and (39) for low risk firms we get moneylenders’ supply of loan,

\[ M^{ss}_{HR} = \eta(1 - \frac{W^{ss}}{l^{ss} \phi_{HR}}) \left( \frac{\gamma_{HR}Am}{1 + h_{HR,t}} \right)^{\frac{1}{1-m}} \]

(43)

\[ M^{ss}_{LR} = (1 - \lambda) \left( \frac{Am_{\gamma_{HR}}}{1 + h_{LR}} \right)^{\frac{1}{1-m}} (\rho - \frac{W^{ss}}{l^{ss} \phi_{HR}}(1 - \eta) - \eta) + (1 - \rho)(Am_{\gamma_{LR}})^{\frac{1}{1-m}} \]

(44)
By solving equation (15) and (19) we get household sector loan

\[ H_{LR}^{ss} = \lambda \left( (Am\gamma_{HR})^{\frac{1}{1-m}}(\rho - \frac{W_{ss}}{\phi_{HR}}(1 - \eta) - \eta) + (1 - \rho)(Am\gamma_{LR})^{\frac{1}{1-m}} \right) \]  

(45)

Considering households loan rate is zero in the equilibrium, we get from Equation (35), (36) and (45),

\[ \lambda = \frac{\left(1 + \frac{W}{2+W}\right)^{1-\varepsilon}}{\left( (Am\gamma_{HR})^{\frac{1}{1-m}}(\rho - \frac{W_{ss}}{\phi_{HR}}(1 - \eta) - \eta) + (1 - \rho)(Am\gamma_{LR})^{\frac{1}{1-m}} \right)} \]  

(46)

3.2 Self-Revelation Regime:

As we mentioned earlier, this situation is socially optimal because marginal benefit for the high risk firms being greater than bank’s marginal cost will allow banks to set a price that includes a certain amount of rent over their marginal cost. And for the low risk firms the price is just equal to banks’ marginal cost since low risk firm’s marginal benefit is exactly equal to bank’s marginal cost. From equations (21), (22) and (30), (31) we get

\[ L_{HR}^{ss} = \left( \frac{Am(\rho - m(1 - \rho)(\gamma_{LR} - \gamma_{HR}))}{\rho(1 + W_{ss})} \right)^{\frac{1}{1-m}} \]  

(47)

\[ L_{LR}^{ss} = \left( \frac{\gamma_{LR}Am}{1 + W_{ss}} \right)^{\frac{1}{1-m}} \]  

(48)

\[ l_{HR}^{ss} = \frac{\rho W_{ss} + m(1 - \rho)(\gamma_{LR} - \gamma_{HR})}{\rho - m(1 - \rho)(\gamma_{LR} - \gamma_{HR})} \]  

(49)

\[ l_{LR}^{ss} = W_{ss} \]  

(50)

Note that from Equation-3, \((\gamma_{LR} - \gamma_{HR})\) is nothing but \((1 + \psi_{t})(\phi_{LR} - \phi_{HR})\). Therefore, above equilibrium conditions show that if the difference between the success rate of the low and high risk firms increases, we observe

1. an increase in amount of loan extended to low risk firm,

2. a decrease in the amount of loan extended to the high risk firms (Fig. 2). This happens because total amount is fixed. Thus if banks want to increase safer loan it has to do at the cost of the high risk loan.

\^\text{4}One thing to be noted here that in the equilibrium the household loan rate is zero for a particular value of the elasticity of substitution between households consumption and household sector loan.
Figure 1: **Variation in High Risk Loan Rate and Amount of Loan Across Different Values of Difference in Success Rate**

![Graph showing variation in high risk loan rate and amount of loan across different values of difference in success rate.](image-url)
3. the loan rate for the high risk firms increases (Fig. 1). This happens because high risk firms’ marginal benefit being more than bank’s marginal cost, even if banks charge higher loan rate for the high risk firms, it does not affect the social welfare inversely so long it is below their willingness to pay.

4 Calibration

To quantitatively assess this model economy we need to find the parameter values. Some of the parameter values we directly calculated using our model while other parameter values we estimated from the data.

Table 3.a represent the behavioral parameters used in the baseline computational experiments. We calculated the value of $\beta$ from the available data. $\sigma$ is assumed to be $1$. The elasticity of substitution, $e$, between household consumption ($C^{ss}$) and loan amount ($H_{LR}^{ss}$) has been calculated from (Equation-15 and 36). Considering inter temporal consumption is constant, Equation-36 reduces to

$$H^{ss} = \frac{1}{(1 + \beta(1 + h_{LR}))^{\frac{1}{e-1}}}$$

(51)

To make our model compatible with available data we solve for the particular value of $e$ such that the equilibrium household sector loan rate turns out to be zero.

Table 2: Mean estimated values of certain indicator variables across high risk and low risk firms

<table>
<thead>
<tr>
<th>Variables</th>
<th>High risk</th>
<th>Low risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent of firms</td>
<td>.54</td>
<td>.46</td>
</tr>
<tr>
<td>percent child labor used</td>
<td>.38</td>
<td>.06</td>
</tr>
<tr>
<td>Percent income from secondary sources</td>
<td>.03</td>
<td>.30</td>
</tr>
<tr>
<td>Percent household members engaged in agriculture</td>
<td>.84</td>
<td>.39</td>
</tr>
<tr>
<td>Default rate in formal sector</td>
<td>.21</td>
<td>.12</td>
</tr>
<tr>
<td>Default rate in informal sector</td>
<td>.29</td>
<td>.15</td>
</tr>
<tr>
<td>Average default rate in both the sector</td>
<td>.22</td>
<td>.15</td>
</tr>
</tbody>
</table>
Figure 2: Frequency Distribution of Number of Borrowers Across Different Rates of Interest in the Informal Market.
Table 3.a: Description of the Behavioral Parameters and their corresponding values

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\beta)</td>
<td>Inter temporal discount factor</td>
<td>.98</td>
</tr>
<tr>
<td>(\sigma)</td>
<td>Degree of risk aversion</td>
<td>1</td>
</tr>
<tr>
<td>(e)</td>
<td>Elasticity of substitution between household consumption and loan</td>
<td>.78</td>
</tr>
</tbody>
</table>

Table 3.b represents the policy parameters. Other than \(W\), values for the policy parameters are taken directly from available data on India\(^5\).

i. \(W\) is estimated using capital asset pricing model in the following way:

According to the Capital Asset Pricing Model (CAPM), \(W_t\) can be constructed as

\[
W_{t-1} = \frac{r_{t-1}D_{t-1}}{(D_{t-1} + S_{t-1})} + \frac{p_{s,t-1}S_{t-1}}{(D_{t-1} + S_{t-1})}
\]

where,

\[
p_{s,t-1} = r_{t-1} + [E(r_{mt}) - r_{t-1}]\mu
\]

and,

\[
\mu = \frac{Cov(S_{t-1}, r_{mt})}{\text{Var}(r_{mt})}
\]

where \(r_{t-1}\) is deposit rate in period \(t-1\), \(p_{s,t-1}\) is price of securities, \(E[r_{m,t}]\) is the expected market price in period \(t\).

Table 3.b: Description of the Policy Parameters and their corresponding values

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(r)</td>
<td>Real deposit rate</td>
<td>.096*</td>
</tr>
<tr>
<td>(p_s)</td>
<td>Real rate of return on securities</td>
<td>.028*</td>
</tr>
<tr>
<td>(W)</td>
<td>Weighted Average of cost of capital</td>
<td>.020</td>
</tr>
</tbody>
</table>

Among the following variables in table-3.c \(i\) is taken from Sirai(2002). We calibrated \(C, (D + S)\) from our model.

Table 3.c : Description of the Real Sector variables and their corresponding values\(^6\)

\(^5\)Sirai,2002
\(^6\)Numbers with "*" have been taken from Sirai (2002)
<table>
<thead>
<tr>
<th>Parameters</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C$</td>
<td>Consumption</td>
<td>.865</td>
</tr>
<tr>
<td>$D + S$</td>
<td>Deposit plus Stock</td>
<td>.625</td>
</tr>
<tr>
<td>$i$</td>
<td>Private investment</td>
<td>.135*</td>
</tr>
</tbody>
</table>

### 4.1 Parameter values estimated using micro data and econometric model

We used a sample of 700 households collected over 1995-2000 from different states of India. Data has been collected by NABARD and IIMA, India. All the technological parameters in table 3-d are calculated from the available data. Estimations are done in the following way:

i. $m = $ capital share: We first found out the labor share from available data on National Income Accounting and then deducted it from total real GDP at factor cost\(^7\) to find capital share in production.

ii. $\eta = $ The proportion of high risk firms in the informal market.

iii. $x = $ Proportion of high risk firms in the formal market.

iv. $\psi = $ Percentage gain in production over mean level when the project is successful: We first regressed the log of real value of production on the log of different inputs and implements used. Percent deviation of actual from the estimated real production is considered as the expected gain for each firms. Since there is no technological differences assumed between high risk and low risk firms therefore, this expected gain is considered to be same for all types of firms.

v. $A = $ Technology parameter: The intercept value of the same regression of real value of output on capital inputs.

The model we used for regression: $\log(output) = 2.14 + .8027 \times \log(Capital^*) + .31196 \times \log(Land^*)$ with $R^2 = .47.\(^8\)

---


\(^8\)* indicates level of significance at less than 1 percent
4.1.1 Parameter values obtained from Discriminant Analysis:

We started with the separating equilibrium in the informal sector based on the available data (Fig. 3). According to the data the distribution of borrowers with respect to informal interest rates has a tri-modal distribution. The first mode is at zero percent real interest rate while the other two modes correspond to .183 and .303 percent real interest rates. We assume that separation of zero percent interest rate from the other rates represents the separation of households low risk loans to their friends or family members from moneylenders loan. Due to households resource constraint moneylenders face a mix of high and low risk firms. Moneylenders do not have information about firms’ type. But having a smaller jurisdiction compared to banks money lenders can get this information by incurring certain cost. Therefore, from the pool of moneylenders’ loan low risk firms cannot be separated costlessly and therefore, this information is unknown to the moneylender at the beginning. Based on the separation of borrowers in the informal market between households and moneylenders loan, and considering household borrowers as low risk borrowers, we created a binary variable as \( y = 0 \) when real interest rate is 0 and \( y = 1 \) otherwise. \( y=0 \) represents low risk firms. With respect to that we used the behavioral pattern of some variables which are unobservable to banks like percentage child labor used, percentage income from trade and services (i.e, other than agriculture) and percentage household members engaged in agriculture, to divide the formal sector borrowers through discriminant analysis (table 2). After we divided our sample firms into two groups - high risk and low risk, we find out the mean values of the following parameters.

i. \( \rho \) = Proportion of high risk firms among the total borrowers.

ii. \( \phi_{HR} \) = success rate of the high risk firms.

iii. \( \phi_{LR} \) = success rate of the low risk firms.

iv. \( \gamma_{LR} \) = Demand coefficient for low risk firms.

v. \( \gamma_{HR} \) = Demand coefficient for high risk firms.

**Table 3.d: Description of the Parameters and their corresponding estimated values**

---

\(^9\)The graph is based on the nominal interest rates. Respective average inflation rate from 1970 to 2000 is 8.7 percent
<table>
<thead>
<tr>
<th>Parameters</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\phi_{LR}$</td>
<td>Success rate of the low risk firms</td>
<td>.86</td>
</tr>
<tr>
<td>$\phi_{HR}$</td>
<td>Success rate of the high risk firms</td>
<td>.78</td>
</tr>
<tr>
<td>$\psi$</td>
<td>Percentage gain in output when successful</td>
<td>.81</td>
</tr>
<tr>
<td>$\gamma_{HR}$</td>
<td>Demand coefficient for high risk firms</td>
<td>1.41</td>
</tr>
<tr>
<td>$\gamma_{LR}$</td>
<td>Demand coefficient for low risk firms</td>
<td>1.56</td>
</tr>
<tr>
<td>$\rho$</td>
<td>Proportion of high risk firms</td>
<td>.54</td>
</tr>
<tr>
<td>$x$</td>
<td>Proportion of high risk firms in the formal market</td>
<td>.72</td>
</tr>
<tr>
<td>$\eta$</td>
<td>Proportion of high risk firms in the informal market</td>
<td>.38</td>
</tr>
<tr>
<td>$A$</td>
<td>Technological parameter</td>
<td>2.14</td>
</tr>
<tr>
<td>$m$</td>
<td>Share of capital in production</td>
<td>.24</td>
</tr>
<tr>
<td>$\lambda$</td>
<td>Percentage of low risk firms gets loan from households</td>
<td>.38</td>
</tr>
<tr>
<td>$c_{LR}$</td>
<td>Cost coefficient for low risk moneylenders loan</td>
<td>.40</td>
</tr>
<tr>
<td>$c_{HR}$</td>
<td>Cost coefficient for high risk moneylenders loan</td>
<td>.60</td>
</tr>
</tbody>
</table>

### 4.2 Parameter values calibrated from the model

Following variables in table 3-d and 3-e have been calculated from the model:

i. $\delta = \text{the depreciation rate of capital: we estimated from our model using the equation of motion of capital (Equation-5). Since we assumed no population growth therefore, value of } \delta \text{ is population growth adjusted.}$

ii. $\lambda = \text{Percentage of low risk firms in the rejected pool from formal sector and get loan from households. We solved Equation-46 to get the value of } \lambda. \text{ Note that } \lambda \text{ is dependent on the value of the elasticity of substitution between households consumption and loan parameter, } e.$

iii. $c_{LR}$ and $c_{HR} = \text{Moneylenders’ information cost coefficients for low risk and high risk loans- are calibrated from our model using Equations-14, 16, 38 and (39).}$

iv. $\alpha = \text{Proportion of loan demand supplied by formal market under credit rationing regime- is calibrated from maximizing bank’s optimization problem under credit rationing (Equation-17, 18).}$
v. $l_i$ = Formal sector loan rate- is calibrated it from Equation- 49 and 50.

vi. $L_i$ = Amount of formal sector loan- is Calibrated from our model using Equation- 47 and 48.

vii. $H$ = Amount of household sector loan is calibrated from our model using equation -15 and 19.

viii. $M_i$ = Amount of informal moneylenders’ loan has been calibrated from model using Equation- 14, 16, 19, 43 and 44.

ix. $k$ = Per capita capital accumulation has also been calibrated from the model endogenously.

We added up the fraction of different types loan that goes to high and low risk firms to calculate per capita capital accumulation in different regimes.

**Table 3.e: Mean calibrated values of differentiated Loan Rates and Per capita amount of Loans under Different Regimes**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Under Credit Rationing</th>
<th>Under Self Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>High risk</td>
<td>Low risk</td>
</tr>
<tr>
<td>$\alpha$</td>
<td>Fraction of credit rationing</td>
<td>.484</td>
<td>.484</td>
</tr>
<tr>
<td>$l^{ss}$</td>
<td>Bank loan rate</td>
<td>.053</td>
<td>.053</td>
</tr>
<tr>
<td>$h^{ss}$</td>
<td>Informal sector loan rate</td>
<td>.303</td>
<td>.183</td>
</tr>
<tr>
<td>$L^{ss}$</td>
<td>Amount of bank loan</td>
<td>.216</td>
<td>.084</td>
</tr>
<tr>
<td>$H^{ss}$</td>
<td>Amount of household sector loan</td>
<td>-</td>
<td>.045</td>
</tr>
<tr>
<td>$M^{ss}$</td>
<td>Amount of moneylenders’ loan</td>
<td>.089</td>
<td>.058</td>
</tr>
<tr>
<td>$k^{ss}$</td>
<td>Total capital formation</td>
<td>.305</td>
<td>.187</td>
</tr>
</tbody>
</table>

### 4.3 Robustness of the Model

We check the robustness of our model by comparing some crucial parameter values obtained from the model with their counterparts in the sample data. One of the major concern in this regard is that we can check these values only for credit rationing regime. None of the parameter values for self selection regime can be checked because we do not observe self selection in the Indian context.

Comparison of sample data with the outcome of our model is captured in the following table-3.f. Now, with the same assumption that every bank lends one dollar as loan then number of borrowers and total amount of loan become identical. So, we find out the following parameter values from the data under credit rationing in the following way:
• $\lambda$: is obtained as the ratio of number of loan at 0 percent to total number of loans up to 30 percent to get $\lambda$ from data.\textsuperscript{10}

• $\alpha$: We considered the ratio of number of borrowers in the formal market to total borrowers as the percent of credit rationing.

• $L$: We considered that credit market clears when total loan in the formal market is equal to total amount of deposit and stock. From Table 3.c we get total amount of deposit plus stock. We have directly taken this value from the data. Now, $\alpha$ proportion of it will represent total supply under credit rationing.

Table 3.f: Comparison of variables/parameter values obtained from the model with those from the sample data

<table>
<thead>
<tr>
<th>Parameter/variable</th>
<th>Description</th>
<th>Value</th>
<th>Model</th>
<th>Sample Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\alpha$</td>
<td>Fraction of credit rationing</td>
<td></td>
<td>.484</td>
<td>.480</td>
</tr>
<tr>
<td>$\lambda$</td>
<td>Percentage of low risk firms gets loan from households</td>
<td></td>
<td>.380</td>
<td>.398</td>
</tr>
<tr>
<td>$L$</td>
<td>Total loan supplied by banks under credit rationing</td>
<td></td>
<td>.300</td>
<td>.317</td>
</tr>
</tbody>
</table>

Table-3.f represents the strength of our model in explaining the existing situation quite successfully. Based on these parametric values when we calibrate our model for self selection regime we can infer that our findings are not very far from reality.

5 Conclusion

In this paper we quantify two alternative credit regimes- credit rationing and direct revelation regimes in the presence of informal credit market. The main contribution of this paper is to show quantitatively the difference in capital accumulation between these alternative regimes under asymmetric information in a dynamic general equilibrium framework. With the consideration of heterogenous agents in the production, direct revelation mechanism can act as a separating tool costlessly and can lead to higher capital accumulation as compared to credit rationing. Our findings in this context can be presented as follows:

\textsuperscript{10}From fig. 3 and table-1
i. Optimum loan rate for the low risk firms, under separating equilibrium, is fixed at banks' marginal cost. This can be considered as the benchmark rate. High risk loan rate is positively correlated with the difference between its success rate from that of low risk firms (Fig. 1). Our findings suggest that high risk bank rate increases with increase in the difference.

ii. In the steady state under separating equilibrium, banks diversify their risk by issuing higher amount of low risk loan as compared to high risk loans. The difference increases as the gap between rate of success of the low risk firms and that of high risk firms increases (Fig. 2).

iii. Our results show that through incentive based pricing mechanism banks can set a price for the high risk firms in such a way that they can enjoy a margin over their marginal cost. This extra margin can be considered as the premium for higher risk loans. As fig. 1 suggests, this premium increases at an increasing rate with respect to the difference in the success rate of high risk firms from that of low risk firms. These upshots of our model suggest that banks can hedge against risk just by charging different interest rates and adjusting the amount they lend based on success rates. Banks do not require collateral as a sorting device as we find in Bester (1985). And since collateral is not needed at all, Besanko-Thakor (1987) findings that, under collateral constraints banks need to ration credit - is also not necessary.

iv. If we compare direct revelation regime with credit rationing our findings suggest that total supply of loan are higher in self revelation regime as compared to credit rationing regime with informal sector.

v. The predetermined loan rate in the credit rationing regime is set at a very high level. This rate is almost equal to the high risk loan rate under self revelation regime. This similarity suggest that banks, with no information about the firms’ type under credit rationing, set the interest rate in such a way so that every firm under identical pool be treated as risky firms. This high price increases the concentration of high risk firms in the formal market pool of borrowers (refer ‘x’ in Table 3.d). This result is quite similar to Stiglitz-Weiss (1981) finding.

vi. Presence of informal market not only prevents market failure by accommodating the rejected pool of borrowers but it also reduces the cost of credit rationing by providing more loans to the rejected low risk borrowers as compared to high risk borrowers. This is possible because of the availability of more information to the households sector as compared to the formal
sector. This leads to a higher capital accumulation path as compared to credit rationing with no informal market.

vii. Per capita capital accumulation is higher under self revelation regime as compared to credit rationing regime even with the presence of informal market. And the difference is significant. Table-3, in this context, suggests that unlike credit rationing regime, capital accumulation from low risk firms is much higher than that from high risk firms.

Another important aspect of the direct revelation mechanism in the context of imperfect credit market is that when the market clears, the absence of spill over of demand for credit restricts the growth of informal sector. This is not possible in credit rationing regime. As we find from equation-13, if rationing decreases to zero, there will still be some demand for low risk loan in the informal market. This is the amount that low risk firms do not reveal to the bank in order to enjoy a surplus being on the lower demand curve. This suggests that under uniform interest rates demand for informal loan will still exist even if there is no rationing.

In this paper we consider no growth in the economy. One possible extension of our model would be to assume endogenous growth in the same framework and analyze the impact of credit rationing and price incentive mechanism on growth. Regarding the policy issues our model suggests that under price incentive mechanism higher price for risky loan discourages many risky firms to apply for loan. Moreover, the margin over the marginal cost of loan acts as a risk premium and therefore, there is no need for costly collateral. Second important policy relevance of our model is that price incentive mechanism not only ensures much higher profit from loan extension but also it ensures lower amount of loan to the risky sector as compared to credit rationing (Table 3.e). Moreover, the price for risky loan being dependent on the difference of success rate, the situation will always be socially optimal.
References


