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**HORIZONTAL AND VERTICAL LINKAGES BETWEEN FORMAL AND
INFORMAL CREDIT MARKETS IN BACKWARD AGRICULTURE: A
THEORETICAL ANALYSIS**

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ABSTRACT: The paper shows that the policy of forging a vertical linkage between the formal and informal credit markets is distinctly superior to the existing credit policy of horizontally substituting the informal sector by the formal one. An inflow of subsidized formal credit to the informal lenders not only ensures better terms of borrowing to the small borrowers but also leads to higher agricultural productivity vis-à-vis the horizontal linkage case. Even if the informal sector lenders are allowed to collude, the informal interest rate is still lower in the vertical linkage case.

Keywords: Formal credit, informal credit, horizontal linkage, vertical linkage, moneylender, collusion.

JEL classification: Q14, O17, D89.

HORIZONTAL AND VERTICAL LINKAGES BETWEEN FORMAL AND INFORMAL CREDIT MARKETS IN BACKWARD AGRICULTURE: A THEORETICAL ANALYSIS

1. Introduction:

Broadly, there are two sources of credit available to the farmers in a less developed country like India – institutional and private. Non-institutional or private sources include moneylenders, traders, landlords, friends and relatives while institutional sources consist of cooperatives, commercial banks, agricultural credit societies (PACS), etc.

In the initial stage of development (after independence) the share of formal credit in total agricultural was very low. For example, in 1950-51 this share was merely 7 %. However, in order to remove the dependence of the farmers on informal credit, in India since independence, a multi-agency approach consisting of cooperatives, commercial banks and regional rural banks - known as institutional credit has been adopted to provide cheaper credit in sufficient amounts to farmers. The major thrust of policy in the sphere of agricultural credit has been its progressive institutionalization for feeding agriculture and rural development programs with adequate and timely flow of credit particularly towards the small and marginal farmers. As a sequel, the share of the formal sector in total agricultural credit has increased to 63 % in 1980-81 (see All India Rural Debt and Investment Survey 1961-62 and 1981). This is the existing policy of rural credit which aims at horizontally displacing the informal credit system by the formal one. However, the experiences with this policy are not really encouraging.

Evidence from several studies (e.g. Lele (1981), Gonzalez Vega (1981), Braverman and Guasch (1986), Egger (1986)) reveal that only a small group of large farmers monopolizes the lion's share of the total volume of credit disbursed by the formal credit agencies. The social and political clout of large farmers ensures their access to these institutions. On the contrary, small and marginal farmers, including tenant farmers have less access to formal credit institutions because of the asset-based lending policies of these agencies. Moreover, Gonzalez Vega points that the formal credit institutions often ration credit to small borrowers in order to reduce their transaction cost, which is very high when serving several small borrowers.

Also, Sarap (1991) has pointed out that the time taken for obtaining a loan from the formal credit agency is negatively associated with the farm size. After analyzing the village level data of Sambalpur district of Orissa, Sarap has come to the conclusion that large farmers, in general, can obtain formal credit (short term) more or less at the time they need it while small and marginal farmers face a substantial delay in getting formal credit. This problem has also been observed by Bedbak (1986) who made a survey of a village of the Sonapur subdivision of Orissa. This, along with some other factors, leads to a highly unequal

distribution of formal credit against small and marginal farmers. Formal loan as a percentage of total loans is much higher for large farmers than for small and marginal farmers (Sarap (1991), table 3.1). Among the factors inhibiting the small farmers from securing formal credit in time, Sarap has emphasized the lower bargaining strength of small farmers vis-à-vis large farmers, the bureaucratic and procedural formalities required, patronage, arbitrariness and corrupt practices of the officials, especially in the cooperatives. Moreover, Chaudhuri and Gupta (1996) and Gupta and Chaudhuri (1997) have shown that when there is corruption in the distribution of formal credit, a credit or price subsidy policy may raise the interest rate in the informal credit market and lower agricultural productivity.

Besides, as Sarap (1991) has pointed out, the real costs of borrowing including tips and opportunity costs of time spent (of the borrowers) are inversely related to the farm size. It has been found that the effective rate of interest paid by the smaller group of borrowers is almost twice the nominal rate of interest (12 per cent) charged by the formal credit institutions in the survey year. This further limits small farmers' accessibility to formal credit.

Moreover, formal credit institutions are plagued by the problem of high level of overdues. From the empirical study of Sarap (1991) it has been revealed that almost 62.39 per cent of the total overdues of the sample farm households is accounted for by the large farms (also see James (1982)) and a lion's share of the overdues was for more than five years, a clear case of willful default. This may be because of their influence in formal credit agencies, which may have enabled them to avoid the payment of loans. These tendencies have clogged the process of credit recycling since the capacity of credit agencies has been reduced substantially.

Thus, in the presence of existing power structure of the rural society, the basic objective of governments' credit subsidization policy has been defeated. The small and marginal landowners continue to depend on the highly exploitative informal sources of credit, making it virtually impossible for them to adopt modern agricultural technology or benefit from development programs. Consequently, the provision of institutional credit rather than bridging the gaps, in many places of the country, have in fact widened the differences between the rich and the poor in the rural society.

There has been a growing realization that the needs of rural credit cannot be adequately served by the traditional credit policy. So we need an alternative policy to achieve the desired targets of adequately serving the small and marginal farmers with cheaper source of credit. There is no doubt that the informal sector lenders are in a better position to grant and recover loans from the small borrowers than formal credit agencies are. So an alternative credit policy ¹ may be not to try to replace the informal credit system horizontally by the formal one, but to encourage the informal sector lenders by enhancing their credit worthiness with adequate supply of subsidized credit. The informal sector lenders e.g. traditional

moneylenders, large landowners or grain traders are in a much better position to put up collateral: from the view point of the formal credit agencies they are good credit risks. The supply of subsidized formal credit to the informal sector lenders (existing or potential) will increase the degree of competitiveness among them which helps to improve the borrowing terms faced by the small and marginal farmers who do not have access to formal credit system. This can be thought of as a policy of forging 'vertical' links between the informal and formal credit systems. This is, by no means, a new idea. This policy has already been applied to the agricultural sector of Philippines with some success (see Umali (1990)).

There is a small theoretical literature, which has examined the economic effects of forging vertical links between the formal and informal credit sectors. The specific question, which the papers in this area investigate, is whether an expansion of formal credit to the informal sector lenders can really create better terms of credit for informal borrowers. Hoff and Stiglitz (1996) have argued that an expansion of formal credit to the informal credit market would pave the way for the entry of new informal sector lenders into the market which, in turn, would make loan recovery more difficult leading to an increase in the costs of loan enforcement for every lender. As a consequence, the informal sector interest rates may go up instead of falling. Floro and Ray (1997) have shown that a credit flow to the lenders in the informal credit market exerts downward pressure on informal interest rates and raises total credit outlay by the informal sector lenders when the lenders are engaged in myopic competition among them. However, this policy may strengthen the ability and incentive of informal lenders to collude among them which would result in a worse terms faced by the informal borrowers. If the latter happens, the basic purpose of forging a vertical linkage between formal and informal credit agencies becomes self-defeating.

Some of the problems with the existing credit policy are administrative, some are economic and the rest are political. However, a pertinent question is whether the policy of forging a vertical linkage between formal and informal credit markets can ensure better terms to the informal borrowers relative to the traditional credit policy even in the absence of the above-mentioned problems associated with the latter. The existing literature on vertical linkage case does not deal with this aspect. The present paper purports to make a comparative analysis between the horizontal and vertical linkage cases when there is no dampening effect associated with either of the two cases. We will show that the policy of forging a vertical linkage between formal and informal credit agencies ensures better terms to the informal borrowers and also leads to higher agricultural productivity compared to the horizontal linkage case. The latter is, however, achieved at the expense of a higher subsidy bill for the government. Even if we keep the subsidy bill the same in the two cases, the vertical linkage case still ensures a lower interest rate in the informal credit market vis-à-vis the horizontal linkage case. We will also show that the vertical linkage case also ensures better borrowing terms even if we allow the informal sector lenders to collude among themselves and maximize their joint income. So this paper shows that the policy of adequate supply of subsidized credit to the informal sector lenders is distinctly superior to the policy of substituting the informal credit market by the formal one.

2. THE MODEL:

We consider a backward agricultural economy consisting of n number of identical small farmers, an existing moneylender² and a potential entrant into moneylending³. We assume that credit is the only input of production⁴ and that the production function of the farmer is of the following Cobb-Douglas type: $Q = C^\beta$, with $0 < \beta < 1$, where Q is the quantity of output obtained and C is the volume of credit application. There are two sources of credit available to each farmer: formal and informal. The farmer resorts to informal credit if the supply of formal credit is inadequate⁵. We here consider two kinds of interactions between formal and informal credit markets. The first is horizontal, where the formal sector credit agencies compete directly with the village moneylenders in credit provision. The other form of interaction is vertical, where informal sector lenders have access to formal sources of credit and funds borrowed are re-lent to the informal borrowers. In the second case, the farmers do not get credit directly from the formal credit institutions. Let us first consider the horizontal linkage case. Without any loss of generality, we take n , the number of farmers in the economy, to be equal to unity.

2.1. The Case of Horizontal Linkage

We assume that the fraction α of the total loan demand of the farmer is available from the formal credit agency. For the remaining $(1-\alpha)$ fraction, the farmer has to go to the informal sector lender (moneylender). P is the procurement price of the crop⁶. The values of α , the formal interest rate r , and P are determined by the government. The informal interest rate i is determined by the moneylender. The farmer maximizes his total profit choosing the optimal amount of credit application C , given r , i and P . On the other hand, the moneylender, who is a monopolist in the informal credit market, maximizes his profit and his instrumental variable is the informal interest rate (or the volume of credit disbursed). We now turn to the behaviour of the farmer and the moneylender, one by one.

2.1.1. The farmers' behaviour

The amount of credit that the farmer get from the formal credit agency is a fixed fraction α of the total credit demand C . Then the total cost of production is given by $((1+r)\alpha C + (1+i)(1-\alpha)C)$. The profit of the farmer, Y_F , is given by,

$$Y_F = P.C^\beta - (1+r)\alpha C - (1+i)(1-\alpha)C \quad (1)$$

The only instrumental variable of the farmer is C and the first-order condition of maximization is given by

$$P.\beta.C^{\beta-1} = (1+r)\alpha + (1+i)(1-\alpha) \quad (2)$$

So, in equilibrium, the value of marginal product of credit (VMP) is equal to the effective price of credit.

Solving equation (2) we get the farmer's demand function for credit as

$$C = [P\beta / \{(1+r)\alpha + (1+i)(1-\alpha)\}]^{1/(1-\beta)} \quad (3)$$

which is of the form, $C = C(i)$, with $C' < 0$

2.1.2. The moneylender's behaviour

Given α , P and r , the moneylender acts as a monopolist in the informal credit market. Let g be the opportunity cost of the moneylender with $g > r$ ⁷. The moneylender maximizes his net interest income, Y_M , with respect to i . Y_M is given by

$$Y_M = (i-g)(1-\alpha).C(i) \quad (4)$$

The first-order condition of maximization is given by

$$[C + (i-g) \partial C / \partial i] = 0 \quad (5)$$

Equation (5) implies that the marginal net interest income of the moneylender (with respect to i) is zero in equilibrium.

We now turn to find out the optimal informal interest rate using the moneylender's first-order condition of maximization. Denoting the equilibrium informal interest rate in the horizontal linkage case by i_H^* , from equations (3) and (5) we get

$$i_H^* = [(1-\beta)\{1 + \alpha r + g(1-\alpha) / (1-\beta)\}] / \beta(1-\alpha) \quad (6)$$

The optimum amount of credit demanded by the farmer, denoted C_H^* , is then given by

$$C_H^* = [P\beta^2 / \{1 + r\alpha + g(1-\alpha)\}]^{1/(1-\beta)} \quad (7)$$

2.2. The Case of Vertical Linkage

We now turn to the vertical linkage case. Here the formal credit institution provides subsidized credit to the informal moneylenders, instead of providing it directly to the farmers, in the expectation that they will pass the funds to the informal borrowers and be forced by increased competition to charge a lower interest rate. We also assume that the provision of subsidized credit will bring another moneylender, say moneylender 2 into the market, who was previously unable to enter the market due to his fixed entry cost constraint. The formal credit institution provides α fraction⁸ of the total credit disbursement of the moneylenders at an interest rate r per period. The value of α must be sufficiently high so that the second moneylender can earn a positive net interest income, greater than his fixed entry cost and enter the informal credit market. We also assume that the existing moneylender cannot successfully undertake any measure, which can deter entry⁹ of the second moneylender into the informal credit market. We now have three economic agents in the model: the farmer and the two moneylenders. We denote the moneylenders by $M1$ and $M2$, respectively. Let us now study the behaviour of these three agents.

2.2.1. The farmer's behaviour

The basic difference from the horizontal linkage case is that here the farmer has only one source of credit: the informal credit market. The profit of the farmer is now given by

$$Y_F = P \cdot C^\beta - (1+i) \cdot C \quad (8)$$

The only instrumental variable of the farmer is C and the first-order condition for maximization is

$$P \cdot \beta \cdot C^{\beta-1} = (1+i) \quad (9)$$

Equation (9) implies that the value of marginal product of credit must be equal to its effective cost per unit.

So, the farmer's demand function for credit may be written as:

$$C = [P\beta/(1+i)]^{1/(1-\beta)} \quad (10)$$

2.2.2. The moneylenders' behaviour

With the entry of the second moneylender, we now have a duopoly in the informal credit market. Each moneylender receives α fraction of his volume of credit disbursement as subsidized credit from the formal credit agency at an interest rate r per period. For the remaining part of their credit supply, we assume that both the moneylenders face the same opportunity cost of funds ¹⁰, denoted by g . The equilibrium informal interest rate is determined from a non-cooperative game between the two moneylenders where both of them act as followers. We denote the net interest incomes of the two moneylenders by Y_{M1} and Y_{M2} and their credit supplies by C_1 and C_2 , respectively. We have

$$Y_{M1} = (1+i) C_1 - (1+r) \alpha C_1 - (1+g)(1-\alpha)C_1 \quad (11)$$

and,

$$Y_{M2} = (1+i) C_2 - (1+r) \alpha C_2 - (1+g)(1-\alpha)C_2 \quad (12)$$

Each of the two moneylenders maximizes his net interest income choosing the amount of credit disbursement. We now substitute the inverse demand function, $i = i(C)$, from equation (10) into equations (11) and (12). The first-order conditions for maximization are

$$P\beta C_1^{\beta-1} + C_1 P \beta(\beta-1) C_1^{\beta-2} = (1+r)\alpha + (1+g)(1-\alpha) \quad (13)$$

$$P\beta C_2^{\beta-1} + C_2 P \beta(\beta-1) C_2^{\beta-2} = (1+r)\alpha + (1+g)(1-\alpha) \quad (14)$$

Here equations (13) and (14) are the reaction functions of the moneylenders $M1$ and $M2$, respectively. These functions state how the moneylender j should react in terms of credit disbursement following a reaction of the credit disbursement decision of the moneylender k , where $j, k = M1, M2$ and $j \neq k$.

2.2.3. Nash equilibrium

This is a non-cooperative game between the two moneylenders, both of them acting as followers. The Nash equilibrium of the game is characterized by the intersection of the two reaction curves. Solving the two reaction functions simultaneously we obtain the optimum amounts of credit disbursement of the two moneylenders. The demand for credit of the farmer (which is equal to the sum of credit disbursement of the two moneylenders), denoted, $C_V^*(=C_1^* + C_2^*)$, in the vertical linkage case is

$$C_V^* = [\{P\beta(1+\beta)\} / 2\{1+r\alpha+g(1-\alpha)\}]^{1/(1-\beta)} \quad (15)$$

With the help of equations (10) and (15), we get the optimum informal interest rate in the vertical linkage case, denoted i_V^* as

$$i_V^* = [2\{1+r\alpha+g(1-\alpha)\}/(1+\beta)] - 1 \quad (16)$$

2.3. Horizontal versus Vertical Linkage

We are now in a position to compare the Horizontal and Vertical linkage cases with respect to the optimum informal interest rate i and agricultural productivity $Q(C)$. Using equations (6) and (16) one can easily verify ¹¹ that $(i_H^* - i_V^*) > 0$. From expressions (7) and (15) it is easy to show ¹² that $(C_H^* - C_V^*) < 0$. From this it follows that $Q(C_H^*) < Q(C_V^*)$. Let us now compare the informal interest rates in a situation where the credit subsidy bill of the government is the same in both the cases. Since the formal credit agency supplies α fraction of credit requirement of the farmer in the two cases, directly or indirectly, the same amount of subsidy bill implies the same amount of credit demand in the two cases. Putting $C_V^* = C_H^*$ from equations (3) and (10) one can easily verify ¹³ that $(i_H^* - i_V^*) > 0$. Thus we have the following propositions.

PROPOSITION 1: The informal interest rate is lower and agricultural productivity is higher when there is vertical linkage between the formal and informal credit markets compared to the horizontal linkage case.

PROPOSITION 2: Even when the amounts of credit subsidy in the two cases are the same, the vertical linkage policy ensures a lower level of informal interest rate than the case of horizontal linkage.

2.4. Collusion between the moneylenders

According to Floro and Ray (1997), the forging of vertical linkage between the formal and informal credit markets may fail to ensure better terms to the informal borrowers because it might strengthen the ability of

informal sector lenders to collude among themselves. Let us examine this aspect in the context of the framework of the present paper. We will study the effects of a possible collusion between the two moneylenders on the informal interest rate and agricultural productivity of the farmer.

We consider a cooperative game between the two moneylenders. The optimum levels of income of the two moneylenders in the duopoly case which are obtained by using equations (11), (12), (15) and (16) serve as disagreement pay-off of the two players in this cooperative game. We assume that they are able to form a cartel and maximize their joint interest income through a choice of the volume of credit disbursement. Adding the net interest income of the moneylenders we get their joint-income, denoted Y_J , as

$$Y_J = (1+i)C - (1+r)\alpha C - (1+g)(1-\alpha)C \quad (17)$$

After substituting the value of C from equation (10) into (17) and maximizing Y_J with respect to C we get the following first-order condition.

$$P\beta^2 C^{\beta-1} = (1+r)\alpha + (1+g)(1-\alpha) \quad (18)$$

Solving equation (18) we obtain the optimum amount of credit disbursement by the moneylenders, denoted C_{Vc}^* as

$$C_{Vc}^* = [P\beta^2 / \{1 + r\alpha + g(1-\alpha)\}]^{1/(1-\beta)} \quad (19)$$

Substituting equation (19) into the farmer's credit demand function, equation (10), we obtain the equilibrium informal interest rate, denoted i_{Vc}^* as

$$i_{Vc}^* = [\{1 + r\alpha + g(1-\alpha)\} / \beta] - 1 \quad (20)$$

Using expressions (11), (12), (15), (16), (17), (19) and (20) it can be shown ¹⁴ that the optimum joint income of the two moneylenders is greater than the sum of their disagreement pay-off. So given the Nash's axioms, a Nash bargaining solution exists. The optimum joint income is distributed equally between the two players.

We now turn to compare this case (Vertical linkage with collusive agreement between the moneylenders) with the Horizontal linkage case with respect to the optimum informal interest rate, i , and the agricultural productivity, $Q(C)$. Using equations (6) and (20) one can easily verify ¹⁵ that $(i_H^* - i_{Vc}^*) > 0$. Expressions (7) and (19) implies that $C_H^* = C_{Vc}^*$. From this it follows that $Q(C_H^*) = Q(C_{Vc}^*)$. Since the formal credit agency supplies α fraction of credit requirement of the farmer in both the cases, directly or indirectly, the same amount credit demand in the two cases implies the same amount of subsidy bill of the formal credit institution. These results lead to the following proposition.

PROPOSITION 3: Despite a collusive agreement between the two moneylenders, the informal interest rate is still lower in the vertical linkage case vis-à-vis the horizontal linkage case. The agricultural productivity and the subsidy bill of the government are, however, equal in both the cases.

3. Concluding Remarks

In this paper, we have made a comparative analysis between the horizontal and vertical linkages between the formal and informal credit markets. The traditional policy of horizontal linkage is plagued by the timeliness problem of formal credit, loan recovery problem, etc. However, the most serious allegation made against this policy is that the small and marginal farmers have been almost completely left out from its purview and the group of large farmers has reaped the benefits of the credit subsidization policy. As an alternative to the traditional policy there emerged the policy of forging a vertical linkage between the formal and informal credit markets. The basic tenet of this policy is to encourage the informal sector lenders by enhancing their credit worthiness with adequate supply of subsidized credit. It is believed that the supply of subsidized formal credit to these lenders will increase the degree of competitiveness among them, which helps to improve the borrowing terms faced by the small and marginal farmers who do not have access to formal credit. But, Floro and Ray (1997) have shown that an inflow of subsidized credit to the informal sector lenders may raise their incentive and strengthen the ability to collude among them which would result in a worse terms faced by the informal borrowers. However, we have found that the policy of forging vertical linkage between the formal and informal credit institutions is distinctly superior to a policy of horizontal linkage even when the problems with horizontal linkage case which we have mentioned at the beginning of the paper are absent. This is because; the policy of vertical linkage ensures lower informal interest rate and higher agricultural productivity vis-à-vis the horizontal linkage case. Even with the same level of subsidy bill, the informal interest rate is lower in the former case. We have also examined the case of collusion between the informal lenders and found that the interest rate is still lower in the vertical linkage case. But we cannot provide any answer to the allegation made by Hoff and Stiglitz (1996) against the policy of vertical linkage that it may raise the informal interest rate by raising the costs of loan enforcement which results from an increase in the number of lenders in the informal credit market (because borrowers can more easily default on existing loans). This is a limitation of the present analysis. However, Floro and Ray (1997) also share the same limitation.

Endnotes

1. Another approach may be to actually design credit institutions at the micro level that will take advantage of local information in innovative ways. The leading example of small-scale lending or micro-finance is the Grameen Bank of Bangladesh.
2. Empirically the moneylender is not the only source of informal credit. Traders, landlords (large farmers), friends and relatives, etc., often give loans to the farmers. So the assumption that the

moneylender is the only source of informal credit may look objectionable when the moneylender charges a high interest and the others charge low interest rates. Bardhan and Rudra (1978) and Rudra (1982) point out that the traders and landlords offer interlinked credit contracts at very low interest rates. But the empirical analysis of Sarap (1991) supplies some weak defenses of this assumption. Firstly, small and marginal farmers take nearly 80% of informal credits from the moneylenders (see his table 2.5). Secondly, the rates of interest charged by the traders, friends and relatives, etc., to the small and marginal farmers are also very high and close to the moneylender's interest rate (see his tables 5.2 and 5.6). Also the All India Debt and Investment Survey (Reserve Bank of India, 1981) shows that even in 1981, the moneylenders' share of informal credit (16.1%) is higher than the combined share of the landlords and the traders (12%).

3. The potential moneylender cannot enter the informal credit market because his expected net interest income from money lending falls short of the fixed costs (e.g. to gather information about the borrowers in the market) he has to incur to enter the market.
4. Any production function that is well behaved may be written as a function of the total expenditure provided input markets are perfectly competitive. Consequently equation (1) can be interpreted as a general production relationship with many inputs under competitive conditions. See Gangopadhyay (1994, p. 132, foot note 3).
5. Alternatively the farmers may have to resort to informal credit even when formal credit is not available at the beginning of the crop cycle. For empirical evidence of delay in disbursing formal credit see e.g. Sarap (1991), Bedbak (1986) etc.
6. Assume that the government conducts the procurement of the crop – a practice followed in India in the case of food grains and some commercial crops.
7. This is obvious; otherwise the moneylenders will not take formal credit.
8. The analysis of entry deterrence game between the moneylenders is beyond the scope of the paper. For a beautiful analysis of entry deterrence game in backward agriculture see Mishra (1994).
9. This implies that the moneylenders face credit constraint in the formal sector. In both the horizontal and vertical linkage cases the government supplies the exogenously given α fraction of the total credit demand of the farmer, directly or indirectly.
10. This assumption has been made to derive straightforward analytical results.
11. Interested readers may check this or details can be obtained from the authors on request.
12. This is left for the readers.
13. The derivations of this result are available from the authors on request.
14. The proof of this result is available from the authors on request.
15. The derivations of this result are available from the authors on request.

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