

## CREDIT RATIONING IN RURAL INDIA

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The view that households are credit rationed by the formal sector, rests on the assumptions that all households have a positive demand for formal credit and it is a cheaper source for borrowing. To empirically verify formal credit rationing three different models are estimated in this paper. The first model is a conventional credit-rationing model. The second model assumes that the probability to borrow from the formal sector is jointly determined by the demand for credit and the decision of the bank on access. Finally, the third model relaxes both these assumptions and the household chooses between borrowing from the formal or the informal sector. Empirical results using recently collected data from Puri, India, confirm that the access to the formal sector in the rural credit markets is limited and there exists a high demand for credit. This suggests a high degree of effective credit rationing by the formal sector in Puri.

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### 1. INTRODUCTION

Most theoretical and empirical studies of rural credit markets assume that they are characterised by high lending costs and a high demand for credit, resulting in high interest rates being charged to the borrowers. It is further assumed that all households have a positive demand for formal credit and that the formal sector, which is bound by the government regulations to lend at a subsidised fixed interest rate, is the cheapest source of credit. Models based on such assumptions usually suggest wide scale credit rationing by the formal sector. However, this might not always be true as the degree of effective credit rationing might not be as high as it is generally assumed in literature and farm households may have a low demand for credit.

This paper is an empirical investigation into the extent of effective credit rationing by the formal sector in the rural credit markets of Puri. It is based on the Kochar (1991, 1997) where the household is free to choose between the formal and the informal sector. However, the empirical model is further modified to include the additional information on the 'access to credit' that is available in our survey data. Another important

contribution of the paper is to update the situation on the extent of formal credit rationing existing in the rural credit markets in Puri, India, by using recently collected data.

Three different scenarios are considered for the estimation of the effective degree of credit rationing. The first model assumes that the probability of borrowing from the formal sector is determined by the bank's decision on access. Two assumptions are made here. Firstly, that the formal sector provides the cheaper source of credit. Secondly, that all households have a positive demand for formal credit. The second model drops the latter assumption and the probability of borrowing from the formal sector is jointly determined by the demand for credit and the bank's decision on access. Finally, the third model considers a two-sector model (formal and informal credit sector) with the household choosing to borrow from the cheaper source of credit.

The empirical analysis in this paper is based on the 'Rural Credit Market Survey of Puri district in India'.<sup>1</sup> The survey has information on 1052 households that were selected by a two stage stratified sample, from 66 villages, spread over the 11 administrative blocks of the Puri district, which is the coastal district of Orissa, in east India. After deleting the households with missing values on some of the variables we are left with information on 989 households. Of the 989 households 761 were identified as farm households. The analysis in this paper is based on these farm households, as there might be a basic difference between the demand for credit and the cost of supplying credit to a farm and a non-farm household.

The following section presents a short review of the government interventions in the rural credit markets of India. The subsequent section examines some of the emerging patterns. Section 4 describes the econometric framework which is adapted to the additional information on 'access to credit' in the survey data. It also gives a concise description of the variables used in the analysis. The results of the estimation of the three different models of sectoral choice are explained in Section 5 of the paper. Finally, the last section presents the concluding remarks.

## 2. INTERVENTIONS IN THE CREDIT MARKETS

Historically, the informal sector has played a dominant role in the rural credit markets of India. According to the All-India Rural Investment Survey, in 1951-52, almost 83 percent of the cash loans were provided by the professional moneylenders whereas the formal institutions provided only 8.7 percent. The Government of India decided to actively intervene in the credit market with the commencement of the Integrated Scheme of Rural Credit (1951). The aim was to set about a systematic expansion of the institutional credit infrastructure, with the Reserve Bank of India (RBI)

<sup>1</sup> The survey was conducted and supervised by the author in 1997.

in the pivotal role. The emphasis of the active government intervention in the credit market has been to provide subsidised loans to agricultural and other priority sectors<sup>2</sup> for investment purposes for development of the weakest sections of the rural populations and modernising agriculture.

In the fifties and the sixties the co-operatives were the main agency of distribution of formal credit. To meet the fast expanding demands for credit a multi-pronged credit delivery system was introduced. In 1969, major commercial banks were nationalised<sup>3</sup> with the specific objective of lending a certain percentage of their credit to the priority sectors.

In 1982 the National Bank for Agriculture and Rural Development (NABARD) was set up by the RBI for providing all types of production and investment credit for agricultural and rural development. NABARD is the apex institution accredited with all matters concerning policy, planning and operations in the field of credit for agriculture and other economic activities in rural areas.<sup>4</sup> In addition to other functions, it co-ordinates the rural financing activities of all institutions engaged in developmental work at the field level and maintains liaison with Government of India, State governments, RBI and other national level institutions.

Furthermore, a scheme of Rural Infrastructure Development Fund (RIDF) and that of specialised branches for agriculture and small-scale industries were introduced in 1995-96 with a view of augmenting the flow of credit to the rural sector. In 1996-97, out of the target of 40 per cent of the net bank credit of the domestic commercial banks to the priority sector, 18 per cent had to be disbursed in the form of credit for agriculture (The Annual Report on the Working of the Reserve Bank of India (1997), Section 1.29). As of the end of March 1997, the public sector banks had exceeded their priority sector

<sup>2</sup> Priority sectors include agriculture, small scale industries, retail, trade and small businesses, road and water transport operators, professional and self employed and education, housing to weaker sections and consumption loans etc.

<sup>3</sup> The All India Credit Review Committee (1969) supported the view that commercial banks should increasingly extend finance in rural areas. This process was accelerated by the nationalisation of 14 major commercial banks in July 1969 and another 6 banks in 1980. The Committee to Review Arrangements for Institutional Credit for Agricultural and Rural Development (CRAFICARD), 1981, which assessed the role of commercial banks in rural credit endorsed the view that commercial banks could play a significant role in the various programmes of rural development and made a series of recommendations to improve the quality of lending through commercial banks. The public sector banks numbering 28 (20 nationalised banks and State Bank of India and its 7 associates) now account for more than 90 percent of the total business of all scheduled commercial banks.

<sup>4</sup> Its prime role is to provide credit for the promotion of agriculture, small scale industries, cottage and village industries, handicrafts and other rural crafts and other allied economic activities in rural areas with a view to promoting integrated rural development and securing prosperity of rural areas and for matters connected with it.

credit target with a total lending of Rs. 791,310 million constituting 41.7 per cent of the net bank credit. Disbursement to agriculture under the special agricultural credit plans, prepared on the advice of the RBI, was Rs. 127,160 million during 1996-97 (the Annual Report on the Working of the Reserve Bank of India (1997)).

These specific efforts to increase the outreach of formal credit in the rural credit markets have given positive results. From nearly 83 percent in 1951, the proportion of cash debt from moneylender has gone down to 36.1 per cent in 1971. According to the report on 'A Review of the Agricultural Credit System in India' (1990) the percentage of borrowings of the rural households (cultivators) from the formal sector to the total debt has increased from 29 (31.7) percent in 1971 to 61.2 (63.3) percent in 1981. However, this expansion of the institutional lending in the rural areas failed to reach a larger number of cultivator households and did not lead to any major increase in the agricultural capital stock per farm (Binswanger and Khandker (1995)).

In 1981-82 only 13 percent of the rural cultivator households in India had outstanding loans from the formal sector.<sup>5</sup> The unequal distribution of the formal credit was reflected by the fact that cultivators who owned more than Rs. 100,000 in assets received 17 percent of the formal loans whereas they constituted only 10 percent of the total cultivator households. In the highest asset group in rural areas (owning more than Rs. 500,000) 85 percent of the cash dues were outstanding to the formal credit institutions whereas only 15 percent were outstanding to the informal institutions. In sharp contrast for the lowest assets group (owning assets of up to Rs 1000) nearly 94.2 percent of the cash dues were outstanding to the informal credit institutions (RBI (1981)).

### 3. EMERGING PATTERNS IN THE RURAL CREDIT MARKET

The provision of subsidised loans by the formal credit institutions has led to the general belief in literature that there exists excess demand for the formal credit and limited access to the formal credit institutions. Moreover the credit rationing is believed to be in favour of the households in more productive regions and of larger farm households that are economically and politically more powerful. This is believed to have led to a further widening of the income inequalities (Adams *et al.* (1984), Braverman and Stiglitz (1989)). However, it is difficult to conclude that this is observed due to the type of formal credit and its lending rules. The lower number of households demanding loans from the formal sector might be a choice decision of the household. The farms, which are small and fragmented, are in areas with a low level of infrastructure facilities or which already have a high capital stock will have a low return on capital. Such

<sup>5</sup> According to Binswanger and Khandker (1995) the data from the All-India Debt and Investment Surveys of 1981-88 appear to seriously underestimate debt of cultivators.

households restrict their demand for production loans even if they have access to them. The extent of the effective formal sector rationing cannot be inferred from the proportion of the non-borrower households alone, the demand side also needs to be taken into account.

The distribution of the borrowers in our survey data shows a similar pattern. The formal institutions favour land owning households, in particular those with large farms, as is evident from the higher share of formal borrowers in the category of households owning more than 4 hectares of land (Table 1). In terms of the total amount borrowed, almost 67 percent is borrowed from the formal sector. The inequalities in the dispersion of credit in favour of the large and the medium farm households are reflected by the fact that 28.2 percent of the total borrowers take 46 percent of the total amount borrowed from the formal sector in loans.

**Table 1.** Distribution of Borrowers by Farm Size<sup>1)</sup>

	Farm Size (in hectares)				Total
	0-1 marginal	1-2 small	2-4 medium	more than 4 large	
All Households	380 (49.9)	196 (25.8)	152 (20)	33 (4.3)	761 (100)
<b>All Borrowers</b> <sup>2)</sup>	204 (53.8)	90 (23.7)	70 (18.5)	15 (4)	379 (100)
Share of borrowers out of all the households	53.7	45.9	46.1	45.5	49.8
<b>Formal Borrowers</b> <sup>3)</sup>	96 (43.6)	62 (28.2)	51 (23.2)	11 (5)	220 (100)
Share of formal sector borrowers out of all the borrowers	47.1	68.9	72.8	73.3	
<b>Informal Borrowers</b> <sup>3)</sup>	108 (67.9)	28 (17.6)	19 (11.9)	4 (2.5)	159 (100)
Share of informal sector borrowers out of all the borrowers	52.9	31.1	37.2	26.7	

*Notes:* <sup>1)</sup> The figure in the parenthesis is the percentage of the cell with respect to its respective row total. This gives us the percentage of that particular category of households with respect to the farm size category. <sup>2)</sup> The percentage of each cell in this row is calculated with respect to their corresponding cell in the first row and is the lower figure in the cell. This gives us the percent of borrowers in each farm size category. <sup>3)</sup> The percentage of each cell in these rows is calculated with respect to the frequency of their corresponding cell in the all second row and is the lower figure in the cell. This gives the percent of the formal or the informal borrowers with respect to the total borrowers in each farm size category.

*Source:* Survey Data.

Never the less the informal sector continues to play an important role in the rural credit markets. Sources of informal credit like friends and relatives, traders and

commission agents and landlords have shown an increase in the proportion of cash debt from 8.4 percent to 32.3 percent from 1951 to 1971. In 1981, friends and relatives were the most important source of informal credit providing 24 percent of the total informal loans in India (Bell (1990)). In our survey data friends and relatives are the second largest lending group within the informal sector with 17.6 per cent of all households borrowing from them. Informal lenders charge a higher interest rate as compared to the formal sector. This could reflect the high risk, administrative or opportunity costs faced by them. However, the informal sector based on their social and geographic proximity to the lender also face a lower screening, monitoring and enforcement costs. Therefore, although some informal lenders charge a higher interest rate than the formal lenders, there exist other informal lenders that charge a lower interest rate as compared to the formal sector's interest rate. This is often the case for the category of friends and relatives.

The formal interest rates on the other hand are administered by the RBI. The following structure was imposed on the interest rates charged: for loans below Rs. 25,000 an interest rate of 12 per cent was charged, for loans between Rs. 25,000 and Rs. 200,000, interest rate was 13.5 per cent, whereas for loans bigger than Rs. 200,000 the banks were free to fix their own interest rates.<sup>6</sup>

The overall picture that emerges is that of a formal sector in the rural market that is bound by the government regulations to lend a certain fixed percent of its net bank credit to the priority sector on a fixed interest rate structure. Whereas, the informal sector is free to charge any interest rate based on its cost and profit considerations.

#### 4. ECONOMETRIC FRAMEWORK

Given the above considerations of the rural credit markets this section seeks to set up three different models. The first model depicts the most prevalent scenario in literature. It assumes that the formal borrowing is determined by the bank's decision on access (Univariate Probit Model). The second model is a further generalisation where the probability of borrowing from the formal sector is jointly determined by the bank's decision on access as well as the household's demand for loans (Bivariate Probit Model with partial observability). The third model estimates the complete theoretical model where the households may have zero demand for formal credit and they are free to choose between the informal sector and the formal (Two-Sector Model).

##### A. The Univariate Probit Model (Model I)

In line with popular belief in literature this model also assumes that the formal sector

<sup>6</sup> 97 per cent of the loans in our sample were of amounts smaller than Rs. 25,000.

determines whether the household has access to its loan or not. Such an assumption implies that the formal credit is the cheapest source of credit for all households and that all households have a positive demand for formal credit at the existing interest rate. The probability of borrowing is given by a univariate normal distribution which reflects that (1) the probability of household's demand for formal credit, (2) the probability of access to formal credit and the (3) probability that the formal credit costs less than the informal credit, is dependent on the formal sector interest rate. This interest rate is fixed by the government, but the stipulated interest rate varies across households of different geographical regions and by the farm size.

The formal sector interest rate is predicted for all the households by taking predictors that are exogenous to the decision of taking credit. The interest rates on the loans taken from the formal sector are regressed on the dummy for the administrative blocks, reflecting the agro economic stratum' to which the household belongs and size of the land owned by the household.<sup>7</sup>

### B. Bivariate Probit Model With Partial Observability (Model II)

The univariate probit model is one particular interpretation of the market based on unrealistic assumptions, therefore further models are estimated. The bivariate probit model with partial observability drops the assumption that all households have a positive demand for formal credit. The probability of borrowing from the formal sector is jointly determined by the demand for credit and the bank's decision on access. The formal structure of the model is as follows:

$$z_{i1} = \hat{\mathbf{a}}_1' \mathbf{X}_{i1} + \mathbf{e}_{i1}; y_{i1} = 1 \text{ if } z_{i1} > 0, \text{ else } 0;$$

$$z_{i2} = \hat{\mathbf{a}}_2' \mathbf{X}_{i2} + \mathbf{e}_{i2}; y_{i2} = 1 \text{ if } z_{i2} > 0, \text{ else } 0;$$

$$\mathbf{e}_{i1}, \mathbf{e}_{i2} \sim BVN(0,0,1,1, \mathbf{r}),$$

where  $\mathbf{X}_{i1}$  is the vector of variables determining the access to the loan and  $\mathbf{X}_{i2}$  are the explanatory variables determining the demand for loan. Instead of observing both  $y_{i1}$  and  $y_{i2}$  we observe the product,  $y = y_1 y_2$  where  $y_1$  and  $y_2$  are simultaneously determined and  $\mathbf{e}_1$  and  $\mathbf{e}_2$  are correlated (Poirier 1980). The log-likelihood for this model is

<sup>7</sup> For the data used in Kochar (1997) this regression explains almost all the variability in the formal sector interest rate with an R square of 0.95 whereas for our estimation it is only around 0.45. This might be due to the fact that the sample data for this paper was collected from a smaller geographical region (within a district).

$$\ln L = \sum_{y=1} \ln \Phi_2[\hat{\mathbf{a}}_1' \mathbf{X}_1, \hat{\mathbf{a}}_2' \mathbf{X}_2, \tilde{n}] + \sum_{y=0} \ln(1 - \Phi_2[\hat{\mathbf{a}}_1' \mathbf{X}_1, \hat{\mathbf{a}}_2' \mathbf{X}_2, \tilde{n}]),$$

where  $\Phi_2$  is the bivariate cumulative normal distribution function.

### C. The Two-Sector Model (Model III)

The econometric specification in this section is based on the theoretical model derived in Kochar (1991, 1997). However, the econometric model has been further adapted to the information that is available in the sample data on the access of the household to credit.<sup>8</sup> Furthermore, some empirical changes have been introduced as the data in the sample was collected at the district level<sup>9</sup> and has considerably less variation.

A linear approximation of the household's loan demand schedule and the sectoral supply schedules available to the household are specified as:

$$B^d = \mathbf{X}_1 \tilde{\mathbf{a}}_1 - r \mathbf{d}_1 + v_1, \quad \text{Loan demand.} \quad (1a)$$

$$B_f^s = \mathbf{X}_2 \tilde{\mathbf{a}}_2 - r \mathbf{d}_2 + v_2, \quad \text{Formal sector supply.} \quad (1b)$$

$$B_i^s = \mathbf{X}_3 \tilde{\mathbf{a}}_3 - r \mathbf{d}_3 + v_3, \quad \text{Informal sector supply.} \quad (1c)$$

These yield the 'reservation interest rate equations', which are estimated as the interest rate at which the optimal loan is zero

$$MR(0, \mathbf{X}_1, u_1) = \mathbf{X}_1 \hat{\mathbf{a}}_1 + u_1, \quad \text{reservation demand rate.} \quad (2a)$$

$$MC^f(0, \mathbf{X}_2, u_2) = \mathbf{X}_2 \hat{\mathbf{a}}_2 + u_2, \quad \text{reservation cost, formal sector.} \quad (2b)$$

$$MC^i(0, \mathbf{X}_3, u_3) = \mathbf{X}_3 \hat{\mathbf{a}}_3 + u_3, \quad \text{reservation cost, informal sector.} \quad (2c)$$

where the random variables  $u_i$ ,  $i=1,2,3$  are assumed to be i.i.d across households, though such omitted variables can be expected to enter into all three equations, yielding a non diagonal co-variance matrix of the error terms. The reservation schedules generate

<sup>8</sup> However, for reader's convenience we continue to use the notation used in Kochar (1997) so that the modified likelihood function might be easily related to her model.

<sup>9</sup> India is divided into a number of states, each state is further divided into districts. Each districts is split into various administrative blocks. In Orissa, the Puri district has 11 administrative blocks.



the following four index functions or selection rules:

$$\begin{aligned} \Pr(\text{demands informal sector loan}) &= \Pr[MR(0, \mathbf{X}_1, u_1) > MC^i(0, \mathbf{X}_3, u_3)], \\ \Pr(\text{demands formal sector loan}) &= \Pr[MR(0, \mathbf{X}_1, u_1) > r_f], \\ \Pr(\text{access to formal}) &= \Pr[MC^f(0, \mathbf{X}_2, u_2) < r_f], \\ \Pr(\text{formal sector is lower cost}) &= \Pr[MC^i(0, \mathbf{X}_3, u_3) > r_f]. \end{aligned} \quad (3)$$

These index functions underlie the household's participation decisions and the access decision of the formal sector, which generate the market outcomes. The choice between the sectors is determined by the household's demand and by the supply decisions of the formal and the informal sectors, whereas the data only report market outcomes. Therefore, the information on individual demand and supply schedules is unavailable. However, our survey has additional information on whether a household has access to credit or was denied credit in our data. The households in the sample were asked the question 'did you try to take any loan during this year, but did not get it?'.<sup>10</sup> Reported answers to this question give the information on whether the household had access to credit or not. It is difficult to know from the data if it was the formal or the informal credit sector that denied the loan to the household. The likelihood function is adjusted to include this information for the complete model.

Combining the information on the borrowing of the household from the formal and the informal sector with the information on whether it had access to credit or was denied credit all the households are divided into five categories.<sup>11</sup> Those households, (I) which borrow from the formal sector, (II) those who borrowed from the informal sector but were not rationed and (III) those who borrowed from the informal sector but said that they were rationed. The two remaining categories include (IV) households that did not borrow even though they had access and (V) households that were non-borrowers because they were refused credit.<sup>12</sup>

<sup>10</sup> We are aware that this does not completely capture the definition of rationing. Additional information is needed on: whether the household did not borrow because it expected that it would be turned down. In addition, one should also have information on whether the household was loan size rationed. Nevertheless, we have to work with the restricted amount of information that we have.

<sup>11</sup> Kochar (1997) divided the households into those who borrowed formal credit; those who borrowed informal credit and those who did not borrow credit at all.

<sup>12</sup> In Kochar (1997) the households borrowing from both sectors were allocated to either sector depending on which sector charged the lowest interest rate. If the formal (informal) sector interest was lowest the household was classified as a formal (informal) sector borrower.

The sectoral outcomes are generated as follows:

(I) Probability that the household borrows from formal sector

$$= \Pr(MR(0, \mathbf{X}_1, u_1) > r_f, MC_f(0, \mathbf{X}_2, u_2) < r_f, MC^i(0, \mathbf{X}_3, u_3) > r_f). \quad (4a)$$

(II) Probability that the household borrows from the informal sector but is not rationed

$$= \Pr(MC^i(0, \mathbf{X}_3, u_3) < MR(0, \mathbf{X}_1, u_1), MC^i(0, \mathbf{X}_3, u_3) < r_f). \quad (4b)$$

(III) Probability that the household borrows from the informal sector and is rationed

$$= \Pr(MC^i(0, \mathbf{X}_3, u_3) < MR(0, \mathbf{X}_1, u_1), MC^i(0, \mathbf{X}_3, u_3) > r_f, MC^f(0, \mathbf{X}_2, u_2) > r_f). \quad (4c)$$

(IV) Probability that the household did not borrow even when they had access

$$= \Pr(MR(0, \mathbf{X}_1, u_1) < r_f, MC^i(0, \mathbf{X}_3, u_3) > MR(0, \mathbf{X}_1, u_1)). \quad (4d)$$

(V) Probability that the household did not borrow because they were rationed

$$= \Pr(MR(0, \mathbf{X}_1, u_1) > r_f, MC^f(0, \mathbf{X}_2, u_2) > r_f, MC^i(0, \mathbf{X}_3, u_3) > MR(0, \mathbf{X}_1, u_1)). \quad (4e)$$

The above equations reflect both the formal sector rationing and the optimal choices by the households. The data reports observed market outcomes; therefore the parameters of the equations have to be inferred from the joint occurrence of the individual decisions rules. The identification criterion for such models is relatively weak, requiring the distinction of one equation from the other. This may be achieved by varying the set of the explanatory variables across equations. Therefore, the sector-specific lending costs enter the set of  $\mathbf{X}_2$  and  $\mathbf{X}_3$  variables but not  $\mathbf{X}_1$ . The  $u_i$ 's are assumed to be normally distributed with variance-covariance matrix  $\sigma^2 \mathbf{I}$ .

The log likelihood of the sample for the model generated from the above sectoral outcomes is specified as:

$$\begin{aligned} \ln L = & \sum_i y_{1i} \ln(\Phi_a \Phi_b \Phi_c) + y_{2i} \ln(\Phi_e) \\ & + y_{3i} \ln(\Phi_f \Phi_g) + y_{4i} \ln(\Phi_h) + y_{5i} \ln(\Phi_i \Phi_g) \end{aligned}$$

where  $y_i$ ,  $i = 1$  to  $5$ , is defined as follows:

$y_1 = 1$  if the household borrows from the formal sector,  $y_2 = 1$  if the household

borrow from the informal sector but is not rationed,  $y_3 = 1$  if the household borrows from the informal sector and is rationed,  $y_4 = 1$  if household does not borrow and is not rationed and  $y_5 = 1$  if the household is a non borrower and is rationed, and:

$$\Phi_a = \Phi(\mathbf{X}_1 \hat{\mathbf{a}}_1 - r_f),$$

$$\Phi_b = \Phi(-\mathbf{X}_2 \hat{\mathbf{a}}_2 + r_f),$$

$$\Phi_c = \Phi(\mathbf{X}_3 \hat{\mathbf{a}}_3 - r_f),$$

$$\Phi_e = \Phi_2\left(\frac{\mathbf{X}_1 \hat{\mathbf{a}}_1 - \mathbf{X}_3 \hat{\mathbf{a}}_3}{\sqrt{2}}, r_f - \mathbf{X}_3 \hat{\mathbf{a}}_3, \mathbf{r}_1\right),$$

$$\Phi_f = \Phi_2\left(\frac{\mathbf{X}_1 \hat{\mathbf{a}}_1 - \mathbf{X}_3 \hat{\mathbf{a}}_3}{\sqrt{2}}, \mathbf{X}_3 \hat{\mathbf{a}}_3 - r_f, \mathbf{r}_2\right),$$

$$\Phi_g = \Phi(\mathbf{X}_2 \hat{\mathbf{a}}_2 - r_f),$$

$$\Phi_h = \Phi_2\left(\frac{\mathbf{X}_3 \hat{\mathbf{a}}_3 - \mathbf{X}_1 \hat{\mathbf{a}}_1}{\sqrt{2}}, r_f - \mathbf{X}_1 \hat{\mathbf{a}}_1, \mathbf{r}_1\right),$$

$$\Phi_i = \Phi_2\left(\frac{\mathbf{X}_3 \hat{\mathbf{a}}_3 - \mathbf{X}_1 \hat{\mathbf{a}}_1}{\sqrt{2}}, \mathbf{X}_1 \hat{\mathbf{a}}_1 - r_f, \mathbf{r}_2\right),$$

where  $\Phi$  is the cumulative distribution function of the normal distribution and  $\Phi_2$  is the cumulative distribution function of the standardised bivariate normal distribution.

#### D. Description of Variables

Table 2 gives the details on the means and the standard deviation of the various explanatory variables used in the estimations. The demand for loans will be affected by the household's characteristics and the regional variation in agricultural productivity and infrastructure. The amount of land owned by the household, the quality of land and the number of earning and working members in the households all affect the demand for credit. The exogenous treatment of the amount of land owned is justified on grounds of limited transactions in the land sales market observed in India.<sup>13</sup>

<sup>13</sup> For example, in a study of a village by Bliss and Stern (1982) the distribution of village land in 1974-75

**Table 2.** Description of Variables Used in the Regressions

Variable	Description	Mean (Std. deviation)
Household Characteristics		
Interest Rate	predicted formal interest rate	14.5 (1.7)
Land Owned	amount of land owned by the household	1.3 (1.1)
Land Quality	is a dummy that is 1 for good land quality <sup>1)</sup>	0.7 (0.4)
Males	Number of working male members in household	1.9 (1.1)
Financial Assets	financial assets of the household	3856.4 (10359.9)
Family Size	Number of members in the family	8.5 (4.7)
Age	age of the head of household	48.0 (12.9)
Village/Block Characteristics		
Road	the distance of the village from the nearest 'concrete road'	3.2 (3.7)
Fyield95	The yield of paddy (dry paddy with husks) has been taken at the block level for 1995	21.9 (5.0)
Plancult	Planned amount of the bank credit dispersed for all purposes	0.01 (0.004)
Rain95	The amount of monsoon rainfall in 1995	249.9 (39.4)

*Note:* <sup>1)</sup> The survey asked the question 'What is the soil quality of the land that you own?' To this the replies were average, saline, sandy and others. The average and others soil quality has been classified as good land quality.

Formal and Informal sector supply schedules are functions of the set of variables just described as they affect the farm productivity and the demand for loans. The formal sector schedule is identified by the planned amount of credit disbursed per cultivator for all purposes, agricultural and non-agricultural. This variable affects the cost of loans to cultivators, given that bank lending for agriculture is required to be a fixed percentage of the total formal credit. This implies that if the planned amount of credit disbursed increases it should imply an increase in access to formal sector. The information on this variable is available at the block level. The regional dummies are also used to identify the formal sector in the two-sector model (Model III). The regional dummies reflect the differences in operation of the formal institutions that operate in certain areas and are a function of existence of businesses, farm efficiency, market opportunities and other

closely reflected that before Independence (1947), and that land is rarely bought or sold.

differences.

The demand schedule is further identified from the formal sector supply schedule by the number of working members in the household. The banks are officially required to evaluate the loan on the basis of the incremental income expected from the project that is financed. Evaluation studies of some banks show that family labour was not included while making these calculations<sup>14</sup> and therefore this variable should not affect the access to the formal sector. The informal sector is identified on the basis of the financial assets of the households.

## 5. RESULTS AND CONCLUSIONS

### A. The Univariate Probit Model

It is widely believed in empirical literature that the households have a positive demand for the formal credit, which is the cheaper source of credit for all households. This implies the existence of wide spread credit rationing by the formal sector. Model I assumes that the probability of borrowing from the formal sector is determined completely by the bank which decides whether a household should get a loan or not. Thus the access to formal credit is a bank's decision as all households have a positive demand for formal credit.

According to the estimation results in Table 3 the probability of access is determined by the amount of land owned by the households, the land quality, family size, the amount of planned bank credit dispersed for all purposes per cultivator, the average monsoon rain and the food grain yield per hectare. The larger the size of land owned by the household, the greater is the probability of its access to the formal sector. A better land quality also improves the household's prospects of access to loan and hence borrowing. Food grain yield per hectare is used as a proxy for the level of infrastructure development of the region in which the household is located. Households in more developed areas with a higher level of infrastructure facility have better access to a formal sector loan. This is especially true for households located in areas near the bank branches, which are nearly always located in the area, near the block's headquarters. Proximity to the bank branches, government offices and pesticides and fertiliser shops also decreases the level of transaction costs for such households. Expectation of good weather and environmental factors proxied by the average monsoon rainfall implies expectation of a higher demand and higher production of output and hence has a positive effect on access to credit.

The planned amount of bank credit to be dispersed for all purposes per cultivator however is negatively related to the formal sector access. One reason for this

<sup>14</sup> For example, UCO Bank (1999).

discrepancy might be arising from the fact that the banks do not follow the official targets for lending to the agricultural and the priority sector at the 'block level'. Another reason could be that this model is mis-specified as compared to the bivariate model, where the coefficient for the planned amount of bank credit to be dispersed for all purposes per cultivator has the expected sign (though it is insignificant).

The model predicts a high degree of rationing by the formal sector. The probability of access to the formal sector yields the value 0.29. This value is evaluated at the mean levels of the explanatory variables. Therefore, under the assumptions of model I 71 percent of the households are credit rationed by the formal sector.<sup>15</sup>

**Table 3.** Univariate Probit Model of Access to Formal Credit

Variable	Parameter Estimates	Standard Error
Constant	-1.020	0.930
Predicted interest rate	-0.080	0.070
Amount of land owned (hectares.)	0.130***	0.040
Land quality	0.240*	0.150
Amount of planned bank credit dispersed for all purposes per cultivator	-76.010***	28.060
Age of the household head	-0.002	0.004
Size of the household	0.019*	0.011
Food grain yield per hectare in 1995	0.050**	0.020
Monsoon rain in 1995	0.004*	0.002
Puri Sadar	0.180	0.510
Kakatpur	-0.270	0.260
Astarang	-0.230	0.190
Kanas	0.070	0.240
Pr (access)	0.29	
Log Likelihood	-410.6	
Sample Size	761	

Note: (\*, \*\*, \*\*\*) indicates significance at 10% (5%, 1%) level.

## B. The Bivariate Probit Model

Model II specifies the probability of access to the formal sector as a bivariate normal distribution, jointly determined by the demand for credit and the decision of the bank on

<sup>15</sup> From data covering a much larger part of India, Kochar (1997) finds that 81% of the households were rationed under similar assumptions as Model I. However, these results are based on data that was collected in 1981 whereas our data is much more recent (1996).

whether it wants to lend to the household or not. Although it no longer assumes that all households have a positive demand for the formal sector, it is still considered to be the cheaper source of credit. This yields the differences in the estimates of the Model I and Model II. Interest rates have a marginally negative effect on the probability of demand for loans whereas its effect on access is weakly positive but statistically insignificant. It has often been claimed in literature that it is the large land owning farmers that benefit from the access to the subsidised formal credit in the developing countries (Braverman and Guasch (1986)). The results from Model II confirm this to a certain extent (Table 4). The amount of land owned and the quality of land both have a positive and significant effect on the access to formal credit, however, their effect on the demand for loans is negative and insignificant.

**Table 4.** Bivariate Probit Model of Demand and Access to Formal Credit

Variable	Access		Demand	
	Parameter est.	Std. error	Parameter est.	Std. error
Constant	-3.100	408813.6	2.314	2.83
Predicted interest rate	0.100	0.131	-0.329**	0.157
Amount of land owned (hectares.)	0.188**	0.080	-0.13	0.108
Land quality	0.783***	0.243	-2.367***	0.772
Age of the household head	-0.002	0.005	0.001	0.010
Size of the household	0.035**	0.018	0.0001	0.030
Amount of planned bank credit dispersed for all purposes per cultivator	-25.038	37.369	-	-
Food grain yield per hectare in 1995	-0.052	0.046	0.253**	0.127
Monsoon rain in 1995	0.009	0.003	0.001	0.009
Distance from the road	-0.041	0.031	0.094*	0.052
Number of working male members in the household	-	-	-0.127	0.114
Puri Sadar	-0.654	0.789	-	-
Astarang	-0.504**	0.265	-	-
Kakatpur	-0.708	0.438	-	-
Kanas	0.373	0.377	-	-
Rho	-0.98			
Pr (access and demand)	0.40			
Log Likelihood	-394.44			
Sample Size	761			

Note: (\*, \*\*, \*\*\*) indicates significance at 10% (5%, 1%) level.

In contrast to the results from Model I, access to formal sector is not affected by infrastructural and weather factors like the food grain yield per hectare and the average monsoon rain. Distinguishing between the demand and the access is responsible for the differences in the results of Model I and II. Food grain yield and the road variable, both of which reflect the level of infrastructural development of the region positively affect demand. Households living in such regions have easier access to facilities, lower transaction costs and better accessibility to their markets and as such have a higher demand for credit. The factors determining the access to the formal sector and the demand for credit are distinct, with formal credit access mainly determined by the land variables (size of land owned and the quality of land).

The probability of access to the formal sector given the demand and access is 40 percent implying that nearly 60 percent of the households are credit rationed. Considering that all households in the rural credit markets of Puri might not have a positive demand for formal credit implies that the households are not as constrained as Model I suggests and this is confirmed by the higher probability of access to the formal sector in Model II.

### **C. The Two-Sector Model**

The rural credit markets have a diverse set of lenders and credit from formal institutions might not always be the cheapest. Credit from friends and relatives, landlords and employer might be offered at lower interest rates than the formal credit. Model III is a general model where the household with a positive demand for credit can make the choice of borrowing from either of the two sectors, the formal or the informal. It therefore relaxes the assumption that the formal sector is the cheapest source of credit. The results of the estimation are presented in Table 5.

Model III confirms the results from Model II that access to formal credit increases with the size of land owned. The larger the amount of land owned the smaller is the reservation cost of the formal sector and leads to an increase in access to the formal sector. Distance of the household from the nearest road reflecting the infrastructural development of the region where the household is located shows that access to formal credit for households located near roads increases. The regional block dummies are the catch all for the differences in the regional variations for the formal sector and are all statistically significant in determining the access to the formal sector. The amount of planned bank credit dispersed for all purposes per cultivator is also a significant but with a positive sign, which is contrary to expectation. This may be explained by the fact that the planning for the amount of the credit dispersed is done in terms of the needs of the different activities at the block level. However, targets for lending to the priority sector are set and followed at the district and not the block levels. This discrepancy between the planning and the implementation at the block level might be responsible for the unexpected sign.



**Table 5.** Model of Demand and Access to Formal and Informal Credit<sup>1)</sup>

Variable	Demand	Reservation cost for the formal sector	Reservation cost for the informal sector
Constant	12.907*** (0.240)	12.201*** (0.492)	14.764*** (0.315)
Amount of land owned (hectares.)	-0.380*** (0.061)	-0.612*** (0.080)	0.035 (0.074)
Land quality	0.256*** (0.053)	0.0003 (0.084)	-0.081 (0.065)
Family size	0.458*** (0.076)	-0.043 (0.068)	0.092 (0.070)
Age of the household head	0.271*** (0.053)	0.088 (0.065)	0.122* (0.070)
Distance from the road	0.407 (0.060)	0.285*** (0.083)	0.580*** (0.064)
Number of working members in the household	-0.260*** (0.072)	-	-
Amount of planned bank credit dispersed for all purposes per cultivator	-	0.338*** (0.101)	-
Puri	-	1.307*** (0.098)	-
Kakatpur	-	0.507*** (0.065)	-
Astarang	-	0.940*** (0.098)	-
Kanas	-	0.872*** (0.080)	-
Financial assets	-	-	-0.1641*** (0.048)
Pr (access to formal sector)	0.53		
Pr (demand)	0.76		
Pr (formal sector is cheaper)	0.72		
Pr (access/demand, formal sector is cheaper)	0.28		
Mean Log Likelihood	-2.12		
Sample Size	761		

Notes: <sup>1)</sup> The model was estimated allowing  $r_1$  and  $r_2$  to take any value. The parameter estimates (standard errors) for  $r_1$  and  $r_2$  are 0.097 (0.058) and 0.776 (0.058). <sup>2)</sup> (\*, \*\*, \*\*\*) indicates significance at 10% (5%, 1%) level. Figures in the bracket are standard errors.

Although land ownership increases access to formal loans, the estimates of the reservation cost for the informal sector shows that it has no effect on the access to informal loans. The variables that determine access to informal loans are the age of the head of household, the distance from the road and the financial assets owned by the household. Distance from the road is a proxy for the infrastructure development of the region in which the household is located. Proximity to the road implies a lower reservation cost for the informal sector and implies greater access to informal credit. Similarly, households with larger financial assets face a lower reservation cost for informal sector and hence have greater access to informal credit.

The factors that determine the demand for the households are amount of land owned,

land quality, family size, age of the household's head and the number of working male members in the household. The negative relation between the amount of loan owned and the credit demanded results from the fact that very large landowners and households with small and fragmented farms have a low demand for credit. The number of males earning in the household might be engaged in primary activities other than cultivation for example, working as a salaried personal etc., which would imply a fixed income and lower demand for credit for agricultural investment and consumption smoothing purposes.

The estimates of the model suggest that a majority of farm households (72 percent) face a lower reservation cost of credit in the formal sector. The demand for credit is fairly high in the region, at 76 percent. The access to the formal sector is 53 percent among all households, but conditional on demanding credit from the formal sector, it is 28 percent. This suggests a high degree of effective credit rationing of 72 percent of the households seeking credit from the formal sector.

## 6. CONCLUDING REMARKS

The estimation of the three models confirms the general belief in the literature that a considerable number of households are credit rationed by the formal sector. The degree of the effective rationing suggested by the three models is 71 percent (Model I), 60 percent (Model II) and 72 percent (Model III). The estimated parameters of the two-sector model were used to predict probabilities that were compared to the actual distribution in the five groups of households (see Equation 4) and reflected a similar pattern.<sup>16</sup> This suggests good predictive performance by Model III. By construction, Model III is the closest to reality and presents the most reliable results of all the three models. Given that the two-sector model is the most general model, the relatively lower level of credit rationing in Model II could result from a *mis-specification*. This would imply that the parameter estimates and thus also their predictions cannot be expected to be good.

Some recent literature (Kochar (1997), Bell (1990)) has suggested that the demand for credit is low and the role that credit can play in enhancing agricultural development is limited. However, most of this empirical evidence is based on data from the 80s which was collected from relatively more productive areas. The evidence for higher degree of rationing should not be surprising, given that Orissa is one of the poorest states in India<sup>17</sup>

<sup>16</sup> The estimated parameters of Model 3, were used to predict the probability for every group in equations 4(a to e). The mean of the estimated probabilities for each group was then compared to the actual probability in the data.

<sup>17</sup> Report of the Expert Review Committee, submitted to the Planning Commission in India in 1993.

with a high degree of dependence on weather and traditional methods of agriculture.<sup>18</sup> The estimates in Model III suggest a relatively high demand for credit with fairly large credit rationing in Puri, suggesting a need for further development of the credit programs. This requires not just increased outreach of credit to the cultivators but also well-designed credit facilities that benefit the disadvantaged and not just the rich and large landowners. The estimates of Model III reflect the land ownership bias of the formal sector as the amount of land owned is a significant determinant of the access to formal credit. Recognising that the project lending approach generally followed by the banks might not be suitable to the rural poor whose need were small loans and loans for short period, credit facilities have been modified by the formal sector in Puri. Some steps in this direction have been taken by the promotion of SHG<sup>19</sup> (Self Help Groups) by NABARD.

The results in this paper therefore support the literature that states that credit policies still have an important role to play in agricultural development. Given the high demand for credit and the limited access to formal credit in Puri, the degree of effective credit rationing in Puri is very high. This result holds even when we relax the assumptions that all households have a positive demand for formal credit and that the formal sector is the cheaper source of credit.

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<sup>18</sup> PLP, National Bank for Agriculture and Rural Development, 1997.

<sup>19</sup> Realising the need for lending to the poor in the rural areas, NABARD formulated a pilot project in 1991-92 for bringing out some innovations in mobilisation of the rural savings and dispensation of credit by way of linkage of Self Help Groups with banks. As per the instructions contained in RBI circular R.P.C. D No. PL.BC. 120/04.09.22/95-96 dated 2<sup>nd</sup> April 1996 the SHG linkage programme has become the normal activity for the banks. Under this, a small, homogenous and affinity group of rural poor, voluntarily formed to save and mutually agree to contribute to a common fund to be lent to its members as per group decisions (Potential Linked Credit Plan 1999-2000).

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