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Credit Constraints and Land Tenancy Markets in Rural India

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This paper provides an empirical investigation of the extent to which rural households in India are effectively constrained in the Government controlled or "formal" credit sectors by analyzing the impact of access to such credit on production decisions, in particular the decision to rent land. The linkage between land rental and credit markets is of particular interest because of its potential effect on the distribution of operated land and hence income inequality in agriculture.

The extent to which access to credit affects the decision to lease land is estimated using an endogenous switching regression model which distinguishes between the leasing behavior of borrowers and non-borrowers, conditional on their credit status. The determinants of the leasing decision of borrowers is found to be significantly different from those of non-borrowers. However, there is no strong statistical support for the hypothesis that credit constraints affect leasing decision. This suggests that formal sector credit constraints are not effective, perhaps due to substitution possibilities between credit-financed capital and other inputs. This paper also finds that the increased demand for land by large farmers is primarily the result of their increased productivity and declining land size.

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SUMMARY

This paper provides an empirical investigation of the extent to which rural households in India are effectively constrained in the Government controlled or "formal" credit sector by analyzing the impact of access to such credit on production decisions, in particular the decision to rent land. The existence of credit constraints on household behavior has conventionally been tested through an analysis of the consumption decision of households. However, the focus on production decisions is more appropriate give that the use of formal credit is restricted to production purposes. The joint treatment of credit and land rental market outcomes also provides a more appealing empirical methodology to directly test for the effect of credit constraints.

The choice of land rental markets is motivated by the widespread assumption in the literature that households primarily use this market to adjust their stocks of non-marketable or imperfectly marketable assets. However, a study of the relationship between land rental and credit markets is of considerable policy interest in and of itself. It has widely been hypothesized that the availability of formal credit is biased towards large farmers, and that this in turn has increased the number of large farm tenant households. Thus, rationed access to credit is believed to have contributed to increased inequality of operated holdings and hence rural income.

The empirical analysis of this paper reveals that access to credit is biased towards large farm households. However, the fact that access is also importantly determined by other variables reflecting farm productivity (the amount of irrigated land and the extent of plot fragmentation), suggests that access to bank credit is constrained by the ability of the farm to undertake productive investment in agriculture.

The empirical results of this paper also reveal the determinants of the leasing decision of borrower households to be significantly different from those of non-borrowers. Traditional inputs such as ownership of draft animals and the number of male family members are of much less significance in the leasing decisions of borrower households than the amount of irrigated land and the extent of plot fragmentation. To the extent that formal sector borrowers represent households investing in more productive techniques, as implied by the estimates of the access equation, this suggests that returns to scale become increasingly important as agricultural productivity improves, and that farmers attempt to capture these returns through transactions in land rental markets.

The importance of access to formal credit is assessed by analyzing the probability of leasing land with and without access to credit for the same sub-sample of households. Thus, if small farm borrower households lost their access to formal credit, their probability of leasing land would fall from 43% to 29%, while that of medium farm borrowers would fall from 21% to 13%. However, such differences are not statistically significant. In particular, we cannot reject the null hypothesis that access to credit has no effect on the probability of a household leasing land.

The estimates do suggest, however, that access to credit constrains small farm households relatively more than it does larger farms. This also implies that the greater participation of large farm households in land rental markets as tenants cannot be ascribed primarily to their better access to formal credit. An analysis of the elasticity of the marginal probability of leasing land with respect to the various explanatory variables considered in this analysis suggests that the demand for land by large farmers is primarily a function of the amount of land owned, the amount of irrigated land, and the extent of plot fragmentation. The fact that the elasticity of the probability of leasing with respect to these variables is much greater for large farmers than it is for small farmers suggests that the increased representation of large farmers in the tenant population can primarily be explained by changes in these variables.

The fact that access to formal credit does not have statistically significant effects on the probability of leasing suggests that credit constraints do not effectively bind rural households. This in turn implies that either the productivity of capital is low, or that there are good substitutes for the capital which is financed by formal credit. On the other hand, the importance of the structure of landholdings, as represented by a household's ownership of land, the amount of irrigated land, and the extent of plot fragmentation, appear to be relatively greater constraints both on leasing behavior and on access to credit. This suggests that government action to improve the structure of landholdings in rural areas would have a greater impact on the rural economy than interventions in the credit market.

I. Introduction

This paper provides an empirical investigation of the extent to which rural households in India are effectively constrained in the Government controlled or "formal" credit sector by analyzing the impact of access to such credit on production decisions, in particular the decision to rent land.

There is now a considerable body of literature, both for developed and developing countries, which analyses the extent to which households are liquidity constrained by examining household decisions which are affected by credit constraints. Of these, the focus has primarily been on the consumption decision of households (Zeldes 1989, Morduch 1990). Without explicitly considering credit market outcomes, this literature tests for liquidity constraints by testing whether the consumption decisions of households which are more likely to be liquidity constrained differs from that of households which may be unconstrained. This methodology is fraught with problems, such as the sensitivity of the results to the method chosen to divide the sample into constrained and unconstrained households, endogeneity problems in the variables used to test for the presence of liquidity constraints (usually current income), and data problems in the measurement of consumption.

Particularly in the context of rural producer-consumer households in countries such as India where formal credit is only available for production purposes, an alternative methodology for testing for credit constraints suggests itself in the analysis of the production decisions of households. If households are credit constrained in the formal sector in the sense that their demand for credit exceeds the available supply, one should expect to see such constraints affect household decisions in other factor markets, such as the land rental market. In this paper I follow this approach by testing whether the probability of leasing land differs for borrower and non-borrower households and analyzing the extent to which such differences

are attributable to the differential access to credit of the two groups. The joint treatment of credit and land rental decisions obviates the necessity of dividing households into constrained and unconstrained households on the basis of some randomly selected variable. Further, there is little scope for measurement error in the participation decision of households.

A study of the relationship between land rental and credit markets is of considerable policy interest in and of itself. It has widely been hypothesized that the availability of formal credit is biased towards large farmers, and that this has improved their position in land rental markets. The evidence cited in support of this hypothesis is the increase in "*re*verse" tenancy, or the increased participation of large farm households in land rental markets as tenants. This has raised concerns that the operation of formal credit markets is contributing to a worsening of the distribution of operated land holdings, and hence is widening income inequality in agriculture (Eswaran and Kotwal 1989, Stiglitz and Braverman 1989). This paper provides a rigorous empirical analysis of this hypothesis.

The analysis of this paper is conducted using Government of India household survey data for approximately 2400 rural cultivator households in the North Indian state of Uttar Pradesh. The data set provides information on both credit and land rental transactions.

This paper finds no conclusive evidence in support of the hypothesis that access to credit influences leasing decisions. This does not imply that households are not rationed in their access to formal credit markets, but instead that there may be effective substitutes for formal credit such that formal credit constraints are not binding. The available evidence, however, does suggest that small farm households are more likely to be affected by credit constraints than are large farm households.

I discuss the literature on credit and land rental markets in Section II of this paper. I then present preliminary evidence from survey data on tenancy transactions in Section

III. Section IV lays out a theoretical model of rural credit and land rental markets, while the econometric model is specified in Section V. Finally, the results of the empirical work are presented in Section VI, followed by the Conclusion.

II. The Effect of Formal Credit Markets on Tenancy Contracts

Government intervention in rural credit markets increased significantly in the late 1960s, following the nationalization of major commercial banks. Nationalized banks and other credit agencies such as credit cooperatives which come under the purview of the Government were required to advance 40% of their credit to "priority sectors", of which the agricultural sector is the largest. Government regulations also control lending terms for agricultural loans. In particular, the Government specifies the interest rate on all agricultural loans. The increased level of government intervention in credit markets coincided with the adoption of the Green Revolution technology in parts of India. This technology involves the adoption of a package of high yielding seed varieties, fertilizers, pesticides and improved irrigation, and significantly increases the resource requirements of farmers investing in it. The perceived increased demand for credit, in conjunction with a limited supply of "formal" credit and the Government's fixed interest rate policy, is assumed to have resulted in the widespread rationing of formal credit. It is widely believed that the access of households to the formal credit sector is biased in favor of larger farm households due to their ability to offer higher collateral.

The extent to which credit constraints effectively bind households has been tested in other empirical work through an analysis of the consumption decision of households, using the fact that the Euler equation for optimal consumption will differ for constrained and unconstrained households (Zeldes 1989, Morduch 1990). This approach divides households into constrained and unconstrained sub-samples on the basis of the household's endowment

of a variable which is thought to underlie the bank's access decision, such as landholding size or asset holdings. The test involves testing for the significance of variables such as current income, which will affect the consumption decisions of the credit constrained sub-sample, but not those of unconstrained households.

This approach suffers from several methodological problems such as the validity of the division of the sample into constrained and unconstrained households on the basis of a single variable, measurement error inherent in consumption data, and the extent to which the test of the significance of current income on consumption can be taken to infer liquidity constraints. There is a further problem in using this approach to infer constraints in the access of households to formal or government controlled credit in countries such as India. Since the formal sector only advances production loans, one should expect its role in smoothing consumption to be limited. A more interesting question in this context is the extent to which a household's production decisions have been influenced by the availability of formal credit.

In this paper I analyze the extent to which households are effectively constrained in the formal credit market by examining the extent to which formal sector credit outcomes influence land rental decisions. Constrained access to credit will affect household transactions in all factor markets, particularly if these constraints are differentially felt across households in a systematic way. The choice of the land rental market is motivated by the fact that this market has generally been considered to provide the principal means by which rural households adjust to their stocks of non-marketable or imperfectly marketable assets. In the absence of a sales market for land, and with no scale economies, households can still achieve optimal input ratios through transactions in rental markets. It is believed that resource adjustment occurs primarily through the land rental market since rental markets for the services of other imperfectly marketable assets such as draft animal services and management

skills embodied in family labor are virtually absent (Bliss and Stern 1982, Bell 1977). The land rental market is assumed to function well, relative to other rental markets, since it is thought to be least afflicted by moral hazard problems (Binswanger and Rosenzweig 1986).

The empirical literature on land rental markets has shown that households do adjust their ownership of fixed resources through the land rental market. Thus the area leased in is inversely related to land ownership, and positively related to household stocks of draft power (Skoufias 1991, Shaban 1990, Nabi 1985, Bliss and Stern 1982, Jodha 1981). The adjustment to stocks of draft power, in particular, has been shown to be very strong. The evidence on adjustment to stocks of family labor are mixed and weaker (Shaban 1990, Skoufias 1991).

There has been, however, little attempt to study the extent to which tenurial relations reflect constraints in a household's access to formal credit. The only exception is Shaban (1990), who attempted to capture the effect of credit constraints by including in his regressions variables which reflect the liquidity position of a household such as the value of its fixed and liquid assets. While the value of fixed assets was found to be insignificant, financial assets and stocks had a significant positive effect on land leased. However, as pointed out by Bliss and Stern (1982), it is not clear that such wealth variables reflect credit constraints, or just income effects on the demand for leisure.

Evidence from field studies suggests that tenancy contracts are, to some extent, a response to credit constraints which in turn implies that credit constraints may be binding for some rural households. Jodha's (1981) study documents the reasons given by farm households for entering into tenancy contracts, and finds that between 6 and 12% of tenancy transactions in the six villages studies were "interlinked" contracts, entered into as a means of access to the tenant's ownership of resources other than land. A significant percentage of

such contracts are believed to be based on linkages between credit and tenancy markets. This linkage has also been noted in village studies in North India (Bliss and Stern 1982). Typically, a household which lacks access to sufficient credit to undertake investment in modern purchased inputs such as fertilizers, pesticides and high yielding seed varieties would rent out its land to a tenant who is not similarly constrained. The credit component enters in that the costs of such purchased inputs are shared between landlord and tenant, generally in the same ratio in which output is shared. The landlord's share is typically deducted from his share of the output at harvest, so that the tenant initially bears the full cost of the purchased inputs.

While a study of the linkages between the land rental market and the credit market can provide information on the extent to which credit constraints effectively bind households, another motivation for focussing on the link between these two markets in particular is that some of the more serious consequences of rationed access to credit markets are assumed to operate through the land rental market. It is widely believed that differential access to credit of rural households lies behind the phenomenon of "reverse" tenancy by which larger landowners rent in land from small farm households. This has led to concerns that the Government's credit policy may lead to a worsening of the distribution of operated land, and hence increased agricultural inequality (Eswaran and Kotwal 1989, Braverman and Stiglitz 1989).

There is some evidence that the emergence of reverse tenancy is concentrated in the high productivity Green Revolution regions. For example, a recent study (Parthasarthy 1991) analyses the 1982 National Sample Survey data for the advanced agricultural state of Punjab in comparison to Bihar where agriculture has been relatively stagnant. The analysis reveals that the percentage of marginal and landless households leasing land was roughly the same in both states (19% in Bihar and 17% in Punjab). However, in each of the larger landholding

groups, the percentage leasing land was much higher in Punjab. Thus, the percentage of semi-medium, medium and large farmers leasing land in Punjab was 41%, 26% and 18% respectively, while the corresponding figures for Bihar are 7%, 4% and 3%.

This evidence is sometimes interpreted as indicating that credit market conditions lie behind reverse tenancy, since the greater demand for credit in high productivity regions increases the probability of households being effectively constrained in rural credit markets. However, while the incidence of reverse tenancy may be particularly strong in the more productive regions, it also exists in regions of low productivity such as the semi-arid tropics of South India, where the demand for credit is much less. Thus, Jodha's analysis of tenancy in six villages of South India reveals that in four out of the six villages large farmers had the largest share (34 to 69%) of total land leased in (Jodha 1981). While reverse tenancy is obviously related to the better resource position of large farmers relative to small farmers, it is not evident that it is access to credit *per se* which is the primary consideration.

III. Evidence from Survey Data

Some light can be shed on these issues by an analysis of the survey data. The data reveals considerable variation in the extent of tenancy by regions. It is most pervasive in the advanced Western region of the state and in the relatively underdeveloped Bundelkhand region, with tenant households accounting for 27% of total households in each of these two regions (table 1). Such regional patterns mirror patterns at the all-India level, where tenancy has been noted to be most widespread amongst the highly developed states and amongst relatively backward states (Parthasarthy 1991).

Regarding reverse tenancy, the sample evidence indicates that tenants are overwhelmingly small farmers. Thus while small farmers account for 58% of the total sample

population, they represent 78% of households leasing in (table 2). However, a significant number of large farmers (11%) do operate as tenants. Moreover, large farmers are more important in the tenant populations in the advanced Western and Central region, where they represent 14% and 13% of large farmers, respectively. The importance of reverse tenancy in the Western region is heightened if we consider the distribution of area leased in. Thus, though large farmers in the Western region account for only 25% of tenant households, they are responsible for 38% of land leased in (table 3).

Is there any evidence to suggest that access to formal credit may be a determinant of tenancy contracts? Consideration of tenant households by their formal sector borrowing status (table 4) reveals that the percentage importance of borrowers in the sample tenant population (20%) is marginally higher than their importance in the population as a whole (18%). However, this primarily reflects the greater importance of formal borrowers in the tenant populations in the Eastern and Hill regions. Overall, the distribution of tenant households does not appear to be skewed towards formal sector borrowers.

This conclusion changes when one considers the area leased in by formal sector borrower (table 5). Thus, while formal sector borrowers accounted for 20% of total tenant households, they accounted for 27% of land leased in. Their importance in the proportion of area leased in appears to be particularly great in the backward Hill and Bundelkhand regions (where they accounted for 40% and 35% of land leased in, respectively), but also in the Western region where formal sector borrowers were responsible for 34% of land leased in.

Thus there appears to be some weak evidence in favor of the hypothesis that tenurial contracts reflect conditions of agricultural productivity, and that access to formal credit is important, particularly in the determination of the amount of land leased. Since borrowers differ from non-borrowers in their endowments of fixed resources in addition to their access

to formal credit, conclusions regarding the effect of credit on tenancy decisions must, however, be based on regression analysis which can isolate the pure effects of access to credit.

IV. A Model of Formal Sector Credit Constraints and Tenancy Decisions:

In this section I model the determination of a cultivator household's access to formal credit. I then describe transactions in land rental markets and derive some comparative static results. The comparative static results are used to understand the factors which govern the extent to which land rental contracts reflect credit market outcomes.

A. The Formal Sector Credit Supply Schedule

Formal sector credit represents loans from government owned credit cooperatives and nationalized commercial banks which are required to operate within the rules specified by the Government In addition to specifying the interest rate on various categories of loans, such rules also dictate general lending criteria. The specified purpose of formal sector loans is to encourage productive investment in agriculture and the shift to improved techniques of production. Banks are required to ensure that the borrowing household is able to repay the loan from the incremental income earned from that investment alone. A household's access to formal credit is thus based not on *ex ante* but on *ex post* farm profitability. Since the majority of formal sector loans are for land-based investments such as minor irrigation, the bank's determination of access to their funds is primarily determined by the structure of landholdings in a farm -- land size and the extent of plot fragmentation. The bank's decisions are based on the household's ownership of land rather than its operational holdings which include any land leased, since land lease contracts are generally seasonal, whereas bank loans are repaid over a longer time horizon.

Specify the production function as $F(K, \bar{A}, \theta)$ where $\bar{A}$ is a set of fixed factors in production, $\theta \in [\underline{\theta}, \bar{\theta}]$ is a random vector of weather and other environmental variables affecting production, and K is the capital financed by the bank. The production function is assumed to be strictly increasing in all its arguments, and strictly concave in K. Under this specification output is random with its distribution determined by that of θ. The uncertainty of output implies a probability of loan default. Banks assume that households will default if income, including the value of remaining capital financed by the bank, is insufficient to repay the loan. The expected profit of the bank is:

$$(1) \qquad E\pi = \int_{\underline{\theta}}^{\hat{\theta}} [F(K, \bar{A}, \theta) + K] f(\theta)\, d\theta + (1+r)K \int_{\hat{\theta}}^{\bar{\theta}} f(\theta)\, d\theta - (1+r)K$$

where $\hat{\theta}$ solves $F(K, \bar{A}, \hat{\theta}) + K = (1+r)K$, and r represents the opportunity cost of funds. Banks maximize expected profits with respect to K, yielding their optimal supply of credit to a household. The Kuhn Tucker first order condition is:

$$(2) \qquad \int_{\underline{\theta}}^{\hat{\theta}} \left[1 + F_K(K, \bar{A}, \theta)\right] f(\theta)\, d\theta + (1+r) \int_{\hat{\theta}}^{\bar{\theta}} f(\theta)\, d\theta - (1+r) \leq 0$$

when (2) is met as an equality we can solve for the formal sector's supply schedule $K(r, \bar{A}, \theta)$ which equates the expected marginal return on the loan with the marginal opportunity cost. This supply schedule is household specific, varying with the formal sector's perception of the probability of loan repayment, and is everywhere increasing in the interest rate. This result follows from the assumption that output is a concave function of the loan amount. An increase in the loan amount thus increases returns in the event of default less that proportionately, so that the opportunity cost of the loan increases relative to expected income.

Despite the fact that the notional formal sector supply schedule is upward sloping in the interest rate, this schedule is not offered to the borrower since the formal sector rate is fixed ar r_f. The formal sector instead solves equation (2) for the maximum loan $\bar{K}_j(r_f)$ it is willing to lend to household j, and hence offers the household a supply schedule which is horizontal at r_f. Thus the formal sector rations credit by determining the fixed amount it is willing to lend to each household. If $\bar{K}_j = 0$, the household is unable to get any formal credit. Rewriting (2), $\bar{K}_j = 0$ if:

$$(3) \qquad r_f < \tau + \int_{\underline{\theta}}^{\hat{\theta}} \left[r_f - F_K(0, \bar{A}, \theta) \right] f(\theta) d\theta$$

The term under the integral on the right hand side reflects the expected marginal loss in income if the borrower defaults and hence the lender's marginal risk cost, while the first term on the right hand side is the marginal opportunity cost. Hence, a household is denied access to the formal sector if the formal sector's reservation cost of lending to the household, evaluated at K=0, exceeds r_f. The determination of access is thus based on the formal sector's notional supply schedule for a household.

Households are effectively constrained in the formal sector only if they demand a formal loan at the interest rate r_f. The probability of their doing so is determined by their reservation demand rate or the productivity of the farm in the absence of borrowing. If the reservation demand rate exceeds the formal sector interest rate for all households, participation in the formal sector will be determined exclusively by the bank's decision on access. Moreover, if the demand for credit is sufficiently high, the observed formal sector loan is $\bar{K}_j$, and is determined by the bank according to equation (2). Since the hypothesis that land rental contracts reflect credit outcomes is premised on the assumption that households

are effectively rationed in formal credit markets, we impose this constraint on the analysis of land rental contracts below.

B. Land Rental Contracts

The dominant land rental contract in the survey area is a share contract. While there are various explanations which can be offered for the prevalence of this contract, I view it as a form of risk sharing between tenant and landlord in the context of uncertainty in agricultural production. Following the theoretical literature on this topic, the terms of the rental contract are viewed as being determined in a principal-agent relationship.[1] This assumes the prior division of households into potential landlords and tenants, on the basis of the difference between land endowments and some "optimal" land size, as determined by the household's endowment of fixed inputs in production.

Typically, the literature allows the landlord to choose the rental share α and any fixed payments ß, along with the amount of land offered in the contract (A). The choice of α and ß has received considerable attention since this determines the nature of the contract (fixed or share). The empirical reality, however, is that the observed share appears to be fixed by prevailing norms, generally at 50%, and exhibits little variation.[2] Thus, while I assume that tenancy contracts are determined in a principal-agent relationship, I take rental shares to be dictated by village norms, with the landlord only choosing A, the amount of land leased out.

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[1]As has frequently been noted (eg. Singh 1989), treating the output share in a share contract as a price-like variable with household taking this price as given in a competitive or Marshallian model yields a solution where the tenant will demand land up to the point where its marginal product is zero. Though there are ways around this (Jaynes 1982), the general method is to do away with the assumption of share-taking behavior and allow one side (typically the landlord) to set the parameters of the contract.

[2]In Bliss and Stern's 1982 study of contracts in Palanpur they found that "... the landlord's share in Palanpur is always 50% and has been the same for a very long time, right back to the time of the zamindars."

Following empirical evidence (Shaban 1987) which reveals considerable differences in the average use of family labor and bullock draft power between tenanted and own-cultivated land, I allow the tenant to choose quantities of both fixed (K_2) and variable inputs (L_2) applied to the tenanted land.

Since the rules under which formal sector banks operate are well known, cultivator households are assumed to have full information on possible outcomes in the formal sector. I therefore treat tenancy decisions as being made after the realization of credit outcomes. A tenant household's formal sector credit allotment $(\bar{K})$ can be viewed as equivalent to its endowment of a fixed input in production, given that it is not a choice variable for the household. The tenant, however, decides how much of the credit allocation will be applied to the rented land (K_2). Given its credit allocation, all households can be treated as credit constrained in the formal sector in that consumption and investment in any period are equal to income.

Let $\bar{A}$ be the amount of land owned by the tenant household, Ω be its labor endowment, L_1 and L_2 be the amount of the variable input used in own farm production and on the rented land respectively,[3] and l be leisure. The tenant's objective function is:

$$(4) \quad \max EU^T\left\{\theta F(\bar{K}-K_2, \bar{A}, L_1) + \alpha\theta G(K_2, A, L_2) - \beta + w(\Omega - l - L_1 - L_2),\ l\right\}$$

The FOC are:

$$(5) \quad EU_1^T(\cdot)\left[\alpha\theta\frac{\partial G}{\partial K}(\cdot) - \theta\frac{\partial F}{\partial K}(\cdot)\right] = 0$$

$$(6) \quad EU_1^T(\cdot)\left[\alpha\theta\frac{\partial G}{\partial L}(\cdot) - w\right] = 0$$

[3] L_i, $i = 1,2$, refers to all variable inputs, though I will occasionally refer to it as labor.

$$(7) \qquad EU_1^T(\cdot)\left[\theta \frac{\partial F}{\partial L}(\cdot) - w\right] = 0$$

$$(8) \qquad -EU_1^T(\cdot)\, w + EU_2^T(\cdot) = 0$$

The FOC imply that the tenant determines input use on his own farm and on the rented land by equating the marginal product of inputs across the two farms.

The landlord's maximization is subject to the tenant's choice of inputs and the constraint that the tenant gets his expected reservation utility ($EU^T(w,\bar{K},\bar{A},\Omega,\theta)$), determined by the profitability of cultivation on his own farm without participation in rental markets. Let T, Ω^L and K^L be the landlord's land, labor and capital endowments respectively, L^L the amount of the variable input applied to any land retained for his own cultivation and l^L be leisure time for the landlord. The landlord's optimization problem is:

$$(9) \quad \max EU^L\left\{(1-\alpha)\,\theta G(K_2^*, L_2, A) + \beta + \theta f(T-A, K^L, L^L) + w(\Omega^L - l^L - L^L),\, l^L\right\}$$

$$\text{s.t.} \quad EU^T\left\{\theta F(\bar{K}-K_2^*, \bar{A}, L_1^*) + \alpha\theta G(K_2^*, A, L_2^*) - \beta + w(\Omega - l^* - L_1^* - L_2^*,\, l^*\right\}$$

$$\geq EU^T(w, \bar{K}, \bar{A}, \Omega, \theta)$$

The FOC for the choice of A is:

$$(10) \quad EU_1^L(\cdot)\left\{(1-\alpha)\,\theta\left[\frac{\partial G}{\partial K_2^*}\frac{\partial K_2^*}{\partial A} + \frac{\partial G}{\partial L_2^*}\frac{\partial L_2^*}{\partial A} + \frac{\partial G}{\partial A}\right] - \theta\frac{\partial f}{\partial A}\right\} + \lambda EU_1^T(\cdot)\,\alpha\theta\frac{\partial G}{\partial A} = 0$$

The landlord chooses the amount of land leased out by equating his marginal utility from the contract with the tenant's. This land amount is a function of both landlord and tenant characteristics. In particular, it will depend on the tenant's endowment of all fixed

inputs used in production, including credit. Thus, if households are constrained in credit markets, tenurial contracts will reflect these constraints. However, even if households <u>are</u> credit constrained, the relative importance of formal credit in determining tenurial contracts may be limited. This can be seen by an analysis of the comparative statics of the problem.

To simplify the comparative static exercises we assume risk neutrality of landlords and tenants so that they are concerned solely with the maximization of income.[4] Under this assumption, the tenant's optimal choice of inputs K_2^* and L_2^* on the rented land varies with his credit endowment $(\bar{K})$ as:

$$(11) \qquad \frac{dK_2^*}{d\bar{K}} = \frac{\alpha\theta \frac{\partial^2 G}{\partial L^2}\left[\theta \frac{\partial^2 F}{\partial K^2}\theta \frac{\partial^2 F}{\partial L^2} - \left[\theta \frac{\partial^2 F}{\partial K \partial L}\right]^2\right]}{|H|}$$

$$(12) \qquad \frac{dL_2^*}{d\bar{K}} = \frac{\alpha\theta \frac{\partial^2 G}{\partial K \partial L}\left[\theta \frac{\partial^2 F}{\partial K^2}\theta \frac{\partial^2 F}{\partial L^2} - \left[\theta \frac{\partial^2 F}{\partial K \partial L}\right]^2\right]}{|H|}$$

where $|H|$ is the determinant of the hessian matrix for the tenant's problem.

From the S.O.C. of the problem, the amount of capital applied to the rented land (K_2) unambiguously increased with the tenant's endowment of capital. The effects on the use of the variable input (L_2) occur through K_2^* and hence depend on whether capital and labor are substitutes or complements. The effect is negative if capital and labor are substitutes.

The extent to which $\bar{K}$ affects the tenant's input decisions on the rented land depends on the extent to which changes in capital use induce changes in the use of other

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[4]Since the objective of this exercise is merely to get a sense of the factors determining the importance of credit in tenurial contracts, this simplification does not affect the conclusions.

inputs. Thus, the effects on K_2^* are largest if there are no substitution possibilities between credit-financed capital and other inputs ($\frac{\partial^2 F}{\partial K \partial L} = \theta$). Conversely, as the degree of substitutability between capital and other inputs increases, the effect of $\bar{K}$ on K_2^* decreases. The effect on L_2^* works in the opposite direction, since $\bar{K}$ only affects L_2^* through K_2^*. Thus, there is no effect on L_2^* if credit-financed capital is separable from labor.

The relationship between the tenant's credit allotment and input use on the rented land in turn determine the extent to which this allotment effects the amount of land offered in the contract. From the landlord's FOC we get:

(13)

$$\frac{dA}{d\bar{K}} = -\theta \frac{\partial^2 f}{\partial L^2} \frac{(1-\alpha)\,\theta \left[\left(\frac{\partial^2 G}{\partial A \partial K} \frac{\partial K_2^*}{\partial \bar{K}} + \frac{\partial K_2^*}{\partial A} \frac{\partial^2 G}{\partial K^2} \frac{\partial K_2^*}{\partial \bar{K}} + \frac{\partial G}{\partial K} \frac{\partial^2 K_2^*}{\partial A \partial \bar{K}} + \frac{\partial L_2^*}{\partial A} \frac{\partial^2 G}{\partial L \partial K} \frac{\partial K_2^*}{\partial \bar{K}} \right. \right.}{|H|}$$

$$-\theta \frac{\partial^2 f}{\partial L^2} \frac{(1-\alpha)\,\theta \left[\left. \frac{\partial^2 G}{\partial A \partial L} \frac{\partial L_2^*}{\partial \bar{K}} + \frac{\partial K_2^*}{\partial A} \frac{\partial^2 G}{\partial K \partial L} \frac{\partial L_2^*}{\partial \bar{K}} + \frac{\partial L_2^*}{\partial A} \frac{\partial^2 G}{\partial L^2} \frac{\partial L_2^*}{\partial \bar{K}} + \frac{\partial G}{\partial L} \frac{\partial^2 L_2^*}{\partial A \partial \bar{K}} \right]}{|H|}$$

The effect of the tenant's credit allotment on the amount of land offered in the rental contract (A) operates through K_2^* and L_2^* and their effect on land productivity. These inputs have both direct effects on the productivity of rented land ($\frac{\partial^2 G}{\partial A \partial K}$ and $\frac{\partial^2 G}{\partial A \partial L}$) and second order effects through the productivity of capital and labor ($\frac{\partial^2 G}{\partial K^2}$, $\frac{\partial^2 G}{\partial L^2}$ and $\frac{\partial^2 G}{\partial K \partial L}$) . If the direct effects dominate, as can be expected at an optimum,[5] increases in K_2^* and L_2^* will increase the productivity of land, assuming that land

[5]From the second order conditions of the problem,this is a sufficient condition to yield a maximum.

is complementary to capital and labor. The effect of a household's credit allotment on the amount of land offered in the contract then turns on its effect on K_2^* and L_2^*. From the analysis of the tenant's optimization problem, $\overline{K}$ has a positive effect on K_2^* and a negative effect on L_2^*, assuming that capital and labor are substitutes. Thus, $\overline{K}$ will have a positive effect on A through K_2^*, but a negative effect through L_2^*. The overall effect of $\overline{K}$ on A is thus ambiguous. However, since $\overline{K}$ effects L_2^* only indirectly through the amount of credit-financed capital applied to the rented land (K_2^*), we can reasonably expect the effect through capital to dominate. The amount of land offered in the contract will then be increasing in the tenant's credit endowment.

Thus, credit market constraints, if effective, will be offset in land rental markets, with more land being offered to those with larger credit allotments, other things being equal. The magnitude of the effect depends not just on the effect of capital (credit) on land productivity, but also on the relationship between credit and other inputs which in turn determines the allocation of credit between the tenant's own farm and the rented land. This, in fact, is a measure of whether credit constraints are effective. If there are good substitutes for the capital financed by bank loans, credit constraints are essentially not binding. To take this to an extreme, if credit-financed capital can also be obtained directly through a rental market (so K = L), credit constraints will have no effect on land rental contracts, even if households <u>are</u> rationed in their access to credit.

C. Equilibrium in Rental Markets

If rental shares are dictated by village norms, there are no prices which clear the market. Under such conditions there will exist temporary market disequilibrium under which some potential tenants (if there is an excess supply of tenants) will be excluded from the market. Applying the Kuhn-Tucker theorem to the landlord's maximization problem (9),

potential tenants will be excluded from the market if, over the set of all landlords, the landlord's reservation cost of the contract $\left[\theta\frac{\partial f}{\partial A}(T,.) - (1-\alpha)\theta\frac{\partial G}{\partial A}(0,.)\right]$, in utility equivalents, exceeds the landlord's assessment of the reservation benefit to the tenant $\left[\alpha\theta\frac{\partial G}{\partial A}(0,.)\right]$, again in utility equivalents. Under the assumption that all landlords assess tenants equally, tenants can be ranked by the benefit they get from a rental contract and hence their desirability to landlords. The "marginal tenant" is the tenant for whom the FOC (10), evaluated at $A=0$, holds as a strict equality. Less desirable tenants will be rationed out of the market. From the comparative statics of the problem it can be shown that tenants with smaller endowments of fixed inputs used in production will be excluded, as will farmers with larger landholdings who have relatively higher levels of income. The disequilibrium in land rental markets is temporary in that excluded households will adjust their stocks of fixed resources over time and hence take themselves out of the market. Such a model accords with the observations of Bliss and Stern's in-depth study of rental contracts in a North Indian village (Bliss and Stern 1982).[6]

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[6]Bliss and Stern make the following observations: "The majority of our informants concurred in the view that a would-be landlord would experience no difficulty in finding a tenant in Palanpur, while a would-be tenant wishing to lease-in land would usually be able to find a landlord. These views were governed by the presumption that a would-be tenant has to be "qualified" if his desire to lease-in land was to count seriously....If, for whatever reason, the share of the landlord does not increase then the market will nevertheless find a kind of equilibrium through the process of land rationing, followed by an accommodation by the households which fail to get the land they would like to lease to the state in which they find themselves... Given an excess demand for land to lease and the minimum amount he is prepared to lease to one person, or the minimum that would be accepted, the landlord will choose as tenants those he regards as the best cultivators and the remainder will be disappointed. In the medium term the disappointed would-be tenants may divest themselves of bullocks and other means of cultivation and may thereby take themselves out of the market (pp. 128, 129)."

V. An Econometric Model of the Effect of Credit Constraints on Tenancy

The empirical analysis of this paper estimates the probabilities of household participation in land rental markets, rather than an analysis of the amount of land rented. This simplifies the empirical work, while still allowing an assessment of the impact of credit decisions on land rental markets.[7] The econometric model is a hierarchical one. Banks' decisions on a household's access to formal credit are made first, independently of the household's rental decisions. Rental decisions are made subsequently, conditional on credit market outcomes.[8] As stated earlier, the bank's decision on access is not based on a household's transactions in rental markets since land rental contracts are entered into for a short duration and are generally not renegotiated. However, the error terms in the access and leasing decisions may be correlated, reflecting the effect of omitted variables common to both decisions, on which data is not available. The empirical analysis allows for such correlation.

Table 6 defines the variables used in the regressions. Following the analysis of the previous section, the formal sector's determination of access for a household is derived from a household-specific notional supply schedule, which reflects the riskiness of lending to the household. Access to bank funds is estimated as a function of the amount of land owned by the household (LOWNED), the extent of plot fragmentation (CULTPLOT) which will negatively effect productivity if there are returns to scale in agriculture, the number of draft animals owned by the household at the start of the season (DRAFT), the amount of irrigated land (IRR) and the maximum level of education of a resident family member (MAXED). Since banks loans

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[7]The effect on the amount of land will be estimated in future work, using two-stage methods.

[8]As stated in the previous section, full knowledge of the rules under which formal sector banks operate allow us to treat credit market outcomes as predetermined.

do not finance all investment in draft animals or in irrigation[9] these variables are not likely to be highly correlated with past access to bank loans. Given their limited information on rural households banks may also use regional measures, such as their past level of experience in the district, to assess levels of household risk. The access equation thus includes a measure of the bank's presence in the district, the number of agricultural accounts per thousand rural cultivator households (AGACCT), amongst the regressors.

Access to bank loans is also a function of the formal sector interest rate. Since this equation is estimated on the full sample of households, it is necessary to use a predicted rate, as no interest rate information is available for non-borrowers. As stated earlier, interest rates charged on agricultural loans are specified by the Government of India. These rates vary by land-size category (small, medium and large farmer), which in turn are defined by the National Bank for Agriculture and Rural Development (NABARD). The acreage ceilings that define these size categories varies by agro-climatic zones and differs for irrigated and unirrigated farms.[10] I thus classify cultivator households into small, medium and large farm households on the basis of NABARD's classification scheme, and use dummy variables for these size categories to capture interest rate effects. Dummy variables are used rather than the actual interest rate for these groups since other terms of the loan (repayment period, down payment, etc.) also vary by these size categories. Thus, the dummy variables capture the difference in all terms of the loan across size categories. It is possible, however, that this classification may additionally reflect differences in ownership or access to other inputs which could also differ

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[9]Irrigated area includes area irrigated by canals, tanks, and other traditional devices which are not financed by banks.

[10]For example, in Ghaziabad district in the Western region, a rainfed holding of 8.5 acres or an irrigated holding of 7.5 acres is classified as a small farm, whereas in Jhansi district in the backward Bundelkhand region, a rainfed holding of 12.25 acres or an irrigated holding of 8.5 acres constitutes a small farm.

by land-size categories[11].

Following the theoretical model of the preceding section, the probability of a household being a tenant on the land rental market is determined by the desirability of the tenant to landlords vis-a-vis other tenants, as determined by the reservation benefit to the household of entering into a tenancy contract. Define this as $R_T = R_T(X_T, U_T)$ and that of the "marginal" tenant as $R_o = R_o(X_o, U_o)$. Taking linear approximations, a contract is offered to a household if:

$$\tau_1 X_T - \tau_1 X_o + U_T - U_o > 0 \tag{14}$$

or

$$U_i > -\tau_1 X_T \tag{15}$$

where $U_i = (U_T - U_o - \tau_1 X_o)$, and hence includes characteristics of the marginal tenant, assumed to be uncorrelated to those of other tenant households.

The probability of leasing land is a function of the same variables considered in the bank's access decision (LOWNED, CULTPLOT, MAXED, IRR, DRAFT). In addition, this probability is considered to be a function of the household's labor endowment -- the number of male (MALES) and female (FEMALES) family workers in agriculture.

Given the limited number of transactions in the land sales market in India, land owned and plot fragmentation have generally been considered to be exogenous variables in empirical work on rural factor markets. The number of draft animals and family labor have also generally been taken to be exogenous, even though their treatment as such is more problematic. An implication of the theoretical analysis is that equilibrium in the land rental market is achieved

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[11]For example, membership in marketing cooperatives which may influence agricultural prices.

through adjustment of the fixed inputs in production over time. The treatment of these variables as exogenous is then valid only under the assumption that the market is in a state of long-run equilibrium. If not, the endowment of these variables at the start of the season reflects adjustment to conditions in the tenancy market of the previous season, in particular the demand for tenants and the tenant household's position vis-a-vis other tenant households. Since these same factors affect current leasing decisions, a household's endowment of fixed factors in production will be correlated with the error terms if there is any auto-correlation in these variables over time. However, even if the estimates are biased, we expect the direction and magnitude of the bias to be the same for borrower and non-borrowers households, so that comparisons of the coefficients of the two equations will still be valid, as will estimates of the probability of leasing.

For households with access to land, X_T includes the amount of formal loan available to the tenant. Following the analysis of the formal sector in the previous section, this amount is determined by the bank and is based on household characteristics. Thus, it is likely that it will be correlated with the error term in equation (15) which may include household characteristics that are relevant to both the leasing decision and the bank's decision on access which we have no information on. Since valid instruments are not readily available[12] I estimate a reduced form, which expresses equation (15) solely in terms of the exogenous variables which determine leasing decisions and the bank's decision on the loan amount. Thus, for households borrowing from the formal sector, the leasing equation is also a function of additional variables affecting access, in particular the formal sector interest rate, as reflected in dummy variables for land-size categories, and the level of formal sector activity in the

[12]The proper treatment of credit allotment is being done in current research through the collection of bank data on lending to the non-agricultural sector by districts. Since bank lending to agriculture is determined by overall lending, this should be a valid instrument.

agricultural sector in the district (AGACCT). Since these variables could additionally reflect productivity differences between farm households and across regions, we also include them in the regression equation for non-borrower households.

This treatment of a household's credit allotment implies that the estimating equation will differ between borrower and non-borrower households, since the coefficients on the equation for the former group will also include the effect of the variable through the formal sector loan amount. Thus, the econometric model is an endogenous switching regression model, with the switch between regimes being determined by whether a household borrows from the formal sector or not.

The natural division of households is into tenants, landlords, and non-participants in rental markets. It is generally recognized, however, that the leasing <u>out</u> of land is widely under-reported. In our sample, for example, 21% of households are reported to be tenants, but only 5% are landlords. We thus confine our analysis to tenant households.

Let I_i be an indicator variable specifying whether a household borrows formal credit ($I_i=1$) or not ($I_i=0$). Since a household's leasing decision is conditional on its credit status, this implies the following econometric model of the probability of being a tenant:

(16)

$$
\begin{aligned}
R_{1i} &= \beta_1 X_{1i} + u_{1i} && \text{leasing equation, borrowers} \\
R_{2i} &= \beta_2 X_{2i} = u_{2i} && \text{leasing equation, non-borrowers} \\
I^*_i &= \gamma Z_i + u_{3i} && \text{access equation} \\
I_i &= \begin{cases} 1 \text{ if } I^*_i > 0 \\ 0 \text{ if } I^*_i \leq 0 \end{cases} \\
R^*_i &= \begin{cases} R_{1i} \text{ if } I_i = 1 \\ R_{2i} \text{ if } I_i = 0 \end{cases} \\
R_i &= \begin{cases} 1 \text{ if } R^*_i > 0 \\ 0 \text{ if } R^*_i \leq 0 \end{cases}
\end{aligned}
$$

where I_i and R_i are the observed variables.

Since it is not possible to estimate the variances of the error terms or the covariance of u_{1i} and u_{2i}, the variance matrix is specified as:

$$\Sigma_u = \begin{bmatrix} 1 & 0 & \Gamma_{13} \\ 0 & 1 & \Gamma_{23} \\ \Gamma_{13} & \Gamma_{23} & 1 \end{bmatrix}$$

The access equation is first estimated by a probit equation on formal sector borrowers. These estimates are then used to estimate the parameters of R_{1i} and R_{2i} in equation (16). To do this, sample households are divided into three groups, reflecting their decisions on the tenancy market and their access to formal credit. Thus:

y_{1i} = 1 if leasing in with access, 0 otherwise

y_{2i} = 1 if leasing in without access, 0 otherwise

y_{3i} = 1 if not leasing

The log-likelihood of the second-stage model is:

$$(17) \quad \ln L = \Sigma_i [\ y_{1i} \ln[\ \Phi(\beta_1 X_{1i}, \tau Z_i, \Gamma_{13})\ ] + y_{2i} \ln[\ \Phi(\beta_2 X_{2i}, -\tau Z_i, \Gamma_{23})\ ] + y_{3i} \ln[\ 1 - \Phi(\beta_1 X_{1i}, \tau Z_i, \Gamma_{13}) - \Phi(\beta_2 X_{2i}, -\tau Z_i, \Gamma_{23})\ ]\ ]$$

where $\Phi(.)$ is the distribution function of the standard normal, and τ are the estimated coefficients from the access equation.

VI. Results

In this section I discuss the results from the estimation of the access equation for formal sector credit and the leasing equation for borrowers and non-borrowers. These estimates are used to assess the impact of access to credit on a household's probability of renting land.

Table 7 reports the estimates of the access equation. These estimates suggest that access to credit is not random, but varies with the capacity of the household to undertake productive investment in agriculture. Thus the probability of access to formal credit increases with land size, the amount of irrigated land and levels of household education, and falls with an increase in plot fragmentation. It can be argued that the positive effect of land size and education levels do not reflect productivity effects on access, but wealth effects. However, the negative effect of the extent of plot fragmentation is a clear indication of the importance of potential farm productivity in determining access to formal credit.

If the classification of farm households into small, medium and large farmers on the basis of NABARD's classification scheme reflected only differentials in the cost of credit, we would expect the coefficients on these dummy variables to be positive. However, while the dummy variable for medium farmers has a positive (but insignificant) effect on access to the formal credit sector, that for large farmers has a significant negative effect. The negative coefficient on the dummy for large farmers thus suggests that this variable is either picking up additional constraints on the operation of formal sector banks which bias the access of credit against large farmers[13] or the effect of access to other fixed inputs which vary by land-size categories and reduce access to formal credit.

Estimates of the probability of leasing for borrower and non-borrower households are in table 7. The results indicate a considerable difference in the leasing decision for these two sub-populations. For non-borrower households, the determinants of leasing correspond to results previously obtained in the empirical literature on tenancy markets. Thus, the demand for rental land is significantly increased by greater ownership of traditional means of

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[13]In fact, banks are required to "target" small farmers and advance a stipulated percentage of their loans to them.

production such as draft power and the number of male family workers in agriculture, as also by the extent of irrigation and plot fragmentation. As in other studies, levels of household education and the number of female agricultural workers in the family are not significant. The amount of land owned has a strong negative effect on the probability of leasing. However, controlling for the amount of land owned, the dummy variables on medium and large farmers are significantly positive, suggesting that large farm households have endowments of other inputs which improve their position in the tenancy markets.

For households with access to credit, the leasing equation is significantly different. Ownership of draft animals has no statistical effect on the probability of leasing, whereas the partial effects of the extent of fragmentation and the amount of irrigation are much greater. The coefficient on the dummy for medium farmers is negative, while it is positive for large farmers, but of smaller magnitude than that for non-borrowers. Thus, the positive effects of being a large farm household as revealed in the equation for non-borrowers are reduced, and even negated, for borrower households. This is consistent with the interpretation of these variables as reflecting the higher cost of credit for large farm households.

The greater importance of the amount of irrigated land and the extent of plot fragmentation in the leasing decisions of borrowers suggests that these variables are more of a constraint for such households than endowments of traditional inputs. If access to formal credit is based on farm productivity, as suggested by the estimates of the access equation, this implies that as cultivator households move towards a more productive agricultural system with greater use of credit and purchased inputs, returns to scale become increasingly important. Under these conditions, we can expect the structure of landholdings to be the primary determinant of household leasing decisions.

To correctly gauge the effect of a variable on the probability of leasing, I report

elasticities in table 8. From the specification of the econometric model in (16), R_{1i} is observed only for households with access to credit markets, while R_{2i} is observed only for non-borrowers. Thus, the distributions of these two random variables are only specified on the relevant sub-population. Accordingly, I confine the analysis to inferences from the conditional distributions, reporting the elasticities of the probability of leasing conditional on credit status. The calculations undertaken thus reflect the fact that changes in X impact on the conditional distribution directly and through the probability of access. Elasticities are reported separately for small and medium farmers, and are estimated at the sample means for the relevant group.[14] These results confirm that the leasing decision of borrower households is primarily determined by the level of plot fragmentation (CULTPLOT) and the ownership of irrigated land (IRR), while traditional inputs such as males in agriculture and draft animals have less significance.

Our main interest, however, is in the extent to which access to credit influences tenancy decisions. While it is tempting to infer that the differences in the equations for borrowers and non-borrowers reflect the effect of the omitted loan amount and hence credit constraints, this may not be the only explanation. Differences in the two equations could also arise if there are underlying differences between borrower and non-borrower households, which in turn generate their differential outcomes in formal credit markets. For example, the differences in the two equations may just reflect underlying differences in techniques of production. This interpretation is in fact consistent with the endogenous treatment of access to credit of this paper.

A more accurate method of estimating the effect of credit on land rental markets is

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[14]Medium farmers were chosen rather than large farmers because of the greater number of observations for this group.

through estimates of the probability of leasing for borrowers and non-borrowers. These probabilities are separately estimated for small and medium farm households at the sample means for the relevant sub-sample, and are reported in table 9.

For both small and medium farms households, the probability of leasing land is larger for borrowers than it is for non-borrowers. Thus, the probability of leasing is 43% for small farm households with access to credit, but only 32% for small farm households without access. Similarly for medium farmers, the estimates are 21% and 8% for borrowers and non-borrowers respectively.

To correctly estimate the effect of access to credit on the probability of leasing, I calculate the probability of leasing for each of the sub-samples under conditions of access and no access to credit. Thus, for example, for the group of households with access to credit I additionally estimate the conditional probability of leasing if denied access to credit ($\Phi(\beta_2 X_{1i} \mid I_i = 0)$). With the exception of medium farm non-borrowers, the probability of leasing is larger with access to credit. Thus, if access to credit were removed for small farm borrowers, their probability of renting land would fall from 43% to 29%, while that of medium farm borrowers would fall from 21% to 13%.

On the basis of estimated standard errors for these probabilities, it is not possible to reject the hypothesis that the probability of leasing for borrower households, assuming that they have no access to credit is equal to that of non-borrowers. Given the high probability of Type I error, however, the failure to reject the null hypothesis that differences in the probability of leasing between borrowers and non-borrowers reflect only differential access to credit cannot be taken as strong evidence in favor of this hypothesis. A more informative null hypothesis is one that states that access to credit has no effect on rental transactions. I thus test whether the probability of leasing with access to credit for any particular sub-group

equals its probability of leasing without access. While "t" statistics are higher, I still fail to reject this hypothesis at conventional levels of significance. The failure to reject this null implies that there is no strong evidence that credit constraints, or differential access to credit markets, does in fact affect rental transactions.

It is worth noting that access to credit plays a smaller role in the leasing decisions of medium farmers than it does of small farms. Thus, the probability of a small farm non-borrowing household leasing land would increase by 12% if it had access to credit, while that of a medium farm non-borrowing household would essentially remain unchanged even with access. This suggests that the lack of formal credit does not constrain larger farm households, but may very well constrain small farmers. This also suggests that if large farm households have been increasingly participating in land rental markets as tenants, this is not primarily due to their better access to credit.

To analyze the factors which <u>have</u> affected the participation of large and small farm households in the leasing market, we must consider the <u>marginal</u> probabilities of leasing for these sub-groups. These probabilities are given by:

$$\Pr(\text{leasing}) = \Pr(\text{leasing} \mid \text{access})\Pr(\text{access}) + \Pr(\text{leasing} \mid \text{no access})\Pr(\text{no access})$$

Table 10 reports the elasticity of the marginal probability of leasing with respect to the various explanatory variables, for small and medium farmers. Changes in the relative importance of large and small farmers in the tenant population can be explained either by differences in the elasticities or by differences in the growth rates of the explanatory variables for the two groups.[15] Differences in growth rates are likely to be more important in the case

[15]Of course, inferences from the estimated model are only valid if the underlying structure of credit and tenancy markets has remained the same.

of household labor (MALES, FEMALES) and draft power (DRAFT) endowments, as well as in levels of education (MAXED), where the elasticities for small and medium farmers are roughly similar. However, even if there are substantial differences in growth rates, the low elasticity of the probability of leasing with respect to these variables implies that they can explain only a small part of the increased relative importance of large farmers. It is more likely that any increase in the participation of large farmers is the result of the effect of landholding size (LOWNED), plot fragmentation (CULTPLOT) and the amount of irrigated land (IRR). The effects of these variables on the probability of leasing is much greater for large farmers than it is for small farmers. There is also evidence that suggests that large farmers have experienced faster rates of change of these variables over time.[16]

In conclusion, credit constraints appear to influence rental contracts to an insignificant degree, suggesting that these constraints do not effectively bind cultivating households. The role played by credit in leasing decisions is even smaller for large farm households than it is for small farmers, implying that access to credit does not lie behind any trends towards reverse tenancy. Instead, the increased participation of large farmers in the tenancy market is explained by increases in productivity (IRR), as well as changes in the structure of landholdings -- decreasing land size and an increased level of plot fragmentation.

VI. Conclusion

It is widely believed that rural households are effectively constrained in formal credit markets, and that differential access to this market has had a major impact on the rural economy. In this paper I have tested these propositions by examining the effect of formal

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[16]Data from the Government of India's Agricultural Census reveal that while the average size of operated holdings between 1976-77 and 1985-86 remained the same for small farmers, it declined by 9.6% for large farmers, from 5.6 hectares to 5.1 hectares.

sector credit constraints on land rental markets. This paper thus differs from other work testing credit constraints by examining its effects on production, rather than on the consumption decision of households. It also differs from previous empirical research on tenancy, which has ignored the role of credit in tenancy contracts.

The results of this paper show that households with access to formal credit are more likely to lease in land than households without access. However, the evidence is weak in that the results are statistically insignificant. In particular, we cannot reject the hypothesis that access to credit has no effect on the probability of leasing. This does not imply that households are not rationed in the formal credit sector. Instead, it suggests that these constraints are not binding either because of existing substitution possibilities for formal credit, or because of the low productivity of credit-financed capital.

While differential access to credit has been blamed for many emerging trends in the rural economy, including a possible increase in income inequality through the effect of credit on land rental markets, I find that any shift in the distribution of operated land in favor of large farmers has more to do with changes in the structure of land holdings than with credit market outcomes. This again suggests that the binding constraint in agriculture is not access to formal credit, but the structure of land holdings.

Table 1.--Distribution of Sample Households in Tenancy Contracts by Region

Region	Number of Sample Households	Leasing-in		Leasing-out	
		Number	% to Total	Number	% to Total
Hill	185 (7.66)	23	12.43	14	7.57
West	824 (34.12)	219	26.58	33	4.00
Central	423 (17.52)	100	23.64	17	4.02
Eastern	852 (35.28)	137	16.08	44	5.16
Bundelkhand	131 (5.42)	35	26.72	11	8.40
Total	2415 (100.00)	514	21.28	119	4.93

Note: The Western Region is the most advanced, followed by the Central.

Table 2.--Distribution of Households Leasing In by Region and Land Size

Region	Small Farmers (0≤5 acres)		Large Farms (> 5 acres)	
	Total	# leasing in	Total	# leasing in
Hill	145 (100.00)	16 (11.03)	22 (100.00)	1 (4.54)
West	427 (100.00)	153 (35.83)	361 (100.00)	51 (14.13)
Central	215 (100.00)	72 (33.48)	188 (100.00)	25 (13.29)
East	496 (100.00)	106 (21.37)	305 (100.00)	19 (6.23)
Bundelkhand	41 (100.00)	25 (60.98)	86 (100.00)	10 (11.62)
Total	1324 (100.00)	372 (28.10)	962 (100.00)	106 (11.02)

Note: Figures in brackets are percentages to total households in the respective regions.

Table 3.--Distribution of Area Leased in by Region and Land Size

Region	Small Farms (0≤5 acres)		Large Farms (>5 acres)	
	Total Leased-In (acres)	Average Area Leased-In	Total Leased-In (acres)	Average Area Leased-In
Hill	23.26 (97.90)	1.45	0.50 (2.10)	0.50
West	361.07 (61.88)	2.36	222.44 (38.12)	4.36
Central	191.97 (81.18)	2.67	44.49 (18.82)	1.78
East	152.99 (85.90	1.44	25.11 (14.10)	1.32
Bundelkhand	114.76 (72.34)	4.59	43.87 (27.66)	4.39
Total	844.05 (71.50)	2.27	336.41 (28.50)	3.17

Note: Figures in brackets are percentages to total land leased-in, in the respective regions.

Table 4.--Importance of Tenancy Amongst Formal Credit Borrowers by Region

Region	Total Households	Formal Sector Borrowers[1]	Households Leasing-in	
			Total	Of which, formal borrowers[2]
Hill	180	27 (15.00)	22	5 (22.73)
West	800	198 (26.75)	209	52 (24.88)
Central	405	48 (11.85)	98	11 (11.22)
East	806	113 (14.02)	126	22 (17.46)
Bundelkhand	127	22 (17.32)	35	6 (17.14)
Total	2318	408 (17.60)	490	96 (19.59)

Note: [1] Figures in brackets are percentages to total households
[2] Figures in brackets are percentages to total households leasing-in

Table 5.--Importance of Formal Credit Borrowers in Area Leased In

Region	Total Area Leased-In (acres)	Area Leased-In by Formal Credit Borrowers	
		Total	% to Total
Hill	23.76	9.44	39.73
West	583.51	198.06	33.94
Central	236.46	36.54	15.45
East	178.10	21.70	12.18
Bundelkhand	158.63	54.86	34.58
Total	1180.46	320.60	27.16

Table 6.-- Definitions of Variables used in Regressions

Variable	Definition
Lowned	Land owned by the household, in acres
Maxed	The highest level of education achieved by any member of the household, measured by a five level index ranging from illiterate (1) to post-matriculate (5)
Males	Number of male family members in agriculture
Females	Number of female family members in agriculture
Draft	Number of draft animals owned by the family
Cultplot	Number of cultivated plots in the holding
Agacct	Number of direct agricultural accounts of commercial banks per thousand rural cultivators in the district
Irr	Amount of irrigated land in the holding

Table 7.--Maximum Likelihood Estimates of Switching Regression Model of Area Leased In

Variables	Land Leased in by		Access Equation
	Borrowers	Non-borrowers	
Constant	-1.1671 (2.4279)	-1.2796* (0.1760)	-0.8534* (0.0393)
Medium farmer dummy	-0.6557+ (0.4906)	0.4072* (0.1898)	0.0379 (0.1012)
Large farmer dummy	0.5695 (0.7792)	1.7604* (0.3644)	-0.2847+ (0.2064)
Lowned	-1.4476* (0.7888)	-1.7845* (0.1570)	0.1091* (0.0532)
Maxed	-0.1213 (0.2648)	0.0556 (0.0476)	0.1256* (0.0337)
Males	0.1565+ (0.1904)	0.1645* (0.0393)	--
Females	-0.0207 (0.0862)	-0.0069 (0.0372)	--
Draft	0.0346 (0.0991)	0.2065* (0.0469)	-0.0018 (0.0331)
Cultplot	0.5346* (0.3300)	0.2272* (0.0423)	-0.0525+ (0.0349)
Agacct	0.0483 (0.2857)	0.0869+ (0.0547)	0.1875* (0.0299)
Irr	0.7489* (0.2227)	0.2948* (0.0732)	0.1298* (0.0356)
Correlation with access equation	0.2786 (0.3592)	0.0013 (0.9047)	--
Log Likelihood	-1254.24		-1092.12

Note: Figures in brackets are standard errors.
* significant at 5% level
+ significant at 10% level

Table 8.--Elasticities of the Conditional Probability of Leasing In, from Switching Regression Model of Area Leased In

	Small farmers		Medium Farmers	
Variables	Borrowers	Non-borrowers	Borrowers	Non-borrowers
Lowned	-0.6061	-0.5767	-2.7681	-4.6714
Maxed	-0.2968	0.2519	-0.6000	0.5866
Males	0.1862	0.2423	0.5038	0.6640
Females	-0.0106	-0.0048	-0.0228	-0.0081
Draft	0.0463	0.2972	0.0447	0.6712
Cultplot	0.7419	0.3039	1.4229	0.7159
Agacct	0.0139	0.3016	0.0249	0.5341
Irr	0.4831	0.1879	2.3275	1.0513

Note: Elasticities are calculated at the variable means for the relevant sub-sample.

Table 9.-- Conditional Probability of Leasing Land for Small and Medium Farmers by Credit Status

	Borrowers	Non-borrowers
Small farm households		
(i) assuming access	0.4282 (0.0483)	0.4358 (0.0519)
(ii) assuming no access	0.2866 (0.1129)	0.3172 (0.0973)
Medium farm households		
(i) assuming access	0.2093 (0.0844)	0.0778 (0.0359)
(ii) assuming no access	0.1306 (0.0205)	0.0824 (0.0685)

Note: Figures in brackets are standard errors, calculated by a first order Taylor expansion of the relevant function around the estimated parameter values.

Table 10.--Elasticities of the Marginal Probability of Leasing in For Large and Medium Farm Households

Variables	Elasticities for Small Farm Households	Elasticities for Medium Farm Households
Lowned	-0.5744	-3.6129
Maxed	0.1561	0.1015
Males	0.2282	0.5792
Females	-0.0063	-0.0159
Draft	0.2346	0.3394
Cultplot	0.4017	1.0550
Agacct	0.2923	0.3718
Irr	0.2791	1.8569

Note: Elasticities are calculated at the means for the relevant sub-samples of borrower and non-borrower households.

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