CHAPTER 13

Informational Rents and Property Rights in Land

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1. Introduction

The institution of sharecropping tenancy and its inefficiency has long fascinated development economists, especially following the famous footnotes on the subject in Marshall (1920).[1] The tendency for a landlord to appropriate a fraction of the crop tilled by a tenant, and to interlink the tenancy contract with monopoly provision of credit, appears to many people to be 'semi-feudal' in character, inducing low levels of agricultural productivity. This orthodoxy has been challenged in the last two or three decades on a number of conceptual grounds, following the critique of the Marshallian argument by Cheung (1969). Sharecropping is viewed as providing a reasonable compromise between the need for a wealthy landlord to share risks with a poor tenant, and to provide incentives to the latter to apply effort (Stiglitz, 1974; Newbery, 1977; Bell, 1989; Singh, 1989). Interlinking of tenancy and credit contracts is viewed as an efficient response to the problem of moral hazard on the part of the tenant, to avoid externalities between landlords and creditors (Braverman and Stiglitz, 1982; Bell, 1989).

Nevertheless, the more recent empirical evidence for India in, for example, the works of Bell (1977), Sen (1981) and Shaban (1987), suggests that sharecropping tenancy is characterized by significantly lower productivity compared to owner-cultivated farms based largely on family labour.[2] Moreover, this appears to be linked to greater application of labour input by owner-cultivators rather than variations in soil quality or irrigation. Similar results pertain to the comparison of small owner-cultivated farms relying primarily on family labour, with large ones relying primarily on hired labour. These outcomes are related to significant imperfections in labour markets, such as the divergence of marginal products from wage rates, particularly for small owner-cultivated farms (Bardhan, 1973; Sen, 1981). Compounding these are further imperfections in land markets which prevent the sale of land by landlords to their tenants or hired workers that might be intended to appropriate the productivity benefits of small-scale owner cultivation. These imperfections have motivated arguments for public intervention in land redistribution. These arguments, however, have not been based on a precise articulation of the nature of the market failure that creates a potential role for government.

In this chapter, we pose a set of questions that need to be answered for a better understanding of these issues. First of all, why are tenant farms characterized by lower application of labour effort than are owner-cultivated farms, when both are based on family labour? The typical argument for lower effort under tenancy is the Marshallian effect: tenants appropriate a fraction of the marginal product, whereas owner–cultivators are presumed to receive the entire marginal product. This argument overlooks the fundamental symmetry between the two ownership modes with respect to feasible contractual structures. For instance, what prevents the landlord from designing a tenurial contract that mimics the incentive system for an owner–cultivator? Indeed, a fixed rent contract would also provide tenants with their entire marginal product. Such contracts are believed to be not so widespread owing to the need for landlords to share risks with their tenants, and the limited wealth of the latter which causes tenants to default on fixed rent obligations in times of distress.

However, owner–cultivators are subject to similar risks and wealth constraints as well, which they will seek to alleviate by entering into formal and informal credit and insurance relationships. Townsend (1994), for instance, presents evidence for the substantial degree of consumption smoothing in three Indian villages achieved by such arrangements. These will also be subject to moral hazard, arising from the need to induce appropriate incentives for the cultivator to apply effort and thereby reduce the likelihood of default. Why should the incentive problem for owner–cultivators be any less severe than for tenant farmers? The usual Marshallian argument simply presumes that owner–cultivators obtain a greater share of their marginal product than do comparable tenant farmers, without explaining the underlying reasons.

Similar issues arise in attempting to explain why family labour is cheaper than hired labour. The conventional explanation runs in terms of the incentive problems with respect to hired labour, necessitating costly supervision. It is implicitly presumed that family labour is not subject to any incentive problems, overlooking the moral hazard inherent in the credit and insurance arrangements that owner–cultivators are involved in.

The answer to either of these questions could be sought in terms of owner–cultivators having less access to credit than do tenants or hired workers. If anything, the collateral value of the land owned should permit owner–cultivators *greater* access to credit, so it would be surprising if this hypothesis did turn out to be valid.[3] And even if it were empirically supported, the reasons for this specific form of credit market imperfection would have to be clearly understood.

Second, the fact that tenant farms are characterized by lower levels of labour effort does not imply anything about the relative *welfare* properties of *self-ownership* and *tenancy*. For instance, tenants may be better protected against weather uncertainties than are owner–cultivators, in which case the benefits of such risk-sharing should be weighed against the cost of reduced incentives. An argument for government intervention to promote a transfer of ownership of land to cultivators should be based on an explicit articulation of the nature of market failure inherent in tenancy or hired labour.

Third, what prevents landlords from selling their land to tenants or hired workers, if small owner-cultivated farms are significantly more productive? The empirical evidence suggests that land markets are thin, and that the institution of tenancy or wage labour tends to persist. A number of possible reasons may be advanced for the thinness of land markets: taxes, collateral value of land, risk diversification motives and legal difficulties: these are reviewed further in section 6. Nevertheless, the persistence of tenancy remains a bit of a puzzle, if one

believes it to be a genuinely inefficient institution. This question forms part of a wider question concerning the evolution of economic institutions: what are the impediments to institutional changes that would appear to promote both efficiency and equity?

One explanation for the higher productivity of owner-cultivated farms could be based on the hypothesis that tenancy contracts are incomplete, and that cultivators must invest in farm specific assets – such as soil improvement or irrigation – to improve productivity, as in the theory developed by Grossman and Hart (1986), Hart and Moore (1990), Klein, Crawford and Alchian (1978) or Williamson (1975, 1985). In this theory, ownership can be identified with the possession of *ex post* bargaining power: for instance, when contracts are renegotiated. Anticipating that the landlord would opportunistically revise contractual terms at later dates to expropriate the rents from past investments, tenant farmers would have lower incentives to make such investments. In such contexts, a transfer of ownership to the cultivator would enhance farm productivity, as well as total surplus. Nevertheless, in such a setting it would be mutually advantageous for the landlord and the tenant to enter into a land sale. In other words, it would fail to address the third question outlined above.

Consequently, the objective of this chapter is to develop an alternative theory of ownership based on a complete contracting framework. We argue that ownership rights affect the allocation of *ex ante* bargaining power, at the stage where tenancy or credit contracts are initially negotiated. Any given ownership pattern thus generates an *ex ante* Pareto-efficient outcome, implying that different ownership patterns cannot be Pareto ranked. Hence there cannot be any scope for a mutually advantageous land sale from landlord to tenant.

This gives rise to the question: why may the allocation of bargaining power have an impact on effort incentives and farm productivity? Our answer is based on the presence of informational rents which need to be paid to the farmer in order to induce effort incentives. These rents arise from wealth constraints which limit the downside risk to which the farmer can be exposed. The wealth constraints cannot be circumvented by borrowing, since loan contracts are also subject to higher default risk owing to the limited ability for farmers to put up collateral. The informational rents that must accompany the provision of high effort incentives represent a payment from the landlord or moneylender to the farmer. These are pure transfers, with no accompanying deadweight losses. Under self-ownership the farmer earns higher bargaining power, thereby serving to better internalize the pecuniary externality arising from the informational rents.

The main results of the model are the following.

1. Increased *ex ante* bargaining power of the farmer *vis-à-vis* landlords or creditors results in a higher level of effort incentives.
2. Bargaining power is affected by ownership, in conjunction with the structure of tenancy and credit markets, alternative employment opportunities for farmers, and their wealth levels. The effects of ownership on efficiency therefore depend on market structure for tenancy and credit, on farmer wealth and on non-farm employment opportunities.
3. Provided population pressure on land is sufficiently great, landlords will have enough monopoly power on tenancy and labour markets to imply that self-ownership will induce greater bargaining power and therefore higher effort incentives.
4. In such contexts, owner-cultivation will be associated with a higher level of (utilitarian) welfare than tenancy or hired labour farms.

5. Despite this, there will never be any scope for mutually profitable land sales from landlords to tenants, as the latter will be unable to borrow enough to finance the purchase.

The implications for land redistribution policies are the following. Coercive land transfers from landlords to cultivators will result in productivity and welfare improvements, though not a Pareto improvement. As indicated above, the magnitude of such improvements will be higher the greater the population pressure on the land, and the lower the off-farm opportunities of the landless. The effects of such land reforms will then be similar to those of free trade, pollution control or increased competition in markets where losers cannot be compensated suitably for a variety of informational and implementational problems, despite the fact that the gains of those who benefit outweigh these losses. In the present context it is not feasible to require that farmers receiving land be made to compensate the landlords, owing to the limited wealth and borrowing capacity of the former. If the landlords are to be compensated suitably then some third party, such as urban taxpayers, must bear the cost of these compensations. In either case the reform is bound to have distributive consequences, and its success will predictably depend on the relative political strengths of different parties affected by it.

The structure of this chapter is as follows. Section 2 introduces the one-period model with risk-neutral farmers subject to a limited liability constraint. Section 3 then considers the case of a bilateral monopoly between a farmer and a landlord-cum-moneylender. The basic results of this chapter – that is, the productivity difference between the two ownership modes and the non-existence of mutually profitable land sales – are presented in this context. Section 4 discusses how the model can be extended to a market setting with numerous farmers and landlords, and the determinants of bargaining power. Section 5 describes extensions to risk-aversion and multi-period relationships. Finally, Section 6 discusses related empirical and theoretical literature, and concludes by discussing possible directions for future research.

2. The Model

We begin by focusing on a single plot of land, and the relationship between two agents: a cultivator or farmer (denoted by F), and a noncultivator (landlord or moneylender, denoted by L). For semantic convenience, we shall refer to the latter party as the lender. The plot can be owned either by the farmer or by the lender (in the latter case L becomes a landlord-cum-lender). When the farmer owns the land, the relationship between the two parties involves the supply of credit by the lender to the farmer; whereas if the lender owns the land, their relationship involves a combination of tenancy (or wage labour) and credit. In our model the tenancy relation is indistinguishable from a wage–labour relation, so the case where the farmer does not own the land can equally be viewed as one involving the management of cultivation by L and hiring in the labour supplied by the farmer.[4]

The nature of the production technology is as follows. There is a single period, which is divided into two points of time: $t = 0$ (beginning) and 1 (end).[5] Only the farmer can till the land. A fraction x of the overall plot can be farmed, where x lies between 0 and 1. The basic technology is linear: at $t = 0$ a material input worth Ix is needed to farm proportion

x of the plot. At $t = 1$ the output of the farm is realized. Between $t = 0$ and 1, nature intervenes, so the crop output is uncertain. There are two possible values of the output: a normal value nx, or a disaster value dx, where $d < n$. The probability of a normal crop depends on the level of effort $e \geq 0$ selected by the farmer at $t = 0$, and is denoted by $p(e)$, where $p(\cdot)$ is a strictly increasing, continuously differentiable and concave function satisfying $1 > p(e) > 0$ for all e.[6] The value of the crop per unit area cropped, net of the material input requirement, in the normal state is denoted $s = n - 1$, and in the disaster state is $f \equiv d - 1$. Indeed, we shall frequently refer to the state by this value itself.

Agents consume at the end of the period, and no one discounts between beginning and end of the period. In order to survive, the farmer's consumption must be at least above a minimum subsistence level, denoted $\underline{s}$. In order to simplify the analysis, and stay as close as possible to the transferable utility context, we assume that both agents are risk-neutral.[7] So the utility of the lender can be equated with the expected income from lending money or leasing out land. The farmer's utility depends on his consumption c and effort e, and is given by $c - D(e)$, where D denotes the disutility of effort. We assume that $D(\cdot)$ is strictly increasing, continuously differentiable and strictly convex. Moreover, $D(0) = D'(0) = 0$.

Next we describe the nature of endowments. The farmer has an exogenous amount of wealth w in the form of liquid assets, which can be used to purchase inputs at the beginning of the period. The remainder can either be used to repay loans or be consumed at the end of the period. The non-farm wealth of the lender, on the other hand, will be assumed to be large enough that she is not subject to any limited liability constraint.

The information structure is as follows. The non-farm wealth w of the farmer, as well as the crop output of the farm, are assumed to be costlessly verifiable by the landlord or lender. On the other hand, the farmer's effort cannot be monitored. All other variables are contractable, such as the respective contributions of the two parties at $t = 0$, the scale of production x, and the returns to both parties at $t = 1$. Hence, there is no incompleteness in the contracts that can be feasibly enforced, in the sense of Grossman and Hart (1986).

A *contract* specifies the following: x, the scale of cultivation, I_L and I_F the respective contributions of the lender and the farmer to cover the inputs required at $t = 0$, and F_i and L_i their respective receipts from the crop output ix at $t = 1$, where i can equal either s or f. Naturally, in order to be feasible, the contract must satisfy

$$I_L + I_F = Ix$$
$$F_i + L_i = (i + I)x$$

In addition, the farmer should be able to survive:

$$c_i \equiv F_i + w - I_F \geq \underline{s} \quad \text{for } i = s, f$$

where c_i denotes his consumption at $t = 1$ when the crop return is i.

Such a contract will induce an effort level from the farmer, which maximizes his expected return

$$p(e)c_s + [1 - p(e)]c_f - D(e)$$

The farmer's optimal effort choice can therefore be described as follows: if $c_s \leq c_f$ then zero effort is selected; otherwise it is given by the solution to

$$p'(e)[c_s - c_f] = D'(e)$$

which is strictly positive. Conversely, given any desired level of effort e, the spread between consumption in the two states necessary to sustain this in an incentive compatible fashion, is given by

$$c_s - c_f = \alpha(e) \tag{1}$$

where $\alpha(e)$ denotes $D'(e)/p'(e)$, a continuous function which is strictly increasing and satisfies $\alpha(0) = 0$.

This incentive constraint will apply identically in either ownership mode, though the specific interpretations may differ. When the farmer owns the land, and acquires credit from the lender, his downside risk will be limited by virtue of the limited liability constraint $c_f \geq \underline{s}$. In other words, if the nominal repayment obligation is L_s, and the farmer cannot feasibly pay this amount in the disaster state, the latter will be interpreted as a default on the loan. The possibility of defaulting on the loan limits the liability of the borrower in the adverse state, therefore limiting his *ex ante* incentive to apply effort. Of course, the extent of loan default will depend on the residual wealth $w - I_F$ of the farmer, which can be interpreted as the loan collateral. Wealthier borrowers are therefore less likely to default, and so likely to apply more effort, which is why they will have greater access to credit. In the tenancy setting, on the other hand, the contract will typically take the interpretation of a cropsharing formula which for the traditional Marshallian reason affects the tenant's incentive to apply labour.

So far we have not discussed the nature of participation constraints. This is because these constraints depend partly on the nature of the market for credit or tenancy, and partly on the pattern of ownership. Nevertheless, there are some lower bounds to the outside opportunities of either party which are independent of ownership or market structure. For instance, the lender cannot obtain a negative return from a contract. Moreover, the farmer can decide to withdraw altogether from the activity of farming, whence he obtains an exogenous net utility of $\bar{U}$ from his next best alternative occupation.[8]

Given the incentive constraint (1), we can redefine a contract as follows: a triple (x, c_f, e) describing respectively the scale of cultivation, consumption of the farmer in the disaster state, and the level of effort induced. The corresponding consumption level of the farmer in the good state is then given by

$$c_s = c_f + \alpha(e)$$

And given the eventual consumption of the farmer in either state, we can derive the net return R_i to the lender in state i as follows:

$$R_i \equiv L_i - I_L = (i + I)x - F_i - I_L = ix - c_i + w$$

since

$$c_i \equiv F_i + w - I_F$$

Letting

$$R(e) \equiv p(e)s + [1 - p(e)f]$$

denote the expected return (net of the material input) when the entire plot is farmed, the expected profit of the lender is thus given by

$$xR(e) + w - [p(e)c_s + \{1 - p(e)\}c_f] \equiv xR(e) + w - c_f - p(e)\alpha(e)$$

It is as if the lender appropriates the entire crop return and wealth of the farmer to start with, and then undertakes the responsibility of providing for the farmer's consumption. Moreover, the particular way in which input costs are shared is immaterial, by virtue of our assumption that there is no consumption need at $t = 0$.

Using the notation $c = (x, c_f, e)$ to denote a contract, the expected return to the lender is given by

$$U_L(c) = xR(e) + w - c_f - p(e)\alpha(e)$$

and to the farmer is

$$U_F(c) = c_f + p(e)\alpha(e) - D(e)$$

For the two parties to enter into such a contract, it must be the case that each obtains at least the (lower bound on their) utility from not participating. Therefore, the set of *feasible contracts* C is defined as comprising contracts $c = (x, c_f, e)$ satisfying the conditions

$$c_f \geq \underline{s}, \qquad U_L(c) \geq 0 \qquad U_F(c) \geq \bar{U} + w \tag{2}$$

However, since the actual benefit from non-participation may exceed the lower bounds $(0, \bar{U} + w)$ incorporated in the above definition of feasibility, not all feasible contracts will be individually rational: either party may have outside points (such as a contract with a different party in a market setting), and disagreement pay-offs need not coincide with 0 and $\bar{U} + w$, depending on the pattern of ownership. The precise level of non-participation utilities will be addressed in subsequent sections.

Finally, we introduce some assumptions that will be retained throughout the rest of the chapter. First, the expected return $R(e)$ from the land net of material input costs is strictly positive at all effort levels. Efficient contracts must then necessarily involve cultivation at the maximal scale $x = 1$, or no cultivation at all. This is true both in a first-best setting (where the effort of the farmer is contractable) as well as in a second-best setting. The first-best must therefore necessarily involve the effort level e^* which maximizes the sum of

utilities $R(e) - D(e)$ of the farmer and the lender. For the model to remain interesting, we assume that it is always jointly profitable to farm the land in a first-best setting:

$$R(e^*) - D(e^*) \geq \bar{U} \tag{3}$$

3. Bilateral Monopoly

We now consider the simple case where there is exactly one lender and one farmer. In other words, if the two parties fail to agree, then neither can enter into any trade at all, as there are no alternative trading partners. Nevertheless disagreement pay-offs may depend on the pattern of ownership and wealth levels, as explained below.

When the land is owned by the lender, the absence of a contract implies that the farmer cannot till the land, and must necessarily earn his outside opportunity of $\bar{U} + w$. In such a case, the set of feasible contracts coincides with the set of individually rational contracts. But when the farmer owns the land, the absence of contracts merely denies him credit: he can still farm the land if he so wishes. Hence while the lender earns zero in this situation, the farmer may conceivably obtain an expected return in excess of his alternative opportunity by farming the land on the basis of his own resources. In such a case the set of individually rational contracts will be a subset of feasible contracts.

Let $\mathcal{U}$ denote the set of expected utility combinations $(U_F(c), U_L(c))$ corresponding to feasible contracts $c \in C$. Owing to moral hazard, this set could conceivably be non-convex. It may therefore be desirable to allow randomized contracts. In our setting, however, the only randomizations which may be worthwhile will involve *ex ante* randomizations over the effort level. Let the set of such randomized contracts be denoted C^*, and the corresponding expected utility combinations be denoted $\mathcal{U}^*$, the convex hull of $\mathcal{U}$ as shown in figure 1.

Under either ownership mode, the chosen contract will be decided on the basis of bargaining between the farmer and the lender. We will assume that the expected pay-off

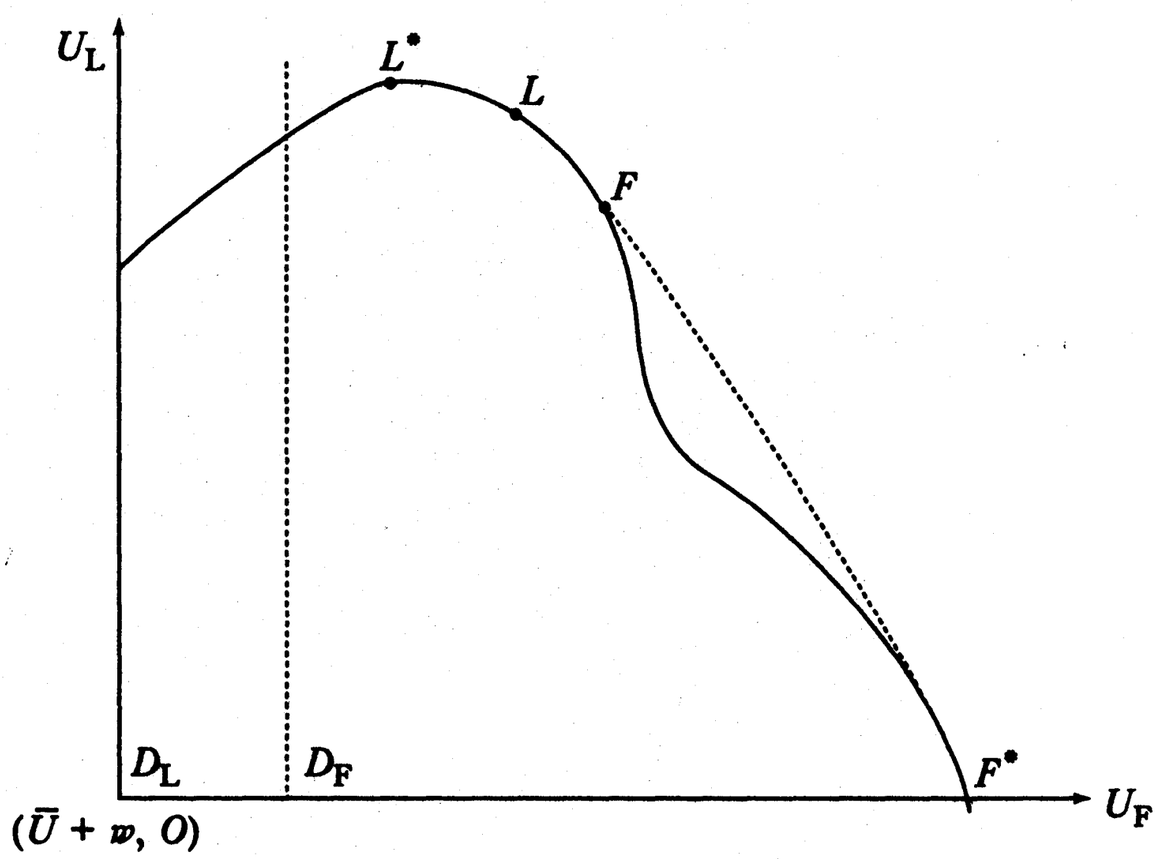

Figure 1 [Figure 1.1] Feasible pay-off sets

functions of either are common knowledge. Hence the chosen contract must be Pareto efficient within the class of feasible contracts. So we can restrict attention to the set of efficient points of $\mathcal{U}^*$. Both ownership modes are characterized by the same set of Pareto-efficient contracts. However, since ownership will typically affect the allocation of bargaining power, the precise contract chosen will depend on the nature of ownership.

By virtue of our assumption that $R(e)$ is strictly positive for all effort levels, all efficient contracts must necessarily involve $x = 1$, that is, the entire plot of land ought to be tilled. Therefore, the outcome of either ownership mode will always be the maximal scale of cultivation. The scale of cultivation may, however, be nonmaximal in the event of the two agents failing to agree on a contract (for example, when the farmer owns the land and does not have access to credit).

We now discuss the precise outcomes of disagreement under either ownership mode. When farmers do not own the land, the absence of a contract corresponds to the case where there is no farming nor supply of credit:

$$x = I_L = I_F = F_i = L_i \qquad \text{for } i = s,f$$

In this case the disagreement pay-offs are 0 and $\bar{U} + w$ respectively for lenders and farmers, so the set of feasible contracts coincides with the set of individually rational contracts. However, when farmers own the land, then the absence of a contract means that there is no credit available:

$$I_L = 0 = L_i \qquad i = s, f$$

But farmers can farm the land on the basis of their own resources, that is, at any scale satisfying $Ix \leq w$, and subsequently have available in the disaster state a consumption level of $fx + w$. It is evident that it will be in the farmers' interests to operate on as large a scale as possible, at $x = w/I$. Therefore in the absence of any credit, farmers can feasibly farm the land as long as the return on the crop in the adverse state enables them to survive: that is, as long as

$$\left[1 + \frac{f}{I}\right] w \geq \underline{s}$$

In other words, farming without any credit is feasible only for farmers with a wealth level of at least

$$\underline{w} \equiv \frac{\underline{s}}{1 + \frac{f}{I}}$$

For poorer farmers, the disagreement pay-offs are identical to those of farmers that do not own the land.

For landowning farmers with $w \geq \underline{w}$, the pay-off consequent on absence of credit depends on whether it is in their interests to farm the land rather than abandon it for

an alternative occupation. Let $x(w)$ denote min $[I, w/I]$, the maximal scale at which such farmers can cultivate. Then the highest utility they can obtain from cultivation is given by

$$\Pi(w) \equiv \max_{e}[x(w)R(e) - D(e) + w]$$

Clearly for w sufficiently low this will fall below $\bar{U} + w$, while for $w \geq I$ this exceeds $\bar{U} + w$.[9] Hence there exists $\tilde{w}$ between 0 and I such that for all landowning farmers with wealth levels above $\tilde{w}$, it pays to cultivate even in the absence of any credit. For all poorer farmers, the credit constraint forces them to abandon cultivation.

The disagreement pay-offs under farmer ownership and bilateral monopoly are therefore as follows. The lenders' disagreement pay-off is always zero. The farmers' disagreement pay-off depends on their wealth. If $w \leq \tilde{w}$, then it is $\bar{U} + w$, just the same as when a lender owned the land. But if farmers are wealthier, they can profitably cultivate on the basis of their own resources in the absence of any credit, leading to a higher disagreement pay-off $\Pi(w)$. The set of individually rational pay-offs is thus smaller than the set of feasible pay-offs. This is illustrated in Figure 1. With a wealth above $\tilde{w}$, the disagreement pay-off D_F under farmer ownership lies to the right of the disagreement pay-off D_L under lender ownership. Indeed, if the farmers' wealth exceeds the maximal input required (I) then they have no need for credit at all, and the disagreement point coincides with F^*, where farmers have all the bargaining power.

A transfer of ownership of the land to farmers will (under most reasonable bargaining solutions) thus allow them to appropriate a larger fraction of the surplus from trade.[10] The extent of increase in the farmers' share is increasing in their wealth level (zero until $\tilde{w}$, and positive thereafter). The contract actually resulting under farmer ownership (F in Figure 1) will thus differ from that under lender ownership (L).

The question then arises: do different contracts on the Pareto frontier differ in terms of farmer effort, or efficiency? Or do they merely reflect different distributions of income? To address this question, it helps initially to compare the two polar contracts L^* and F^* where the lender and the farmer respectively have all the bargaining power. The comparison between contracts L and F actually resulting under the two ownership modes will turn out to be qualitatively similar.

The contract F^* where the farmer has all the bargaining power is obtained as the solution to the following problem:

$$\max_{e, c_s, c_f} p(e)\alpha(e) + c_f - D(e)$$

subject to:

$$\begin{aligned} c_f &\geq \underline{s} \\ R(e) + w &\geq p(e)\alpha(e) + c_f \end{aligned} \tag{4}$$

The effort level resulting is described as follows

PROPOSITION 1 *The effort level in the contract where the farmer has all the bargaining power is given by the solution to:*

$$max\ R(e) - D(e)$$

subject to

$$R(e) + w \geq \underline{s} + p(e)\alpha(e) \tag{5}$$

The reasoning is straightforward: given the lender's breakeven constraint, and an effort level e, an upper bound to the expected value of consumption is given by $R(e) + w$, so an upper bound to the expected utility of the farmer is given by $R(e) - D(e) + w$. This bound can be achieved by setting

$$c_f = R(e) + w - p(e)\alpha(e)$$

and

$$c_s = c_f + \alpha(e)$$

On the other hand, if the constraint is not satisfied, then the effort e is not feasible.

Turn now to the contract L^* where the lender owns the land and has all the bargaining power. This will solve the following problem:

$$\max_{e, c_s, c_f} R(e) + w - p(e)\alpha(e) - c_f$$

subject to:

$$\begin{aligned} c_f &\geq \underline{s} \\ p(e)\alpha(e) + c_f - D(e) &\geq \bar{U} + w \end{aligned} \tag{6}$$

The effort level selected in this contract is described below.

PROPOSITION 2

1. *Given effort e, the contract under landlord monopoly which implements e awards consumption to the tenant as follows:*

$$c_f = \underline{s} + q(e)$$

$$c_s = \underline{s} + q(e) + \alpha(e)$$

where

$$q(e) \equiv \max[0, \bar{U} + D(e) - p(e)\alpha(e) - \underline{s} + w]$$

2. *The effort level under landlord monopoly e_L is determined by solving:*

$$\max_e [R(e) - p(e)\alpha(e) - q(e)]$$

Given effort e which the landlord seeks to induce, the minimum conceivable levels of consumption for the tenant in the two states are $\underline{s}$ and $\underline{s} + \alpha(e)$ respectively, if the participation constraint, is ignored. Such a contract will indeed satisfy the participation constraint if $q(e) = 0$. Otherwise the landlord must pay $q(e)$ additionally in both states to induce voluntary participation. This explains part 1. Therefore $q(e) = 0$ implies that the tenant earns an 'informational rent', the result of a minimum limit on consumption in every state, combined with the need to provide the tenant with the requisite incentive to apply effort. With multiple potential tenants, this corresponds to the case of involuntary unemployment and tenancy 'queues'. This arises when the effort e sought to be induced is 'high'. This is the situation depicted in figure 2, where the participation constraint of the farmer is not binding at the tenancy solution where the landlord has all the bargaining power.

The effective *cost of labour effort* as perceived by the landlord is given by the upper envelope of the two functions

$$\bar{U} + w - \underline{s} + D(e) \qquad \text{and} \qquad p(e)\alpha(e)$$

For small values of effort, the first function dominates, provided $\bar{U} + w - \underline{s}$ is positive. For such effort levels, the tenant obtains no informational rents, and marginal cost of effort from the point of view of the landlord coincides with the tenant's marginal disutility of effort $D'(e)$. For larger effort levels, the tenant earns informational rents, as the required incentive bonus grows sufficiently. Over this range the marginal cost of effort as perceived

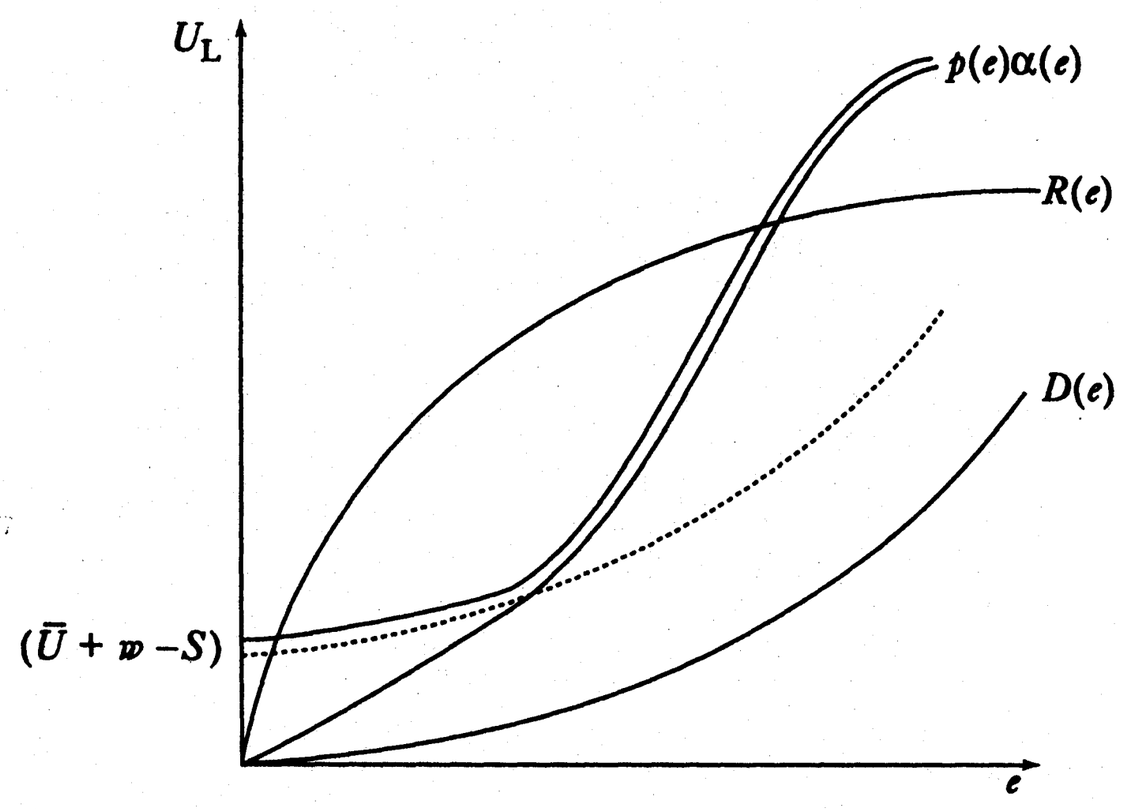

Figure 2 [Figure 1.2] Effort cost under tenancy

by the landlord is higher, as it must additionally include the marginal informational rents paid to the tenant.[11]

It is therefore plausible that the effort level selected under landlord monopoly is less than that under farmer monopoly, as confirmed by our first main result:

THEOREM 1

1. *For any effort level optimal under landlord monopoly, there exists a (weakly) higher effort level which is optimal under farmer monopoly. Moreover, the effort level under landlord monopoly is strictly lower, as long as it provides a positive surplus to both parties.*
2. *The sum of expected utilities of the lender and the farmer under landlord monopoly is smaller than under farmer monopoly, and strictly smaller as long as landlord monopoly generates a positive surplus for the farmer.*

PROOF Let e_L and e_F denote effort levels optimal under monopoly of the landlord and the farmer respectively. It is readily verified that the monopoly landlord obtains a non-negative expected profit if and only if the monopoly farmer obtains an expected return no less than his alternative $\bar{U} + w$. That is, the two monopoly problems have identical feasible sets. Therefore a switch from e_F to e_L cannot decrease the landlord's surplus when he has monopoly power:

$$R(e_L) - p(e_L)\alpha(e_L) - q(e_L) \geq R(e_F) - p(e_F)\alpha(e_F) - q(e_F)$$

Now suppose that $e_L > e_F$. Noting that

$$p\alpha + q = \max\{p\alpha, \bar{U} + w - \underline{s} + D\}$$

it follows that

$$p(e_L)\alpha(e_L) + q(e_L) - [p(e_F)\alpha(e_F) + q(e_F)] \geq D(e_L) - D(e_F)$$

Hence

$$R(e_L) - D(e_L) \geq R(e_F) - D(e_F)$$

so e_L must be optimal as well for the owner-cultivator.

If the farmer earns positive surplus under landlord monopoly, $q(e_L) = 0$, and

$$\underline{s} + p(e_L)\alpha(e_L) - D(e_L) > \bar{U} + w$$

Hence for a neighbourhood of e_L, $q(e) \equiv 0$. So e_L must locally maximize $R(e) - p(e)\alpha(e)$, implying the first-order condition

$$R'(e_L) = D'(e_L) + p(e_L)\alpha'(e_L)$$

This implies $R'(e_L) > D'(e_L)$, and so $R'(e) > D'(e)$ for all $e \leq e_L$. Reasoning in a manner similar to the previous paragraph, it follows that no effort less than e_L can be optimal for the monopoly farmer. Since the landlord obtains a positive surplus at e_L, a small increase in effort beyond this is feasible and hence profitable under farmer monopoly.

Under farmer monopoly, the lender earns zero income, while the farmer has an expected utility of

$$R(e_F) - D(e_F) + w$$

When the landlord has monopoly power on the other hand, his expected income is

$$R(e_L) + w - EC$$

while the farmer's expected utility is $EC - D(e_L)$, where EC denotes expected consumption. So the sum of expected utility under farmer monopoly is

$$R(e_F) - D(e_F) + w$$

while that under landlord monopoly is

$$R(e_L) - D(e_L) + w$$

Now apply the argument of 2 above.

The effect of a partial shift of bargaining power in favour of the farmer will be qualitatively similar. Since the set of feasible utilities $\mathcal{U}^*$ is convex, any point on its efficiency frontier can be described as a solution to the maximization of a welfare-weighted sum of utilities over this set: select c_f and e to maximize

$$R(e) + w - c_f - p(e)\alpha(e) + \beta[c_f + p(e)\alpha(e) - D(e)]$$

subject to $c_f \geq \underline{s}$, where β denotes the welfare weight of the farmer relative to the lender. Since the outcome of farmer ownership (F in Figure 1) awards a greater share of the surplus to the farmer than the outcome (L in Figure 1) when he does not own the land, the implicit welfare weight of the farmer will be higher under self-ownership than under tenancy. Since the effort level is selected to maximize

$$R(e) - D(e) + (\beta - 1)[p(e)\alpha(e) - D(e)]$$

in an unconstrained fashion, it immediately follows that the effort level under farmer ownership will be higher.[12]

The underlying explanation for the greater application of labour effort under self-ownership is similar to that conventionally advanced in the literature: that the labour of others is perceived as 'more expensive' than own-labour, owing to incentive reasons. But the conventional explanations of this phenomenon are incomplete, and even misleading in some respects. As explained in section 1, they are based on an implicit notion that

owner-cultivators have *no* access to credit or insurance. This overlooks the fundamental symmetry in contractual structures between different ownership modes.

Our theory is based instead on the externality arising from the informational rents accruing to the farmer. To the landlord these rents represent a cost, whilst to the farmer they constitute a benefit. So the farmer desires a higher effort level than does the landlord, and a shift of bargaining power towards the farmer as a result of transfer of ownership causes a higher effort level to be applied. The real cause of the inefficiency of tenancy is a pecuniary externality: the landlord disregards the benefit of higher effort levels accruing to the farmer in the form of higher informational rents. Increasing the bargaining power of the farmer allows greater internalization of these rents.

Turning now to the question of the possible sale of land from the landlord to the tenant, it is obvious that such a sale cannot be mutually advantageous to both parties. This follows from the premise that contracts are complete, so the outcome under either ownership structure cannot be Pareto dominated by the other. Otherwise, if there was scope for a mutually advantageous sale, then both landlord and tenant would be better off following the sale. The same allocation could, however, be achieved by the landlord under tenancy with the design of a tenancy contract that would mimic the effect of the sale. For instance, the landlord could select a composite contract which combined a fixed rent exactly equal to the price of the land, with a supplemental contract which exactly replicated the credit contract arising after the land sale. Since the land sale resulted in a Pareto improvement, this contract would also yield a Pareto improvement over the original tenancy contract, thereby contradicting the premise that the latter was optimally chosen. We therefore formally note:

THEOREM 2 *Starting with a situation where the land is owned by a landlord, a voluntary sale of land to the tenant will never occur.*

Nevertheless, one might wonder how to reconcile this result with that of Theorem 1: if a transfer of ownership increases the welfare of the farmer by more than it reduces the welfare of the landlord, what prevents the former from purchasing the land at a price which compensates the landlord sufficiently? The limited wealth of the farmer plays a crucial role here: the amount that is needed to compensate the landlord is typically likely to greatly exceed the wealth of the tenant. What prevents the farmer from borrowing (either from the landlord directly, or from a third party lender) to finance the land purchase?

To understand the result better, it is worth answering this question directly. Suppose that a mutually advantageous sale were to occur at price P. Let the post-sale contract be denoted $(\tilde{c}_f, \tilde{e})$, and the pre-sale contract be $(c_f^{\mathrm{L}}, e_{\mathrm{L}})$. Since the farmer must be better off:

$$\tilde{c}_f + p(\tilde{e})\alpha(\tilde{e}) - D(\tilde{e}) > c_f^{\mathrm{L}} + p(e_{\mathrm{L}})\alpha(e_{\mathrm{L}}) - D(e_{\mathrm{L}})$$

Moreover, the landlord must also benefit:

$$P > R(e_{\mathrm{L}}) + w - c_f^{\mathrm{L}} - p(e_{\mathrm{L}})\alpha(e_{\mathrm{L}}) \tag{7}$$

But the pre-sale contract c_f^L, e_L was Pareto efficient, so the landlord must have preferred the pre-sale contract to the post-sale contract:

$$R(\tilde{e}) + w - p(\tilde{e})\alpha(\tilde{e}) - \tilde{c}_f \leq R(e_L) + w - p(e_L)\alpha(e_L)\alpha(e_L) - c_f^L$$

This implies that the lender must fail to break even in the post-sale situation:

$$R(\tilde{e}) + (w - P) - p(\tilde{e})\alpha(\tilde{e}) - \tilde{c}_f \leq R(e_L) + w - p(e_L)\alpha(e_L) - c_f^L - P < 0$$

the last inequality following from condition (7). Hence the farmer will be unable to obtain the credit necessary for the purchase.

One way of understanding this result is that the land sale exerts a wealth effect: the farmer's debts grow as a result of the land purchase loan, which exacerbates the moral hazard associated with repayment of the loan. Owing to the 'limited liability' of the farmer, he must be guaranteed at least $\underline{s}$ in the disaster state; whilst in the good state the farmer must repay a larger amount. The debt 'overhang' reduces the farmer's incentive to exert effort on the farm after purchasing it. Anticipating this, lenders assess a default likelihood high enough that they are unwilling to advance the loan.

Alternatively, if the farmer finances the purchase from his own assets, the purchase lowers his wealth subsequent to the purchase. This reduces the collateral available to lenders, with the consequence that he will not be able to obtain the credit necessary to sustain the intended productivity advantages of owner cultivation.

4. A Market Setting

We now introduce multiple farmers, plots of land, and lenders-cum-landlords, and explain a number of additional considerations that now bear on the efficiency of tenant or wage labour farms relative to those cultivated by their owners. The main new feature is that the allocation of bargaining power will depend additionally on market structure: the shorter side of the market will tend to obtain a larger share of the surplus.

First note that landless farmers will operate in a different market compared with those that do have land. The former will be seeking tenancy leases which, owing to the usual moral hazard reasons (Braverman and Stiglitz, 1982), will take the form of interlinked tenancy-cum-credit contracts. The suppliers in this market will be landowners who do not plan to cultivate the land themselves. Landowning farmers will operate on the pure credit market on the other hand. The structure of the two markets could be quite different. In contrast to the market for leasing land, the demanders for credit *per se* will include landowning peasants as well as those without any land to farm at all. The suppliers will include all those with money to lend, which will typically include all the landowners that appear in the tenancy market, plus other non-landowning agents of sufficient wealth. Both markets are typically somewhat oligopolistic in nature, with a few large suppliers and numerous small purchasers. There is no *a priori* reason to believe that one market will be characterized by more monopoly power than another. To that extent the conclusions of the earlier section may be reversed, if it is the case that the market for pure credit is characterized by significantly greater monopoly power.

Nevertheless, it is typical of many developing countries, especially in Asia, to have high population densities and large reserves of landless workers. The intrinsic shortage of land in such countries would be expected to confer relatively large degrees of bargaining power to landlords with their tenants. The model developed below confirms this idea: with a sufficiently large number of poor landless workers relative to the land available for tenancy cultivation, the equilibrium contracts are approximated by the landlord monopoly solution described in section 3. In such contexts, therefore, owner-cultivators will have at least as much bargaining power as tenant-cultivators, and often more, so self-ownership will again tend to be the more productive mode.

Consider a village economy with a number of landless farmers or would-be-tenants T, and a number of landlords L, both of which are given. Technology and preferences are as in the previous section: in particular, a single farmer can cultivate a single plot of land, and landlords are assumed unable or unwilling to farm. For the sake of simplicity, we assume there are no landowning farmers, in order to abstract from the cultivate/lease-out decision. Moreover, no landlord owns more than a single plot.[13] We assume there is no market for land purchases: this can be justified by the arguments in section 3. So we can focus on the outcome of the market for tenancy leases.

We also additionally impose the following two assumptions. First, tenancy is *strictly viable* in the sense that there exists an effort level e such that:

$$\begin{aligned} &R(e) + w - \underline{s} - p(e)\alpha(e) > 0 \\ &\underline{s} + p(e)\alpha(e) - D(e) > \bar{U} + w \end{aligned} \tag{8}$$

In other words, it is possible for both landlord and tenant to obtain a positive surplus simultaneously. Second, all potential tenants are homogenous with a common wealth level satisfying

$$w < \underline{s} + p(e_L^*)\alpha(e_L^*) - D(e_L^*) - \bar{U} \tag{9}$$

where e_L^* denotes an unconstrained maximizer of $R(e) - p(e)\alpha(e)$. This implies that tenants will earn a positive surplus in any Pareto-efficient contract.

The nature of the market for tenancy contracts is assumed to be as follows. The market opens at date $t = 0$, whereby landlords and farmers are matched with one another. We consider the case where there is *surplus labour* in the sense that $T > L$: that is, there are more farmers than plots of land available. Then at $t = 0$, every landlord is matched with a farmer, while a farmer is matched with a landlord with probability L/T. Those farmers remaining unmatched must await future dates in the hope of being matched with some landlord, should any landlords decide to remain in the market beyond $t = 0$. Then at $t = 0$, matched pairs bargain over the set of feasible contracts, and we assume that the outcome of this is represented by the Nash bargaining solution over the pay-off set $\mathcal{U}^*$, with status quo pay-offs given by the continuation pay-offs expected from $t = 1$ onwards.[14] If a landlord-farmer pair agree on a contract, they leave the market. Otherwise they stay in the market, and the same process repeats itself from $t = 1$ with the agents who remain without a contract. Finally, the cost of delayed agreement is represented by a discount factor $\delta \in (0, 1)$, so an agreement yielding utility u to any agent at the following date is equivalent to an agreement yielding utility δu at the current date.

This is essentially the process studied by Osborne and Rubinstein (1990, ch. 6) for a market involving many buyers and sellers of an indivisible good. As in their analysis we assume that the market behaves in an 'anonymous' fashion (that is, agents in the market do not condition their behaviour in a bargaining encounter on their experience in previous encounters, or on the identity of their opponents).

Note that the extent of 'supply-side-shortness' in the market is constant at all dates when it opens, since the number of landlords who leave the market at any date exactly equals the number of farmers who leave. The process continues until there are no landlords left in the market. Each farmer remaining without a contract then proceeds to alternative employment and earns an expected utility of $\bar{U} + w$.

Given the 'anonymity' assumption, the outcome of the continuation game from any date onwards is a function only of the number of farmers and landlords remaining in the market at that date, which effectively becomes the 'state variable'. A (Markov) perfect equilibrium of the market game is thus represented by a set of functions $c^*(B,S), V_L(B,S), V_F(B,S)$, which describe the contract c^* agreed upon by a landlord matched with a tenant, and their expected pay-offs, for any continuation game starting with B 'buyers' or farmers, and S 'sellers' or landlords. Clearly, B is any integer less than or equal to the initial number of farmers T, and similarly S is less than or equal to L. Moreover, attention can be further restricted to (B,S) pairs satisfying $B - S = T - L$.

Introduce the convention that failure to agree on a contract is defined as agreeing on a null contract, which is denoted by N. Then such an equilibrium must satisfy the following conditions.

1. $c^*(B,S) = N$ if it is the case that there exists no contract $c^* \in \mathscr{C}^*$ such that

$$U_L(c^*) \geq \delta V_L(B - S + 1, 1)$$

and

$$U_F(c^*) \geq \delta V_F(B - S + 1, 1)$$

Otherwise $c^*(B,S)$ must be selected from $\mathscr{C}^*$ to maximize the Nash product

$$[U_L(c^*) - \delta V_L(B - S + 1, 1)][U_F(c^*) - \delta V_F(B - S + 1, 1)] \tag{10}$$

2. $$V_L(B,S) = \begin{cases} U_L[c^*(B,S)] & \text{if } c^*(B,S) \neq N \\ \delta V_L(B,S) & \text{otherwise} \end{cases}$$

3. $$V_F(B,S) = \begin{cases} \frac{s}{B} U_F[c^*(B,S)] + (1 - \frac{S}{B})(\bar{U} + w) & \text{if } c^*(B,S) \neq N \\ \delta V_F(B,S) & \text{otherwise} \end{cases}$$

The selected contract is therefore the Nash bargaining solution corresponding to status quo pay-offs representing the continuation value of remaining in the market while all other matched pairs enter into an agreement and leave the market at the current date. This presumes that there exists a contract which gives both landlord and farmer at least their

continuation pay-offs from the next date onwards; otherwise there can be no agreement. In the event that there is scope for a mutually profitable contract between any given pair, there is a similar scope for all other matched pairs at any date. This is the reason why each pair expects all other pairs to enter into a non-null contract and leave the market at the current date.

Continuation pay-offs for the landlord are defined in an obvious fashion: it is the utility value of the equilibrium contract from the current date, assuming this is non-null; otherwise it is the continuation pay-off from the next date, discounted back to the current date. For the farmer, however, it must incorporate the probability of being selected in a match with a landlord at the current date: if selected it is given by the value of the expected equilibrium contract; otherwise it is the discounted value of continuing in the market from tomorrow. The latter of course equals the utility consequent on not receiving a contract at all, if currently matched partners are all expected to enter into a non-null contract and leave the market at the current date. Otherwise if no currently matched partners are not expected to conclude an agreement, then the market is expected to be in the same position at the next date.

It is easy to see that given our strict viability assumption (8), there cannot be an equilibrium where matched pairs ever fail to agree upon a non-null contract. Otherwise it follows from the expression for continuation pay-offs $V_L(B,S)$ and $V_F(B,S)$ that these pay-offs are equal to zero. Then (8) implies that there does exist a non-null contract which gives both parties a pay-off strictly greater than their status quo payoffs, so the equilibrium contract must be non-null.

The main result of this section is the following.

THEOREM 3:

1. *A Markov perfect equilibrium exists.*
2. *Let $\eta > 0$ be given. Then there exists $\delta^* \in (0,1)$ and integer K^* such that if $\delta \in (\delta^*, 1)$ and the degree of surplus labour $T - L$ exceeds K^*, every Markov perfect equilibrium necessarily yields a contract generating utility for each landlord within an η-neighbourhood of the landlord monopoly solution described in the previous section.*

PROOF

(i) Let $\{U_L^*, U_F^*\}$ and $\{U_L^0, U_F^0\}$ denote the utilities associated with the landlord monopoly and farmer monopoly solutions respectively.
Let $eff(\mathcal{U}^*)$ denote the set of Pareto-efficient pay-offs of the set $\mathcal{U}^*$. Finally, define

$$\mathcal{G} \equiv \{(u_L, u_F) \in [0, U_L^*] \times [\bar{U} + w, U_F^0] \mid \exists (\bar{u}_L, \bar{u}_F) \in eff(\mathcal{U}^*) \text{ which Pareto dominates} (u_L, u_F)\}$$

Clearly, $\mathcal{U}^*$ is a subset of $\mathcal{G}$, both sets being convex and compact. Given $v \in \mathcal{G}$, let $\mathcal{U}_v^*$ denote the set of points of $\mathcal{U}^*$ satisfying $(u_L, u_F) \geq \delta v$, also a convex set.

Define a correspondence S from $\mathcal{G}$ to itself with the property that $u \in S(v)$ for $v \in \mathcal{G}$ if and only if

$$u_L = u_L^*, u_F = \frac{1}{B-S+1} u_F^* + (1 - \frac{1}{B-S+1})(\bar{U} + w)$$

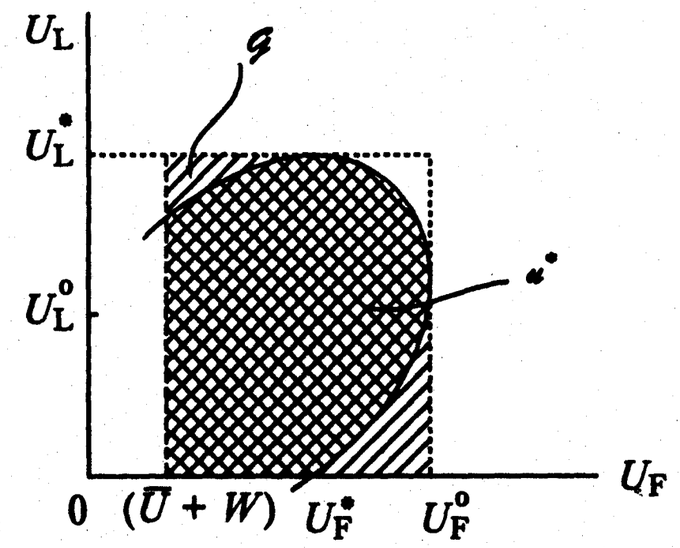

Figure 3 [Figure 1.3] Feasible pay-off sets

where (u_L^*, u_F^*) maximizes the Nash product $[u_L - \delta v_L][u_F - \delta v_F]$ over the set $\mathcal{U}_v^*$. This is non-empty-valued. It is also convex-valued: u_L^*, u_F^* are selected to maximize a strictly quasi-concave function over a convex set. So it is defined uniquely, unless it so happens that either $u_L = \delta v_L$ for all $(u_L, u_F) \in \mathcal{U}_v^*$, or $u_F = \delta v_F$ for all such points. In the latter case every point in $\mathcal{U}_v^*$ solves the maximization problem, so this entire set is optimal. Finally, note that

$$\mathcal{U}_v^* \equiv \mathcal{U}^* \cap \mathcal{H} \quad \text{where } \mathcal{H}_v \equiv \{(u_L, u_F) \in \mathbb{R}^2 | \ (u_L, u_F) \geq \delta.v\}$$

Since the correspondence $\mathcal{H}_v$ is continuous in v, it follows that $\mathcal{U}_v^*$ is also continuous. Hence the Maximum Theorem assures that $S(v)$ is upper-semicontinuous in v, and by Kakutani's Theorem there exists a fixed point $V^* \in S(V^*)$. Moreover, by construction, there exists $c^* \in \mathscr{C}^*$ which maximizes

$$[U_L(c) - \delta V_{L^*}][U_F(c) - \delta V_F^*]$$

over C^*, whilst $V_L^* = U_L(c^*)$ and

$$V_F^* = \frac{1}{B-S+1} U_F(c^*) + (1 - \frac{1}{B-S+1})(\bar{U} + w)$$

Define

$$c^*(B-S+1, 1) = c^*(B, S)$$

as the contract c^*, and $V_L(B-S+1, 1)$ and $V_F(B-S+1, 1)$ equal to V_L^* and V_F^* respectively. Finally, define

$$V_L^*(B, S) = U_L[c^*(B, S)]$$

and

$$V_F(B,S) = \frac{S}{B} U_F[c^*(B,S)] + \left(1 - \frac{S}{B}\right)(U + w)$$

This represents a Markov perfect equilibrium.

(ii) We first claim that there exists integer K^* and a number $k > 0$ such that for $(B - S) > K^*$, every point U on the Pareto-efficient frontier of $\mathcal{U}^*$ satisfies

$$U_F - \delta V_F(\bar{U}_F, B, S) > k$$

for all $\tilde{U}_L, \tilde{U}_F \in \mathcal{U}^*$, and all $\delta \in (0,1)$, where $V_F(\tilde{U}_F, B, S)$ denotes

$$\frac{1}{B-S+1}\tilde{U}_F + [1 - \left[\frac{1}{B-S+1}\right] (\tilde{U} + w)$$

Take $k_1 \in (0, U_F^* - \bar{U} - w)$, so that $U_F > \bar{U} + w + k_1$ for all u in eff $(\mathcal{F})$. Next select $k \in (0, k_1)$, $\theta \in (0, k_1 - k)$ and integer K^* such that

$$\frac{1}{K^*+1}[U_F^0 - (\bar{U} + w)] < \theta$$

This is possible since $U_F^0 \geq U_F^* > \bar{U} + w$: that is, the tenant obtains positive surplus even when the landlord has all the bargaining power. This implies that

$$|V_F(\tilde{U}_F, B, S) - (\tilde{U} + w)| < \theta$$

whenever $B - S > K^*$, for all $(\tilde{U}_L, \tilde{U}_F) \in \mathcal{U}^*$. It follows that

$$U_F - \delta V_F(\tilde{U}_F, B, S) > U_F - V_F(\tilde{U}_F, B, S) > k_1 - \theta > k$$

thus establishing our claim.

Suppose the result in (ii) is false. Then given $\eta > 0$, we can find a sequence of discount factors $\delta^n \in (0,1)$ $\delta^n \to 1$, and levels of surplus labour $T_n - L_n > K^*$ and a corresponding sequence of equilibrium payoffs (U_L^n, U_F^n) such that $U_L^n < U_L^* - \eta$ for all n. Let (U_L, U_F) be a limit point of this sequence, so $U_L \leq U_L^* - \eta$. Then the corresponding sequence of Nash products

$$N^n \equiv (U_L^n - \delta^n V_L^n)(U_F^n - \delta^n V_F^n)$$

must be converging to 0, since

$$U_L^n - \delta^n V_L^n = (1 - \delta^n) U_L^n \to 0$$

However, it is feasible for a landlord and tenant to select the landlord monopoly contract which generates the utility pair (U_L^*, U_F^*) and a sequence of Nash products $[U_L^* - \delta^n V_L^n][U_F^* - \delta^n V_F^n]$ which is bounded away from zero, using the fact that

$$(U_L^* - \delta^n V_L^n) \rightarrow U_L^* - U_L \geq \eta$$

and the result of claim 1. This contradicts the hypothesis that the equilibrium contracts maximize the Nash product for large n.

The main implication of this result is that farmers in owner-cultivated farms will have at least as much bargaining power with their creditors as will tenant farmers with their landlords, *irrespective of the structure of the market for credit*. Indeed, a sufficient condition for owner-cultivators to obtain a strictly higher share is that their autarky pay-off exceeds that obtained in the landlord monopoly contract. Then our results concerning relative productivity of the two modes of ownership will be as in the case of a bilateral monopoly.

A second implication is that the productivity of tenant farms will be lower, the higher the population pressure on land (as measured by the land : labour ratio). This suggests that the effect of ownership on farm productivity will typically depend on demographic patterns. Precise predictions concerning productivity effects of ownership are rendered difficult because of the difficulty of saying anything about the effect of higher population pressure on the structure of credit markets. But our model is consistent with the productivity differential (and correspondingly the benefits from land redistribution programmes) being higher in overpopulated regions.

4.1. Other comparative static properties

We briefly describe a number of other determinants of farm productivity in our model. These could in principle be tested from available data and, if valid, provide useful guidance to policy. In what follows, we shall restrict attention to overpopulated economies where theorem 3 applies to ensure that tenant farms are characterized by the landlord monopoly contract. Moreover, credit markets are also assumed to assign significant monopoly power to lenders, with the effect that owner–cultivators are pressed down to their autarky pay-off levels.

First, consider the effects of varying farmers' wealth levels. For very low wealth levels, there will be no productivity difference between owner-cultivated and tenant farms, as the disagreement pay-offs for both kinds of farmers equals $\bar{U} + w$. There are 'queues' for tenancy contracts among landless farmers, and landlords will attempt to hire the wealthiest farmers first: so 'tenancy ladders' will emerge, for reasons similar to those analysed by Shetty (1988). Within this range, small increases in the farmer's wealth are captured entirely by landlords and lenders (for example, in the form of lower defaults or repayments on past loans), providing such farmers with minimal incentives to augment their wealth and escape a 'poverty trap'. For intermediate wealth levels, the farmers owning their own land will be able to do better than $\bar{U} + w$ by farming the land even in the absence of any credit. They will then enjoy a greater share of the gains from trade compared with tenant farmers, and consequently apply higher levels of effort. They will also derive the full benefit from an increase in their wealth levels, unlike tenant farmers, and so have greater

incentives to invest elsewhere to increase their non-farm wealth. Tenancy ladders continue to persist over this range. Finally, as wealth levels grow sufficiently large, the disagreement pay-offs for tenant farmers exceed $\bar{U} + w$, tenancy queues and ladders disappear, and the productivity of tenant farmers grows, eventually arriving at first-best levels. Similarly effort levels of owner–cultivators also grow, eventually arriving at the first-best level. With high enough wealth levels, the productivity gap tends to disappear again, as the Coase Theorem begins to apply. Hence the productivity gap between tenancy and owner-cultivated farms tends to be highest for intermediate wealth levels (figure 4).

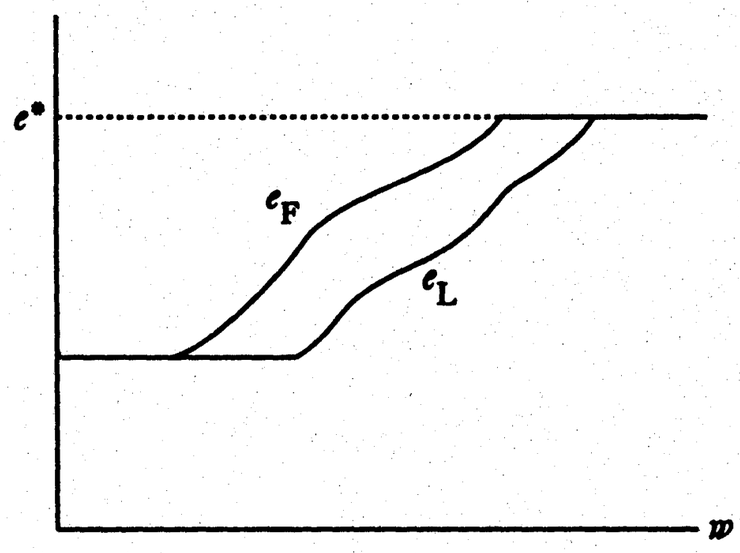

Figure 4 [Figure 1.4] Effort under tenancy and owner cultivation

Next consider the effect of increasing non-farm opportunities available to the landless, which increase $\bar{U}$. Clearly, owner-cultivated farms are unaffected, as long as the alternative opportunities do not grow so large as to prompt the farmer to abandon cultivation. On the other hand, tenancy farm outcomes will depend on $\bar{U}$. If these alternative opportunities are very unattractive, poor tenant farmers will enjoy a surplus, and increases in their outside options will have no effect at all on productivity in tenant farms. However, when $\bar{U}$ increases sufficiently, tenancy queues and surpluses will disappear, and productivity will consequently increase. This suggests that public employment programmes for the landless may have the beneficial side-effect of increasing productivity on tenant farms, and may even be viewed as a substitute for land redistribution programmes from this viewpoint.

5. Risk-Aversion and Dynamics

So far we have assumed farmers to be risk-neutral with respect to consumption variations above the subsistence level. This is clearly unrealistic, especially for low consumption levels. Suppose instead that the farmer has a von Neumann–Morgenstern utility function defined over his consumption and effort level, which is strictly concave. This function can take many different forms. For instance, it could be a function of $c - D(e)$; whence the effort disutility is measured by its monetary equivalent $D(e)$: this is appropriate when the effort level pertains to the purchase and application of certain material inputs, or when the value of the farmer's time can be measured in terms of its opportunity cost in earnings forgone elsewhere. Alternatively, it could take the additively separable form $U(c) - D(e)$, whence $D(e)$ represents the physical or psychic cost of effort.

From an economic standpoint, the main consequence is the introduction of at least two kinds of wealth effects in the farmer's preferences. The first pertains to the demand for 'leisure', defined as the converse of effort. The second is the effect of wealth on the farmer's risk-aversion. The transfer of ownership of land to the farmer and the attendant increase in his bargaining power will induce both kinds of wealth effects. The first wealth effect will tend to lower effort. The second will depend on the precise way that the farmer's risk-aversion varies with his wealth. It is plausible that the farmer become less risk-averse, thereby inducing a contract with stronger incentive properties: this effect (modelled for instance by Bell, 1989) will tend to increase effort. The overall consequence will depend on the precise form of the farmer's preferences.

Both kinds of wealth effects are absent in the case where the utility function takes the form: $-\exp(-[c - D(e)])$, that is, effort costs are monetary and display constant absolute risk-aversion. Then our preceding results concerning productivity comparisons can be shown to be unaffected. In this sense, therefore, our results do not get overturned by the introduction of risk-aversion *per se*. However, the possibility of significant wealth effects can cause our conclusions to be significantly altered. The model should be viewed as providing merely one set of factors pertaining to the effect of ownership on productivity.

We turn now to the issue of dynamics, where the relationship between landlords and tenants or hired workers, or that between owner–cultivators and their creditors, is long-lived. In the tenancy setting, the landlord may be able to ease the incentive constraint by virtue of an ability to use eviction threats as an additional instrument of control. This is particularly true when the tenancy mode results in less effort than owner–cultivation: in such contexts tenants enjoy informational rents, and the prospect of forgoing these in the future can cause the farmer to apply more effort. In particular, the results of Radner (1985) imply that if the relationship between landlord and tenant is long-lived, and both discount the future at a sufficiently low rate, then the first-best outcome can be attained by a landlord, with the application of suitable 'trigger strategy' policy. While such folk theorems pertain to rather extreme situations, they suggest that in a multi-period setting the productivity gap between the tenancy mode and peasant mode may be narrower than is indicated by our preceding analysis. However, if tenants are believed not to be very far-sighted (owing to the high uncertainty of their environment, and their near-subsistence way of life), the ability of the landlord to alleviate the incentive problem via trigger strategy policies will be limited.

Nevertheless, the result concerning the absence of mutually profitable land sales will of course continue to hold for the same reason as in a static setting, if contracts are assumed to be complete. In a multi-period setting a lender of course has access to a larger range of instruments to control the moral hazard of borrowers. This will help ease credit constraints. Nevertheless, at the same time, the landlord will also gain access to the very same range of instruments to control the moral hazard of tenants. The set of feasible contracts is essentially the same under tenancy and owner–cultivation. So while the dynamic structure of debt contracts permit the easing of credit limits for owner–cultivators, the borrowing requirement to finance the land purchase goes up concomitantly, since the price needed to compensate the landlord adequately also goes up.

6. Concluding Remarks

6.1. Related literature

We first discuss the empirical evidence pertaining to the effects of ownership on productivity in Indian farms. A number of different authors have examined the comparative productivity of owner-cultivated and tenant farms, with mixed results. For instance, Chandra (1974), Rao (1971), Rudra and Chakravarty (1973) and Rudra and Dwivedi (1973) discovered no significant differences. The more recent work of Bell (1977), Sen (1981) and Shaban (1987) does, however, identify a significantly higher productivity on owner-cultivated farms, especially those of small size, after controlling for soil quality and irrigation. Shaban, for instance, controls additionally for family-specific, plot-specific and village-specific effects by utilizing a panel data set. He finds that owned farms apply significantly more inputs per acre, especially those in which the landlords do not share costs, such as family labour and bullock labour. The negative findings of earlier authors are explained by the nature of the data used, which clubbed sharecroppers and fixed rent tenants, and sharecroppers and part owners, besides their failure to control for differences in soil quality, irrigation or degree of mechanization (see also Sen, 1981). Shaban additionally finds the absence of systematic difference in productivity and labour application between owned plots and fixed rent tenancies. This evidence is consistent with our model: that is, fixed rents would be observed as long as the tenant was sufficiently wealthy and, as noted in section 4, productivity differences between owner-cultivated and tenant farms would then disappear.

Consider next the comparison of owner-cultivated farms with varying degrees of reliance on family *vis-à-vis* hired labour. Most authors have identified significant productivity advantages in farms relying primarily on family labour, leading to the well-known inverse relation between farm size and productivity. These differences are insufficiently explained by technological scale diseconomies, and are related primarily to greater application of labour on small family labour farms (Bardhan, 1973; Sen, 1981). The conventional explanation for this is the 'dual economy' hypothesis of Sen (1962, 1964), based on an exogenous gap between market wage rates and the marginal disutility of family labour. It postulates that hired labour is employed to the point where marginal product equals market wages, while family labour is employed to the point where marginal product equals marginal disutility. The empirical evidence on the validity of this hypothesis is mixed. In favour are the facts that productivities rise with farm size, that market wages have significant effects on marginal productivities of hired labour but not of family labour (Bardhan, 1973; Sen, 1981). The negative evidence pertains to the absence of a direct relationship between family labour content and productivity or labour input per acre (Bardhan, 1973; Rudra, 1973a, b). Sen (1981), however, explains this negative result by the nature of the data used, which clubbed owner-cultivated and sharecropped farms amongst those relying primarily on family labour. Within the class of owner-cultivated farms, he obtains a significant positive relationship between family labour content and labour input.

Hence, the positive relationship between family labour content, labour effort and farm productivity appears to be characteristic of owner-cultivated farms. Indeed, Sen (1981, Table 7) finds that the productivity of tenant farms (which does not appear to vary with

size) is approximately the same as those of owner-cultivated farms of large size, in turn significantly smaller than owner-cultivated farms of small size. This is exactly consistent with our model: that is, the essential similarity of tenant farms with those relying primarily on hired labour, both of which result in lower effort incentives than a farm cultivated by its owner.

The 'dual economy' hypothesis of an exogenous gap between market wages for hired labour and the shadow cost of family labour is not persuasive, especially as the evidence suggests that family labour does frequently participate in the labour market (Sen, 1981). What prevents family workers from undercutting the going market wage? Some explanation on efficiency wage grounds is perhaps more attractive. Our approach belongs to this genre, whereby involuntary unemployment on the labour market is derived endogenously on the basis of wealth constraints and moral hazard with respect to labour effort. Indeed, our model is consistent with the phenomenon of 'tenancy ladders', whereby landlords give priority to wealthier peasants in awarding leases; see Shetty (1988) for citations of relevant empirical evidence and a similar theoretical explanation.

More generally, our approach draws attention to related imperfections in credit and land markets that seem just as essential as labour market imperfections in understanding the effects of ownership and contracting mode on farm productivity.

We turn now to the evidence concerning the sale of land by landlords to their tenants. The thinness of land markets is part of the folklore of development economics, though the direct evidence concerning this appears to be less systematic than on productivity differentials. Jodha (1981) found in a study of six Indian villages over a three-year period that 14–46 percent of the land was transferred, but sales ranged from only 3 to 23 percent of all transfers. Kumar (1975) presents evidence indicating that the distribution of land ownership in Madras Presidency manifested no trend over a period of almost a hundred years, from 1853–4 to 1946–7, despite substantial inequality. Rosenzweig and Wolpin (1985) studied data for 2900 Indian farm households during the period 1968–71, and found that less than 2 percent of them sold land during the year 1970–1. Moreover, most of these sales appeared to be of the form of distress sales by owner–cultivators. Moll (1988) argues that the thinness of land sales markets is a phenomenon observed in developed countries as well: the percentage of farmland transferred on average each year is 3 percent of the total in the USA, 1–1.5 percent in Britain, 1.5 percent within the white sector in South Africa and 0.5 percent in Ireland and Kenya.

A number of explanations for the absence of significant redistribution of land through the market have been offered. Binswanger and Rosenzweig (1986) and Binswanger, Deininger and Feder (1993) base their explanation on the fact that land has collateral value, over and above its income-earning potential as a productive asset. Mortgaged sales are therefore uncommon, as the buyer cannot compensate the seller for the collateral value on the basis of the future income-stream from the land. However, a transfer of land to a more productive mode ought to result in an increased earning potential, and it is unclear why the collateral value of the land should always exceed this potential. Moreover, this explanation does not preclude the purchase of land by farmers on the basis of their savings.

Heston and Kumar (1983) describe a variety of possible reasons for the thinness of land markets, such as asymmetric information concerning the value of any given piece of land, the value of land as a liquid asset and the desire for portfolio diversification. The extent of asymmetric information concerning land within a close-knit village community is also

questionable. Moreover, a tenant farmer experienced in cultivating a plot of land for some time ought to have detailed information regarding its quality. The portfolio diversification argument may have some merit, but requires to be understood better: in particular, is the diversification value necessarily greater for wealthier investors? Alternative explanations may run in terms of tax advantages of investments in land for the wealthy.

Basu (1986) explains the market thinness as a coordination problem manifested as one of many Nash equilibria: owners are reluctant to sell land because others are, implying that buying back land later if worthwhile is not a feasible option. Alternative equilibria are, however, characterized by vigorous land sales and are welfare superior. Rosenzweig and Wolpin (1985) argue that the benefits of learning from past experience in tilling the family land implies that the land is more valuable to family members than to outsiders, so there is no prospect of a profitable sale. This obviously applies to a different phenomenon: why owner–cultivators appear reluctant to sell land belonging to the family to outsiders. It does not apply to the question of why a noncultivating landlord should be reluctant to sell land to a tenant or hired workers. If anything, the benefits of experience should argue in favour of such sales.

Finally, we discuss related theoretical research. A number of recent papers have modelled wealth effects created by credit market imperfections arising endogenously from moral hazard. Aghion and Bolton (1991), Banerjee and Newman (1991, 1993) and Piketty (1992) have studied the implications of these for the dynamics of growth, inequality and occupational choice. In a static setting, Legros and Newman (1994) study the implications of wealth effects on productivity by influencing the choice of organizational form. More productive organizational forms have higher financing requirements, so low wealth levels force selection of less productive forms. Our results concerning the comparative inefficiency of tenancy, however, do not stem from higher capital requirements, but rather from the induced allocation of bargaining power. Consequently, in the Legros–Newman model, the inefficiency resulting from low wealth levels can be removed only by a change in organizational form, induced in turn by changes in wealth distribution or capital market interventions. In our model, a change in organizational form is not necessary: increased wealth or subsidized credit can cause tenancy to turn efficient.

The relationship between informational rents and effort incentives is of course a familiar theme in the principal–agent literature. Nevertheless, the implications for organizational form have not been sufficiently explored, with few exceptions. Shapiro and Stiglitz (1984) identify the superior productivity and welfare levels in labour-managed firms relative to capitalist resulting from the internalization of these rents. Esfahani and Mookherjee (1995) focused on these informational rents as the reason why some profit-maximizing firms select organizational forms with low-powered incentives, and studied the impact of external parameters such as relative factor proportions and product market competition on these choices.

6.2. Future directions

The theory sketched here could apply to many other kinds of asset. One example is the ownership of retail outlets or taxis: the theory extends in a straightforward way, since these assets yield uncertain income streams upon application of effort by a single agent. The model then suggests that if the producing agent is wealth-constrained, self-ownership

will generate higher productivity than when the asset is leased in. Despite this, the market will not transfer ownership to producing agents, owing to credit constraints.

A more ambitious extension would be to a multiple agent setting: for example, comparing worker-owned cooperatives with capitalist firms which separate ownership and labour. Informational rents of workers subject to incentive problems then suggests one efficiency advantage of cooperatives. If this is sufficient to overcome free-riding and other organizational problems (that is, if there is suitable monitoring of individual contributions, and suitable incentive mechanisms in place), it suggests that cooperative forms may flourish in competition with capitalist firms. This may provide part of the explanation for the prevalence of partnership forms of organization in different contexts where mutual monitoring is relatively costless: accounting and law, start-up companies and credit cooperatives.

Other areas where this approach may be fruitful include vertical integration, and transfer of technology to developing countries by multinational companies. Informational rents can cause the allocation of ownership rights to affect levels of efficiency. The incentive to internalize such rents may provide a strong reason for vertical integration, and for direct foreign investment as a form of technology transfer preferred to technology licensing.

Notes

1 For an overview of this literature, see Bardhan (1984, 1989), Basu (1990), Binswanger, Deininger and Feder (1993), Otsuka, Chuma and Hayami (1992), Sen (1981) and Singh (1989).

2 This is reviewed in more detail in section 6. For evidence relating to other countries, see Berry and Cline (1979).

3 Indeed, the evidence in Townsend (1994, Table VI) does not reveal an unambiguous pattern across all three villages studied.

4 These two modes differ insofar as the management of cultivation is retained by the landlord rather than delegated to the cultivator. Our model, like most others in the literature (with the exception of Eswaran and Kotwal, 1985), is not rich enough to consider issues of management and delegation. Note that the case of wage labour is not interpreted as employment at a fixed wage rate, but rather allows the payment of wages conditioned on the output of the farm.

5 Section 5 extends the model to a multi-period setting.

6 The effort variable typically represents the amount of labour applied by the tiller and his family and livestock, and is thus difficult to monitor by the landlord or lender. We are assuming for the sake of simplicity that the effort required does not vary with the scale of cultivation.

7 Section 5 describes the consequences of farmer risk-aversion.

8 We assume that the farmer cannot participate in an alternative occupation or in farming another plot as long as the plot in question is farmed at a positive level ($x > 0$), but he can when $x = 0$. This indivisibility plays an inessential role in our analysis: we could alternatively assume that if x fraction of the land is farmed, then the farmer obtains a utility of $x\bar{U}$ from outside activities, without altering any of the essential results.

9 Here we utilize the assumption that $R(e^*) - D(e^*) > \bar{U}$ at the first-best effort level e^*.

10 This is clearly true for the Nash bargaining solution, as well as related axiomatic bargaining solutions. As Binmore, Rubinstein and Wolinsky (1986) argue, such bargaining solutions can be rationalized in a noncooperative framework where there is small chance of a breakdown in negotiations, whereupon the disagreement pay-offs are realized. If, on the other hand, the essential friction in bargaining arises from the possibility of delayed agreement, these pay-offs correspond to outside options, which exert an effect on the bargaining outcome only if a player's

pay-off from the latter happens to fall below the option, in which case the player receives a pay-off equal to the option. Nevertheless, even in this context of bargaining, a transfer of ownership to the farmer would have an effect on effort incentives as long as the autarkic solution under owner cultivation gave the farmer higher utility than under tenancy.

11 The derivative of $p(e)\alpha(e)$ equals $D'(e) + p(e)\alpha'(e)$.

12 It will be strictly higher as long as the utility possibility frontier is strictly convex at either F or L. Note that F or L may represent randomized contracts, in which case the frontier is linear at these points. However, in such a case, each outcome is a mixture of two pure contracts, one of which involves higher effort, and F involves a greater probability weight on the higher effort contract.

13 This amounts to making the tenancy market 'as competitive as possible'. So our results will be strengthened further when landownership is more concentrated.

14 As Binmore, Rubinstein and Wolinsky (1986) show, this approximates the outcome of the following bargaining process. Suppose that the time period between $t = 0$ and $t = 1$ is divided into a finite but large number of subperiods. In the first subperiod one party makes an offer, which the other either accepts or refuses. If accepted, an offer is implemented. Otherwise the process continues into the following subperiod. With an exogenous probability q the negotiations break down, and there is no agreement; both parties are returned to the population to await being matched with a new partner to bargain with at the following date. If negotiations do not break down in this fashion, then at the next subperiod it is the turn of the party refusing the proposal of the previous subperiod, to make a new proposal, which subsequently the other party must accept or reject. And so the process continues; if at the end of the last subperiod they have failed to agree, then they await a new partner at the following date. If the breakdown probability q at each stage is small, and the number of subperiods is large, then the outcome of bargaining will be to produce this solution.

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