Limited liability and the existence of share tenancy

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The paper considers the problem confronting an absentee landlord who can lease out his land on a fixed-rent contract, share-rent contract or a mixture of the two. It is argued that in poor areas it is natural to have each contract underwritten by an implicit, limited-liability clause, which allows a person to forego paying rent under extreme crop failures. In the presence of such an implicit clause, a certain tension appears between a tenant and a landlord with the former preferring risky projects and the latter preferring safe ones. It is shown that in such a case share tenancy turns out to be the dominant system, from among the class mentioned above, because it minimises the tension between the landlord and the tenant. The result is then used to discuss conditions under which share tenancy will tend to wither away.

1. Introduction

The early laws of aerodynamics had seemed to suggest that the bumblebee cannot fly. Consequently, the flight of the bumblebee has been a source of provocation and advance in the study of aerodynamics. Something similar is true of share tenancy. The axioms of textbook economics suggest that share tenancy cannot exist. Its existence – which is fairly widespread in backward economies1 – has, therefore, been a source of puzzlement and provoked a large literature.2 This has enhanced our understanding of not just tenancy but agrarian structure and sharing arrangements in general.

After the early realization3 that a landowner could do better if, instead of

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1See, for example Rao (1971), Reid (1975), Bell (1977), Pearce (1983) and Boyce (1987).


3For a clear statement, see Marshall (1920).
leasing out his land on a share rental basis, he leased it out on fixed rental, it was believed that we could explain the existence of sharecropping if we allowed for uncertainty in our models. But it was proved later that just having one kind of exogenous uncertainty (e.g., that due to the weather) could not explain sharecropping. A more complicated argument, which brought in labour market uncertainty as well, was needed [Newbery (1977)].

Similarly, attempts to explain share tenancy by introducing variations in entrepreneurial skills and asymmetric information have proved to be futile. It has been shown that there must be at least two factors of production for which quality is uncertain and the information among buyers and sellers is asymmetric [Hallagan (1978), Allen (1982), Basu (1984)].

The aim of the present paper is to contribute to this debate by providing a new and simple theory of the dominance of share over fixed rents by using the concept of ‘limited liability’, in particular the version of it which was used by Stiglitz and Weiss (1981). In a recent paper, Shetty (1988) lucidly explains the role of limited liability in the context of agrarian relations. The limited liability axiom asserts that if i has some financial commitment towards j (for example, a loan to be repaid or rent to be paid) but happens to be bankrupt, then j has to forego his claim. We could defend this axiom by referring to the law (in many countries bankruptcy is a legitimate reason for reneging on certain kinds of contracts) or social sanctions, which can be compelling on individuals, as described in Basu (1986). But if we treat the word ‘bankrupt’ literally as a state of total insolvency, then the axiom becomes almost self-evident. In a multi-period model claims need not necessarily be forgone but can be carried over to the future, but, as will be shown later, this leaves my argument intact.

A landowner is considered who cannot be present on his land to directly supervise hired labour. So his problem is to devise a suitable tenancy contract (share, fixed or a mixture) and lease out the land. It is assumed that underlying any tenancy contract is an implicit limited-liability clause. That is, if the weather fails and the harvest is sufficiently poor, then the landlord would not be able to claim his full rent. We already know from the Stiglitz–Weiss theory that the presence of a limited-liability clause introduces a certain tension between the two agents. As will be shown below, in the presence of limited liability, the tenant would prefer risky projects (i.e. his behaviour will mimic that of a risk-loving person) whereas the landlord would act like a risk-averse person even if they are innately risk-neutral.

4See, also, Newbery and Stiglitz (1979). The more recent model of Allen (1985) pursues a very different line of argument and what it establishes is the existence of share tenancy with side payments and not of share tenancy, pure.

5As a concept, limited liability originated outside economic theory. See Jensen and Meckling (1976) for discussion of it in the context of corporate finance. See, also, the discussion on bankruptcy in Brealey and Myers (1988, section 18.3).
agents. It will be shown that share tenancy has the advantage of minimizing this tension. In other words, by offering a share rental contract, the landlord is able to 'direct' the tenant's choice of project towards the kind that the landlord prefers, to wit, the less risky ones.

In traditional models, a tenant chooses the volume of inputs, like labour, to be used and the principal moral hazard problem stems from the landlord's inability to monitor input-use. I shall here refer to this as labour moral hazard. The term 'labour' will often be dropped though, since traditionally a reference to moral hazard is a reference to labour moral hazard.

In the present model the tenant does not have to decide on the intensity of labour use, but chooses from among techniques or projects which are differentiated only in terms of riskiness. The landlord's inability to monitor the tenant's choice of technique may be referred to as technique moral hazard. It is the presence of technique moral hazard that distinguishes this model from related ones like Kotwal (1985) and Shetty (1988).

The central aim of this paper is to highlight the rather surprising theoretical result that the presence of technique moral hazard (which has not been given much prominence in agrarian studies) coupled with the limited liability axiom [which has been used earlier, e.g., in Shetty (1988)] helps us explain the existence of share tenancy.

It should be emphasized at the outset that I shall establish the dominance of share tenancy by focussing exclusively on the above problem and by ruling out features which tilt the argument in favour of fixed-rental tenancy (e.g., the well-known problem of moral hazard in labour use). Hence, in the context of a real agrarian economy, this paper may be viewed as providing one reason why share tenancy may be preferred. What will actually come into existence in reality will then depend on the nature of the economy, that is, on whether the features I focus on in this paper dominate or features like the moral hazard problem in the use of inputs are more prominent.

This can be the basis of a theory of what kinds of tenurial contracts we could expect in different economic situations. The last section of this paper provides a tentative discussion of this problem.

2. Limited liability and attitude to risk

In order to discuss a whole range of possibilities I shall begin with a 'mixed'-rental contract, of which share tenancy and fixed-rental tenancy appear as two polar extremes. The aim is to isolate conditions under which the polar end of share tenancy will come to prevail in equilibrium.

A mixed contract is defined by \((r, R)\), where \(r\) is the fraction of the gross output and \(R\) the lump-sum which the tenant has to pay the landlord after the harvest. In other words, if the harvest yields \(X\) units of output, the landlord will get a total rent of \(rX + R\) and the tenant will get \((1 - r)X - R\),
given that they have agreed to the mixed contract \((r, R)\). It is obvious that if \(R = 0\) and \(r > 0\) then we have a case of pure share tenancy and if \(r = 0\) and \(R > 0\), it is a fixed-rental contract. The case of \(R < 0\) is ruled out by assumption since we are considering absentee landlordism.

In this paper we study the effects of the limited liability axiom. I shall, therefore, assume that underlying all contracts is the limited liability clause which says that the tenant has a prior right to output level \(S\); and he fulfils his contract only after guaranteeing himself \(S\). This \(S\) can be as low as one wishes, and may or may not be treated as subsistence consumption. Nothing hinges on its interpretation.

Given this limited liability clause and a mixed contract \((r, R)\), if the harvest yields \(X\) units of output, the tenant’s income, \(Y_T\), is given by

\[
Y_T(r, R, X) = \min \{ (1 - r)X - R, S \}
\]

and the landlord’s income, \(Y_L\), is given by

\[
Y_L(r, R, X) = \min \{ rX + R, X - S \}.
\]

It is easy to check that \(Y_L = X - Y_T\).

Now, even if we assume — and I do make such an assumption — that individuals are innately risk-neutral, given the limited liability clause, the tenant and the landlord will behave as if they have non-neutral attitudes to risk. The tenant will act risk-living and the landlord will act risk-averse. In fact, they would behave thus even if the former was mildly risk-averse and the latter mildly risk-living. This is transparent as soon as we represent equations (1) and (2) on a diagram as in fig. 1.

In fig. 1, \(SAB\) represents \(Y_T\) as a function of \(X\) and \(-SCD\) represents \(Y_L\) as a function of \(X\). What limited liability has done is to concavify the landlord’s earnings curve. Hence the conflicting attitudes towards risk.

Suppose there are two projects the tenant can choose from: (I) cultivate by traditional method and (II) use high-yielding varieties. For simplicity let us assume that the expected output in both cases happens to be the same, but uncertainty is greater in (II). That is, if the weather is good, (II) implies an output of \(x_2\) and (I) implies an output of \(x_1\) and \(x_2 > x_1\) and if the weather fails (II) implies an output of \(x'_2\) and (I) implies an output of \(x'_1\) and \(x'_2 < x'_1\). Assume also that \(x'_1 < (S + R)/(1 - r) < x_1\). It is very easy to check that the tenant will select the riskier project, that is, (II), whereas the landlord would have preferred if the safer project, that is, (I), was selected.

To give the reader an early insight as to why a landlord may prefer share tenancy, suppose we have a mixed-rent tenancy, \((r, R)\), to start with. Now if \(r\) becomes smaller and goes towards zero, this could be thought of as a gradual move away from share tenancy towards the pure fixed-rental system.
What does a lowering of \( r \) imply in fig. 1? It is easy to see that it makes the \( AB \) segment steeper and \( CD \) flatter. That is, it accentuates the conflict in the two agents' attitude towards risk.

Inverting the above argument one can see that it is in the landlord's interest to raise \( r \) and thereby make their attitudes to risk more compatible which, in turn, would imply that the tenant's choice of project from his feasible set may be more in line with the landlord's preference. Hence, moving away from the fixed rental system towards share tenancy enables the landlord to influence the tenant's choice behaviour vis-à-vis alternative risky projects more easily and in the direction which the landlord prefers.

The above analysis is no more than a sketch. To establish it formally we need to resort to an explicit specification of the tenant's reservation income. Also, we have to specify a cost function for project implementation because
otherwise we shall end up invariably with a corner solution. All this and the
formal analysis of the equilibrium is conducted in the next section.

3. Share tenancy in equilibrium

The landlord has to decide what kind of tenancy contract to offer. That is,
he has to choose \((r, R)\). The tenant has to decide whether to take up the offer
or not and, if he decides to take it up, he has to choose which project to
implement from an exogenously given feasible set.

Let us take on the tenant’s second decision problem first. By a ‘project’ I
mean a method of cultivation, choice of crop, etc. Once a project has been
chosen, the output will depend on the weather; and for simplicity I shall
assume that each project can be either successful or a failure.\(^6\) I shall
denote a project by \(D\). If project \(D\) is chosen, then it means that if the project
is successful, output will be \(D\) units. If it fails output is \(F\) (\(F\) is the same for
all projects\(^7\)). In order to give the limited liability clause some bite, it is
assumed that a failed project would necessitate the invoking of the limited
liability clause. That is, we are restricting ourselves to the case where

\[
S > (1 - r)F - R. \tag{3}
\]

A sufficient condition using only exogenous variables, which ensures (3) is
discussed later: see footnote 10.

To keep the focus exclusively on the uncertainty aspect of projects, it will
be assumed that all projects have the same expected income, \(E\). Hence, the
probability, \(p(D)\), of project \(D\)’s success is given by

\[
p(D) = \frac{(E - F)}{(D - F)}. \tag{4}
\]

It is being assumed that \(D\) can take any value above \(E\).

We use \(c(D)\) to denote the cost of implementing project \(D\). Since the tenant
chooses the project it is natural – and that is what I am assuming – that the
tenant incurs the cost of its implementation. In any case since the project
choice cannot be monitored by the landlord, if he paid for it, the tenant
would take the money and choose the project which is most advantageous
from the tenant’s point of view.

\(^6\)It is possible for some projects to be more resilient, that is, these projects would succeed
under a wider range of weather conditions.

\(^7\)This assumption is inconsequential and made only for algebraic simplicity. Thus the example
in section 2 involving projects I and II does not fit into this framework. But it can be checked
that even if it were true that increasing risk meant that bad-weather output is worse (as for
instance, is the case with some high-yielding varieties) our general result would continue to be
true though the class of available projects would be different from the one just assumed.
Given \((r, R)\) if the tenant takes up the tenancy offer and implements project \(D\), his expected net income, denoted by \(Z_T\), is

\[
Z_T(r, R, D) = (1 - p(D))S + p(D)((1 - r)D - R) - c(D).
\]  

(5)

It is being assumed that in the event of success, the tenant’s income exceeds \(S\). That is, \((1 - r)D - R > S\). This coupled with assumption (3) and eq. (1) gives us eq. (5), since \(Y_T(r, R, F) = S\) and \((1 - r)D - R = Y_T(r, R, D)\).

The tenant’s choice of project, given \((r, R)\), will be denoted by \(D(r, R)\) and this is defined as

\[
D(r, R) = \arg\max_D Z_T(r, R, D).
\]  

(6)

In order to ensure that an optimal \(D\) exists and can be derived by the use of standard first- and second-order conditions, it is sufficient to assume – and from here on I am making this assumption – that \(c(D)\) is twice differentiable and everywhere strictly convex, more specifically, \(c'(D) > 0\) and \(c''(D) > 0\).

It is worth noting that the convexity of \(c(D)\) is a very reasonable requirement. This is because (1) it is sensible to assume that there exists an upper limit to the output that can emerge from a plot of land no matter how congenial the weather and as we try to implement projects which strive towards this upper limit, costs become arbitrarily high; and (2) as \(D\) approaches \(E\) (from the right) the probability of success approaches unity and it may be argued that, such projects, for which success is near certain, are arbitrarily costly.

8The case where this is not so is uninteresting and will therefore be ignored here. This will be obvious as we go along.

9Note that I am applying the limited liability clause on the gross yield from harvest. Another possibility would have been to first deduct \(c(D)\) from the harvest and then check whether this net yield is above \(S\) or not and then apply the limited liability clause. For the theorem below it does not matter which convention is followed, so I choose what appears to be mathematically simpler.

10This does not prove the convexity of \(c(D)\) but urges us towards it. It proves that if we have to choose between \(c(D)\) being convex everywhere and concave everywhere, it can only be the former. If \(D\) is represented on the horizontal axis of a diagram, \(c(D)\) would typically be a U-shaped curve on the interval between \(E\) and \(X\) marked on the horizontal axis, where \(X\) is the highest possible output under the best of weather conditions. It is now possible to state a condition on exogenous variables which ensures (3) holds in equilibrium. Let \(\tilde{c} = \min c(D)\). Consider:

\[
S > (Z^* + \tilde{c})F/E
\]  

(F.1)

where \(Z^*\) is as defined immediately after eq. (7). It is easy to show that if (F.1) is true and \(K\) is restricted to non-negative values then (3) must be true in equilibrium. The essential step involves noting that if (F.1) is true, then whenever \((r, R)\) is such that \((1 - r)E - R = Z^* + \tilde{c}\) is true, it cannot be that \((1 - r)F - R \geq S\).
The solution to (6) is now easy to see. Substituting (4) into (5) and differentiating, we get

\[ \frac{\partial Z_T}{\partial D} = \frac{[(E - F)(S - F(1 - r) + R)]}{(D - F)^2} - c'(D) \]

and

\[ \frac{\partial^2 Z_T}{\partial D^2} = \frac{[-2(E - F)(S - F(1 - r) + R)]}{(D - F)^3} - c''(D). \]

Given (3) and \( c''(D) > 0 \), it follows that \( \frac{\partial^2 Z_T}{\partial D^2} < 0 \). Hence \( Z_T \) is strictly concave in \( D \). It follows that in order to maximize \( Z_T \), it is enough to work out the first-order condition.

Given a mixed contract \( (r, R) \) and the tenant's choice of project \( D \), the landlord's expected net income, denoted by \( Z_L \), is

\[ Z_L(r, R, D) = (1 - p(D))(F - S) + p(D)(rD + R). \quad (7) \]

Recall that one of the things that the tenant has to decide is whether to at all take up the tenancy offer or not. It will be assumed that the tenant has a reservation (net) income of \( Z^* \) and he would take up the landlord's offer as long as he expects at least \( Z^* \) out of it.

Hence the landlord's problem is to choose \( r \in [0, 1] \) and \( R \geq 0 \), so as to

\[
\max Z_L(r, R, D), \\
\text{subject to (i) } D = D(r, R), \\
\text{(ii) } Z_T(r, R, D(r, R)) \geq Z^*. 
\]

The first constraint takes account of the fact that it is the tenant who chooses the project and (ii) \( \geq Z^* \) accounts of the tenant's freedom not to accept the landlord's contract. \( (r, R) \).

Let \( (r^*, R^*) \) be the solution to the above maximization problem. Then \( (r^*, R^*) \) is the tenancy contract that will prevail in equilibrium. We are now in a position to state the main theorem of this section.

**Theorem 1.** In the above model share tenancy is the dominant tenurial arrangement. That is, in equilibrium, \( R \) is always set equal to zero.

**Proof.** Suppose \( (r^*, R^*) \) is the tenancy contract that prevails in equilibrium and \( R^* > 0 \). The proof is completed by constructing another \( (r, R) \) which satisfies (i) and (ii) and for which the landlord earns a larger net income \( Z_L \).
Define \((r', R')\) such that \(R' = 0\) and

\[
r' = r^* + R^*/D(r^*, R^*). \tag{8}
\]

It will first be shown that

\[
Z_T(r', R', D(r', R')) \geq Z^*.
\tag{9}
\]

From (8) and \(R' = 0\), it follows that

\[
Z_T(r', R', D(r^*, R^*))
\]

\[
= (1 - p(D(r^*, R^*)))P
\]

\[
+ p(D(r^*, R^*))((1 - r^* - R^*/D(r^*, R^*))D(r^*, R^*) - c(D(r^*, R^*))
\]

\[
= Z_T(r^*, R^*, D(r^*, R^*))
\]

\[
\geq Z^*, \quad \text{since } (r^*, R^*) \text{ is an equilibrium.}
\]

From the definition of the mapping \(D(\cdot)\) [see (6)], we know

\[
Z_T(r', R', D(r', R')) \geq Z_T(r^*, R^*, D(r^*, R^*)).
\]

Hence, (9) must be true.

What remains to be proved is that

\[
Z_L(r', R', D(r', R')) > Z_L(r^*, R^*, D(r^*, R^*)). \tag{10}
\]

The first step towards this entails noting that

\[
D(r', R') < D(r^*, R^*). \tag{11}
\]

From the definition of \(D(\cdot)\) and applying the first-order condition to (5), we know

\[
\frac{\partial Z_T}{\partial D}(r^*, R^*, D(r^*, R^*)) = 0. \tag{12}
\]

It is easy to check using (5), (8) and \(R' = 0\), that
\[
\frac{\partial Z_T}{\partial D}(r', R', D(r^*, R^*)) = \frac{\partial Z_T}{\partial D}(r^*, R^*, D(r^*, R^*)) - p(D(r^*, R^*))R^*/D^* < 0. \text{ by (12).}
\]

Hence it follows from the second-order condition that if \( D' \) is such that

\[
\frac{\partial Z_T}{\partial D}(r', R', D') = 0,
\]

then \( D' < D(r^*, R^*) \). Since \( D' = D(r', R') \), we get (11).

Now, it may be checked that (10) is true if and only if

\[
(1 - (E - F)/(D' - F))(F - S) + ((E - F)/(D' - F))(r'D' + R') > (1 - (E - F)/(D^* - F))(F - S) + ((E - F)/(D^* - F))(r^*D^* + R^*). \tag{13}
\]

where \( D' = D(r', R') \) and \( D^* = D(r^*, R^*) \). Substituting (8) and \( R' = 0 \) in (13) and using (11), it can be checked that (13) is true if and only if \( S/F > 1 - r^* - R^*/D^* \). But the latter must be true given assumption (3). Hence (10) must be true. Q.E.D.

It must be pointed out that while my model uses the Stiglitz-Weiss formulation of limited liability, a more elaborate formulation would assert that under limited liability a tenant would be assured of \( S \) units of output only as long as this does not entail the landlord actually having to pay the tenant. Let us call this 'weak limited liability'. Note that our limited liability clause could require that not only does the landlord forego his rental claim but in some really bad years he may actually have to pay the tenant. This would happen if \( X \) is less than \( J \) in fig. 1. The weak limited liability clause does not go that far. If we had used the weak limited liability clause, (2) would have to be written as follows

\[
Y_L(r, R, X) = \max \{0, \min \{rX + R, X - S\}\};
\]

and (1) also would have to be changed since \( Y_L = X - Y_T \).

In terms of fig. 1, the landlord's income function would be \( OJCD \) and the tenant's income would be shown by \( OHAB \).

As will be immediately transparent, we now have a more complicated picture of when share tenancy will dominate and when the fixed rental system will dominate. If the bad and good output levels occur between, respectively, \( OJ \) and \( JC' \), fixed rentals will dominate. But it is clear that share

\[\text{footnote: I owe this observation to Siddiq Osmani.}\]
tenancy could still dominate over the fixed-rental system in many cases. This would happen for sure if a failed project yields an output between $J$ and $C$.

Hence, using the weak limited liability clause, we could have a more sophisticated model of the domination of alternative tenurial arrangements. But in this paper I shall continue to focus on our more simple model.

A question which naturally arises is that if instead of a one-period model, as above, we had a multi-period model, would my analysis still be valid? Would not the ability of agents to carry over imbalances in account in one period to the next one affect the argument? More specifically, would we not expect that in such a model a system like the one discussed by Kotwal (1985) which entails a fixed rental with positive and negative side payments to compensate for fluctuations in output caused by the weather to dominate over other tenurial arrangements?

The answer is no for two reasons. First, in Kotwal’s model, the random term in the production function is additive which allows for easy identification of output shifts caused by the weather. Secondly, and more importantly, Kotwal’s tenant does not confront a choice of technique problem and so his model does not have any scope for technique moral hazard which is central to my model.

Suppose we do have several periods. It is true that a non-payment of rental over a few periods may be carried over. But this cannot be done endlessly. A debt carried over for too many periods may be construed as a case of bonded labour in terms of the legal definition [see Government of India (1976)] and a landlord must entertain the possibility of not being able to recover the full rent for reasons of society or law. Moreover, a tenant’s life being finite, there is no way of guaranteeing that a tenant will owe the landlord no unpaid rents at the time of his death. And since the practice of making a child work off a father’s debt is no longer a common practice, a multi-period model cannot rule out the possibility of a tenant being unable to pay the full rent because of extreme poverty. If we do allow some transfers from one period to another, all we would have to do is to work with present values of income, instead of income. Thus in eqs. (5) and (7) we would have to use the present values of, respectively, the tenant’s and the landlord’s incomes over time, instead of $Z_T$ and $Z_L$. With this and with the tenant choosing between projects or techniques [instead of an input, as in Kotwal (1985)] we would, as before, get the result that in some situations, share tenancy would be dominant.

It is also noteworthy that tenancy relationships are often of brief durations. Walker and Ryan (1990, p. 173) in their detailed study of India’s semi-arid tropics observe: “The brief duration of most leases represents one feature of tenancy that is widely shared by the study villages. The majority, or about 60 percent of the sharecropping and fixed rent contracts, were for
only one cropping season'. They go on to suggest that the fear of tenants acquiring permanent rights on land is probably what prompts landlords to go in for short-duration contracts. But for us the upshot is that in the light of this the scope for multi-period levelling out of income fluctuations may not be very large in practice. Hence my focus on a single-period relation need not be too untenable an abstraction.

Finally, I wish to draw attention to the fact that, as in Shetty's (1988) model, I have restricted attention to 'linear landlease contracts'. Hence \( R \) is restricted to non-negative values and non-linear contracts are ruled out by assumption. A wage labour system, which amounts to \( r=1 \) and \( R<0 \), was thus ruled out by assumption. This seems reasonable in a model of absentee landlordism [see also Shetty (1988, footnote 7)] but giver that Theorem 1 suggests that in equilibrium \( R \) takes a corner value, to wit, zero, for purely theoretical reasons it is interesting to check what would happen if no non-negativity constraint is placed on \( R \).

To understand this, it is useful to first find out the Pareto-optimal contracts. Clearly if project \( D \) is implemented, the total income of the landlord and the tenant is \( E-c(D) \). That is,

\[
Z_L(r, R, D) + Z_T(r, R, D) = E-c(D).
\]

Hence, for Pareto optimality, it is necessary that project \( \tilde{D} \) gets chosen, where

\[
\tilde{D} = \arg\min c(D).
\]

Let us write \( \tilde{c} \) for \( c(\tilde{D}) \). Next, note that if \((r, R)\) is such that

\[
(1-r)F-R \geq S, \tag{14}
\]

then the limited liability clause has no bite and the tenant will choose the most efficient project, namely \( \tilde{D} \), since the tenant's gross income will be \((1-r)E-R\) no matter which project is chosen. Hence, if the landlord chooses \((r, R)\) satisfying (14) Pareto efficiency is ensured.

Hence, if the landlord wants to maximize his own income, he should ensure that \((r, R)\) satisfies (14) and in addition that the tenant gets only his reservation income, that is,

\[
(1-r)E-R-\tilde{c} = Z^*. \tag{15}
\]

Thus any \( r \in [0, 1] \) and any real number \( R \) which satisfy (14) and (15) will be selected by the landlord in equilibrium, if we do not place a non-negativity requirement on \( R \).
It is easy to check that, if $c + Z^* \geq S$, then $R = -c - Z^*$ and $r = 1$ is a solution to this problem. That is, a wage labour system with wage equal to $-c - Z^*$ is a solution. There are other solutions but [given (F.1) in footnote 10] it follows that all these entail a negative $R$. It may be argued that with an absentee landlord and $r = 1$, there would be very serious labour moral hazard problems. This was not modelled explicitly because, as was explained earlier, inputs like labour and effort were kept out of the model in order to focus attention on the technique moral hazard problem. But, just to get a glimpse into the problem, suppose a tenant has to put in effort into the land for success. That is, without effort, no matter which project is chosen output will be $F$. In such a situation it is obvious that if a contract has $R = -c - Z^*$ and $r = 1$ (that is, a tenant's income has no relationship with yield), then the tenant will put in zero effort. In order to induce effort out of him $r$ has to be less than 1. How much less will depend on the cost of effort. As $r$ become less than 1, $R$ will go from $-c - Z^*$ towards 0. While it is conceivable that we will get an equilibrium with $R = 0$ and $0 < r < 1$, what is most reasonable to expect is an equilibrium with $R < 0$ and $0 < r < 1$. This in itself is interesting. It amounts to a system of sharecropping with a fixed side payment of $R$. It will not resemble a wage contract system since typically $R$ will be less than $S$, and so, in the event of a failure, the fixed payment of $R$ will go unnoticed since it will anyway be more than made up by the remission under the limited liability clause. In the event of success the tenant will get $(1 - r)D - R$.

In brief, if we restrict attention to only linear land lease contracts, share tenancy would come out as dominant. If, however, we allow the fixed payment to be negative and take account of labour moral hazard, the dominant system would typically be share tenancy with a fixed side payment from the landlord to the tenant. There remains, however, much work to be done on combining the present model with labour moral hazard in a more explicit and rigorous fashion.

4. Conditions for the disappearance of share tenancy

The above model may be described as the pure risk model because the principal decision there is of how to respond to the uncertainty inherent in nature. In such a model, it has been proved, share tenancy would be the dominant tenurial arrangement. If we combine this risk model with what I shall label as the 'productivity' aspect of decision (which allows us to bring in the well-known Marshallian arguments against share tenancy), then we get a framework in which the fixed-rental system, share tenancy or the mixed-rental system could dominate depending on whether the risk or the productivity considerations are larger and larger by how much. Such a construction would allow us to discuss the conditions under which we could
expect share tenancy to disappear. This section takes an informal look at this problem.

The way we can introduce the productivity problem in the above model is to assume that a tenant can choose to put in different amounts of labour, \( L \) (or any other input or vector of inputs, for that matter). What this does is to shift the expected yield from land, \( E(I) \). Having chosen the amount of labour, he can choose between projects of different riskiness [but with the same expected yield of \( E(L) \)]. This latter decision problem is identical to what we have encountered in the previous section.\(^{12}\) It is of course expected that labour is costly. If \( w \) is the market wage then \( w \) can be treated as the opportunity cost of each unit of labour.

The decisions of labour use and riskiness of project may be described as, respectively, the productivity and the risk decisions. If in a particular economy the former problem was not there, then, as we already know from Theorem 1, share tenancy would prevail in equilibrium. If, on the other hand, the only decision problem of the tenant was the productivity one, then as we know from Marshall, fixed-rental tenancy would dominate. This is simply because in share tenancy the tenant gets a fraction of the yield from land but he bears the entire cost of inputs.\(^{13}\) This introduces a wedge in the marginal calculus and results in an inefficient use of inputs.

It is now easy to see the conditions under which we would expect share tenancy to give way to the fixed rental arrangement. Our analysis suggests that share tenancy will be less predominant in areas (i) where production is relatively weather-independent (e.g., irrigated areas) or (ii) where the cultivator has little latitude in terms of the choice of projects of varying riskiness. Also, if (iii) there is considerable substitutability between land and other inputs, the fixed-rental system will be more prominent. To see this one has to simply consider the other extreme where inputs have to be used in fixed proportions. In that case, once the amount of land is specified the amount of other inputs that can be used is well-defined. The productivity decision is therefore trivial and the risk aspect is dominant, thereby laying out the basis of Theorem 1.

Finally, (iv) in relatively well-off areas, where incomes are unlikely to drop too low even in bad weather, share tenancy is unlikely because the limited liability clause in such an area may not have to be invoked. So that clause cannot influence the tenurial structure.

It should be clear that as a condition for the disappearance of sharecropping, (iv) has a different status from (i)–(iii), because (iv) also happens to be

\(^{12}\)While, for ease of exposition, I speak as if the two decisions [(i) how much labour to use and (ii) which project to implement] are taken in a sequence, actually these will be simultaneous and indeed one decision may well depend on the other.

\(^{13}\)I am, of course, ignoring here the case of input-sharing share tenancy, which could, in some circumstances, remove the distortion.
the precondition for explanations of the incidence of share tenancy of the kind captured in (i), (ii) and (iii). This is because, in this paper the focus is on the consequences of the limited liability axiom. Where the axiom is void, there may be other reasons for share tenancy but the explanation in this paper is certainly not the relevant one.

There remains considerable scope for expanding the institutional context of the debate between share tenancy and the fixed-rental system, by recognizing the role of law and social sanctions. Basu (1989) demonstrates that under legal institutions which are quite widespread in developing economies and which do not allow for the adjustment of rents over time, the fixed rental system can have an adverse effect on innovative activity. One possible line of research which may yield insights into the dynamics of tenurial systems is the relation between innovative activity and alternative tenurial systems. This relation would however depend critically on the nature of legal and social institutions.

5. Concluding remarks

Returning to the subject with which this paper began, I would like to reiterate that in LDCs the limited liability axiom need not be a matter of law or social custom but is nevertheless a reasonable assumption. Before going into this, it is worth noting that a class-based explanation of the limited liability clause has been discussed in the literature [see Adnan (1985)]. The argument is based on the fact that the landlords as a class and in the long run may not benefit from exploiting tenants to the point that is feasible in an immediate context. This is because such extreme exploitation may in the long run destroy the very class structure which makes the exploitation possible. However, from this to conclude that exploitation will not be pressed to its immediately feasible limit it is necessary to explain why what is in a landlord’s class-interest would also be in his self-interest or to explicitly

14This could mitigate what would otherwise appear to be conflicting between my theoretical findings and Rao’s (1971) empirical observations.

15Recently, de Janvry, Fukui and Sadoulet (1989) have considered an environment similar to that in my model, namely, one with ‘highly risky income, extreme levels of poverty and lack of insurance’. Their model of share tenancy is, however, very different from mine and assumes ‘safety-first behavior’. Another approach to explaining sharing risks is to explicitly consider the repeated-nature of most agrarian relations. This is done by de Janvry, Fukui and Sadoulet and also by Coate and Ravallion (1989), though the two papers end up reaching very different conclusions concerning efficiency. There ought to be considerable scope for empirical investigation into the relation between tenurial forms and yield uncertainty. Though there has occurred some fairly meticulous work in this area, the evidence that exists and has been analyzed [for example, in Anderson and Hazell (1989)] does not seem to be suited for testing the kind of hypothesis suggested in this paper. But this is an objective worth keeping in mind.
defend the position that individuals act in their class-interest whether or not that goes against their self-interest.

Custom-based explanations have also been made in the literature. Even in exploitative relationships, patronage has often been a prominent element [see, for example, Epstein (1967), Breman (1974)], which entails that the landlord or the employer has some responsibility to provide subsistence consumption to a tenant or a labourer in bad years. This could take the form of direct assistance or the remission of a part of the rent... Writing about pre-war Japan, Ishikawa (1975, p. 463) remarks that even fixed rental contracts turned out to have an element of the 'ordinary cropsharing arrangement' because in years of crop failure there would occur some reduction in rent.

While these are indeed cases of the limited liability clause at work, even in the absence of class-based or custom-based explanations, the limited liability clause must automatically be potentially there in a sufficiently poor economy because in the event of a crop failure (or two or more successive crop failures) a tenant may just not have the wealth to fulfil his contract. In such a case, rent remission becomes inescapable.

I use the word 'potentially' because in such a poor economy landlords would take precautions to minimize the likelihood of losing out on rent because of crop failure. This is one reason why landlords prefer tenants to be relatively better-off -- a consideration which does not seem to appear in hiring wage labour. Shetty (1988) builds a model where wealthier tenants are offered better terms by the landlord. Though his argument is different, it is interesting that limited liability is an essential feature of his model.

Even in non-hierarchical relationships one can find the institution of reciprocity functioning as a mechanism of insurance against economic disaster [see Platteau and Abraham (1987)].

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