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**Limited Liability and the Existence
of Share Tenancy**

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LIMITED LIABILITY AND THE EXISTENCE OF SHARE TENANCY

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1. Introduction

The early laws of aerodynamics had seemed to suggest that the bumble-bee cannot fly. Consequently, the flight of the bumble-bee 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 economies[1] - 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 realisation,[3] that a landowner could do better if, instead of 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 (eg., 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, 1977; Allen, 1982; Basu, 1984).[4]

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' as developed by Stiglitz and Weiss (1981). 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 quite self-evident and needs no external justification.

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. It will be shown that share tenancy has the advantage of minimising 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.

My model could be seen as a reinstatement of the early view - for example, the one expressed in Cheung (1969) - that share tenancy is a response to the uncertainty of agricultural output. My argument, though, is very distinct from that of Cheung.

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 (eg., 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 - 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 $r = 0$, $R > 0$, it is a fixed-rental contract.

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 share S; and he fulfills 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

$$Y_T(r,R,X) = \max \ \{(1-r)X - R, \ S\} \tag{1}$$

and the landlord's income, Y_L, is given by

$$Y_L(r,R,X) = \min \ \{rX + R, \ X - S\} \tag{2}$$

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 <u>as if</u> they have non-neutral

attitudes to risk. The tenant will act risk-loving and the landlord will act risk-averse. This is transparent as soon as we represent equations (1) and (2) on a diagram as in Figure 1.

In Figure 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 convexify the tenant's earning's curve and concavify the landlord's earning's 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 happen 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 and output of x_1' and $x_2' < x_1'$. Assume also that $x_1' < \frac{S+R}{1-r} < x_1$. 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. Now, what does a lowering of r imply in Figure 1. It is easy to see that it makes the AB segment steeper and CD flatter.[5] That is, it accentuates the conflict in the two agents' attitude towards risk.

Figure 1
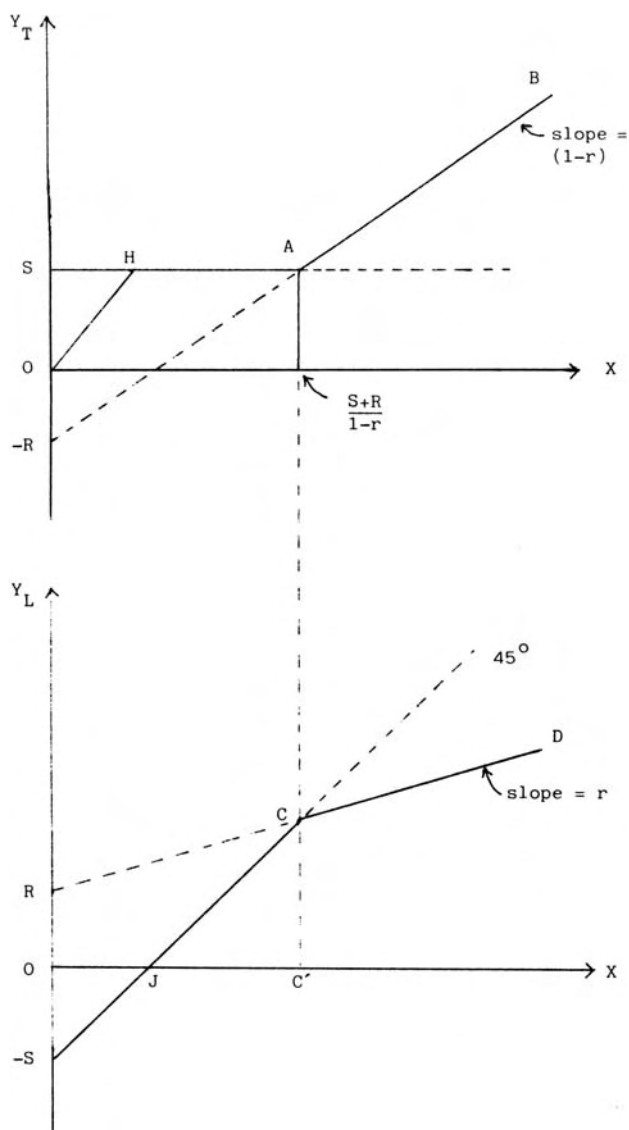
Inverting the above argument one can see that it is in the landlord's interest to raise r and thereby make their attitudes to risk more compatible which, in turn, would imply that the tenant's choice of project from his feasible set may be more in line with the landlord's preference. Hence, moving away from the fixed rental system towards share tenancy enables the landlord to influence the tenant's choice behaviour vis-a-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 land 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

$$S > (1-r)F - R \tag{3}$$

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

$$p(D) = (E - F)/(D - F). \tag{4}$$

We use $c(D)$ to denote the cost of implementing project D.

Given (r,R) if the tenant takes up the tenancy offer and implements project D, his expected net income, denoted by Z_T, is

$$Z_T(r,R,D) = (1 - p(D))S + p(D)((1 - r)D - R) - c(D). \tag{5}$$

It is being assumed that in the event of success, the tenant's income exceeds S.[8] That is, $(1 - r)D - R > S$. This coupled with assumption (3) and equation (1), gives us equation (5), since $S = Y_T(r,R,F)$ and $(1-r)D - R = Y_T(r,R,D)$.[9]

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

$$D(r,R) = \text{argmax } Z_T(r,R,D) \qquad (6)$$

In order to ensure that the optimal D can be derived by the use of standard first and second-order conditions, I shall take it that Z_T is differentiable and concave with respect to D. The concavity is ensured if $c(D)$ is sufficiently convex in D.

It is worth noting that the convexity of $c(D)$ is not an unreasonable expectation, since it is plausible that there will exist 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.[10]

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

$$Z_L(r,R,D) = (1 - p(D))(F - S) + p(D)(rD + R) \qquad (7)$$

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 to get atleast Z* out of it.

Hence the landlord's problem is as follows:

$$\underset{\{r,R\}}{\text{Max }} Z_L(r,R,D)$$

subject to (i) $D = D(r,R)$

and (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) takes account of the tenant's freedom not to accept the landlord's contract, (r,R).

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

<u>Theorem 1</u>. In the above model share tenancy is the dominant tenurial arrangement. That is, in equilibrium, R is always set equal to zero.

<u>Proof</u>. Suppose (r^*, R^*) is the tenancy contract that prevails in equilibrium and $R^* > 0$. The proof is completed by constructing another (r,R) which satisfy (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

$$Z_T(r',R',D(r*,R*)) = (1-p(D(r*,R*)))S + p(D(r*,R*))(1-r*-R*/D(r*,R*))D(r*,R*)$$

$$- c(D(r*,R*))$$

$$= Z_T(r*,R*,D(r*,R*))$$

$$\geq Z*, \text{ since } (r*,R*) \text{ is an equilibrium.}$$

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

$$\frac{\partial Z_T}{\partial D} (r',R',D(r^*,R^*)) = \frac{\partial Z_T}{\partial D} (r^*,R^*,D(r^*,R^*)) - \frac{R^*}{D^*} \ p(D(r^*,R^*))$$

$$< 0, \text{ by } (12).$$

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

$$(1 - (E - F)/(D' - F))(F - S) + ((E - F)/(D' - F))(r'D' + R')$$

$$> (1 - (E - F)/(D^* - F))(F - S) + ((E - F)/(D^* - F))(r^*D^* + R^*) \qquad (13)$$

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.)

Before moving on, 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 <u>only as long as this does not entail the</u>

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 Figure 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 Figure 1, the landlord's income function would be OJCD and the tenant's income would be shown by OHAB.[11]

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 tenancy could still dominate over the fixed-rental system in many cases. This would happen for sure if a failed projected yields an output level 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.

4. Conditions for the Disappearance of Sharecropping

The above model may be described as the pure risk model because the principle 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 either the fixed-rental system or share tenancy could dominate depending on whether the risk or the productivity considerations are larger. 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, $E(L)$. 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 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 (eg., 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 the precondition for explanations of the incidence of share tenancy of the kind caputered in (i), (ii) and (iii).[14] 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.

5. Concluding Remarks

Returning to the subject with which this paper began, I would like to reiterate that in backward economies where the weather has considerable influence on agriculture, the limited liability axiom need not be a matter of law or social custom but is almost a self-evident proposition. 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 such 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 defend the position that individuals act in their class-interest whether or not that goes against their self-interest. The latter seems untenable to me, and the former is still an open question. Till it is resolved, this particular line of argument has to be treated as an incomplete one.

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.[15] 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 <u>potentially</u> 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 <u>have</u> 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 minimise 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. In a sense sharecropping could be viewed as a tenurial arrangement with an element of a built-in limited liability clause. Viewed in this way it becomes clear that if there is an <u>underlying</u> limited-liability clause, then share tenancy would be distorted less by this than would a fixed-rental contract.

Footnotes

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

2. To cite a few references: Cheung (1968), Bardhan and Srinivasan (1971), Newbery (1975), Stiglitz (1974), Mazumdar (1975), Bell and Zusman (1976), Hallagan (1977), Allen (1982), Basu and Roy (1982), Binswanger and Rosenzweig (1984), Quibria and Rashid (1984), Bardhan (1984), Singh (1987).

3. For a clear statement, see Marshall (1920).

4. See, 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.

5. Also, the kink moves to the left.

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.

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

9. Note 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.

10. This does not prove the convexity of $c(D)$ but urges us towards that. It proves that if we have to choose between $c(D)$ being convex everywhere and concave everywhere, it can only be the former. Note that we do not deny that at some levels of D, an increase in D (i.e., an increase in the riskiness of the project) may lower $c(D)$, which is equivalent to saying that a riskier project has a higher expected (net) yield.

11. I owe this observation to Siddiq Osmani.

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.

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

15. 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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