Share, Size and Subsistence

Revisiting Some Old Controversies of Tenancy

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The last fifteen years or so have seen a resumption of the debate over share-tenancy. An attempt is made in this paper to construct a theoretically vigorous model of tenancy based on assumptions which are realistic to India.

"BUT this deplorable method of cultivation, the daughter of necessity and mother of misery, has nothing in common with the good farming established in certain districts".

"This subject may be easily despatched; for there is not one word to be said in favour of the practice and a thousand arguments can be used against it."

These remarks made by the Marquis of Mirabean and Arthur Young, respectively,[1] refer to the institution of share tenancy. They reflect the passions and controversy that this subject has generated. Mill [1848] and Higgs [1894] had approved of share tenancy and Smith [1776] and Marshall [1920] disapproved it.

Despite Young's comment, the subject was not "easily despatched". The last 15 years or so have seen a resumption of this debate;[2] and, if the language has not been as strong as the above quotes, it is only because our notions of propriety have undergone some changes in the last two centuries.

Many questions remain unsettled. One of the most generalised theoretical models[3] is that of Bardhan and Srinivasan (1971); however, it is based on assumptions which are admittedly none too realistic, particularly in the Indian context. Bagchi (1973) describes a decidedly more realistic picture of share tenancy, but he does not attempt to make his analysis rigorous. What we try to do, in this paper, is to construct a theoretically rigorous model based on assumptions which appear to be realistic in the Indian set up. It should be noted that, while parcelisation of land is discussed by Bardhan and Srinivasan as a digression, it is one of the principal characters in our analysis.

Observations on Institution of Share-Tenancy

Share-tenancy is a system of agricultural production in which the landlord (the owner of land) leases out his land to a tenant. He may, if he wishes, parcel his land to more than one tenant. The tenant cultivates the land and gives a fixed proportion, agreed upon in advance, of the total output to the landlord, who could be thought of as a sleeping partner in this venture. Within this general framework, share-tenancy has taken diverse forms. For theoretical simplicity we restrict ourselves to certain specificities. We shall assume that only one kind of commodity is produced on these tenant farms, and that land and labour are the only two factors of production. It will also be assumed that the share-tenant cultivates his land with his own labour and that of his family members. He does not hire labour.

Cheung (1968), in his celebrated paper, assumes that not only do landlords enter into contracts for a fixed percentage share of the total output but that the contracts stipulate the amount of labour that tenants have to put in. He cites examples from pre-revolution China, and there is some meagre evidence of labour contracts in nineteenth century France. But contracts of this kind are certainly very rare and probably non-existent in India.

Cheung and others assume that, in the rural sector, there exists a market wage at which individuals can hire and sell as much labour as they wish. The labour market is assumed to be competitive: the wage rate is fixed for each individual, and at the same time it is determined by the collective action of individuals. This is again somewhat unrealistic in India, because labour markets here are frequently rationed markets with rigid wages and excess supply. Thus individuals can seldom be sure of finding employment at the going wage rate, as pointed out by Bagchi. It is not too unrealistic to assume that the share-tenants in such markets have no viable alternatives. This does not mean that, if they are evicted from their farms they will necessarily perish, but that alternative opportunities are so meagre and uncertain that they are likely to be treated as non-existent by the tenant. It should be clear that in reality wealthy tenants also exist, who lease in land from a number of small farmers; livelihood is never a real problem for them. We shall, however, concentrate on the more common and typical smaller tenants.

In Cheung's model, the percentage share or rental, r, of the landlord is determined separately for each landlord-tenant contract. The empirical evidence on r shows a remarkable constancy of r around 0.5, i e, the landlord gets 50 per cent of the output (see Rudra, 1975). This makes Cheung's assumption appear somewhat unrealistic. Whether r is institutionally determined or competitively fixed as assumed by Bardhan and Srinivasan, we shall assume that to individual agents it is parametrically given.

We have already mentioned that the parcelisation of land is an important variable in our analysis. This provides some interesting light on the empirically well-known inverse relationship

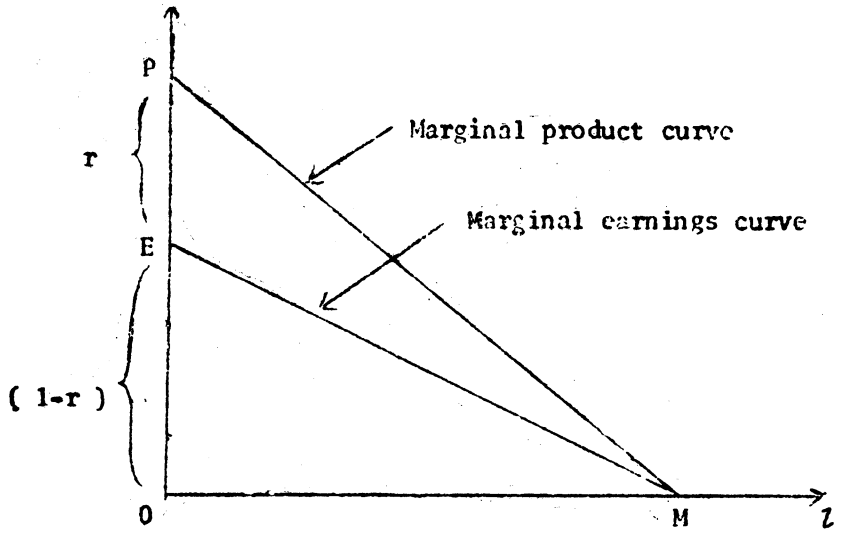
TABLE 1: VALUE OF LAND PER ACRE FOR TENANT FARMS

(in rupees)

Size Groups (acres)	Ahmednagar	Nasik
0-5	600	289
5-10	100	258
10-15	137	255
15-20	131	180
20-25	124	109
25-30	199	150
30-50	214	189
above 50	166	226

Source: Farm Management Studies: Maharashtra, 1955/6, Directorate of Economics and Statistics, Government of India, New Delhi.

FIGURE 1



between farm size and productivity. What we actually look at is the relationship between farm size and land quality or 'fertility' as Sen [1964] calls it.

It has been generally observed that smaller farms are associated with more fertile land. Our interest is mainly in farms under share-tenancy. Evidence on this is very difficult to come by; but the table below is taken from a farm management survey and is quite revealing. While the value of land per acre is not the same thing as land productivity, and it is possible to think of situations where the two diverge, it appears to us that, given the limitations of data, it is not unreasonable to use the value of land as a proxy for land quality. Table 1 reveals a striking inverse relationship for farm sizes below 25 acres. In fact, considering both Ahmednagar and Nasik, the relationship is violated only once for farm sizes between 5-10 acres in Ahmednagar. Some explanation is needed for this inverse relation. In the ensuing pages, we try to show how the institution of share tenancy has built-in reasons for the emergence of the inverse relation.

The Table shows that, for tenant farms above 25 acres, the inverse relation breaks down; and if there is any relation it is a direct one. This is not at all surprising given that above this size, it is very likely that the market structure of tenancy is quite different, with big owners leasing-in land from small owners.

Theory

We consider a landlord who owns A acres of land which he leases out to share-tenants.[4] Each tenant receives a plot of size a acres on which he is free to choose the amount of labour l, that he puts in. The output, q, from each plot (where the number of plots $n = \frac{A}{a}$) is a function of a and l: $q = q(a, l)$. For simplicity, we assume that this function is homogeneous of degree one (i e, that there are constant returns to scale), though it can be shown that our results do not hinge critically on this assumption.[5] Let the proportion of this output that goes to the landlord be r.

A tenant's behaviour on a farm is crucially dependent on the alternative opportunities open to him. Our analysis is restricted to poorer tenants who lease-in land from only one landlord. How much labour will the tenant choose to put in on his plot?

Let MP be the marginal product of labour on a tenant's farm. For every unit of output produced, the tenant earns (1-r). The tenant's marginal earnings curve is labelled ME in Figure 1.

The amount of labour that the tenant puts in depends on the opportunity cost of labour on this farm. This Cheung takes to be the market wage, w, as (according to Cheung) does Mashall. But, as we shall see later, Marshall nowhere asserts the opportunity cost to be equal to the prevailing wage. He states that the tenant will work as long as his marginal earning is greater than "the return required to remunerate the tenant for one dose" (observe the carefully selected ambiguous expression) of labour.

Let us assume that an hour of leisure is worth b units of output to the tenant. Then, like Marshall, if we assume this to be constant, the tenant's indifference curves in the leisure-income space are straight lines with a slope of -b. The opportunity cost of labour used on his farm is given by max (b, w), i e, the remuneration from the best alternaitve.

Bagchi [1973] has argued that, typically, wages [or, rather, expercted wages) tend to be very low as they are determined by the large supply of landless labourers who comprise the poorest section of society. So, usually max (b, w) = b. For simplicity, we shall assume that the labour market is not open to the tenant which implies that for the tenant w = 0.

There is one proviso in the above type of preference structure between leisure and income. There will typically exist a subsistence income, T, for which labourers would be prepared to put in any amount of work as assumed by Bagchi [1973] and others.[6]

If we consider the objective function usually ascribed to tenants — in which the tenant maximises his earnings in excess of the opprtunity cost, (1-r)q (a, l) — b l, and if this is maximised for $l = l^{\circ}$, then, given the subsistence argument the objective function can be expressed as follows:

If $T > (1\text{-}r)q(a, l^{\circ})$ then the tenant would put in as much labour as is necessary to produce T — i e, he chooses l such that $(1\text{-}r)q(a, l) = T$.

Howover, if $(1\text{-}r)q(a, l) > T$, then the tenant chooses in order to maximise $(1\text{-}r)q(a, l) - bl$, in which case, by definition he chooses l°.

Given that r is institutionally determined, clearly l is a function of a. So $l = l(a)$.

The landlord's aim is simply to maximise the total rental accruing to him with the size of each tenants plot as the control variable:

$$\text{Max}_{a} \; A \, r \, q \, [a, l(a)] \qquad \ldots (1)$$

where $l = l(a)$ is determined by the tenant. Note that the landlord exercises an indirect control over the tenant's labour by choosing the size of plot for each tenant.

Define a* and l^* as those values of a and l for which

$$(1\text{-}r) \; (a, l) = T \qquad \ldots (2)$$

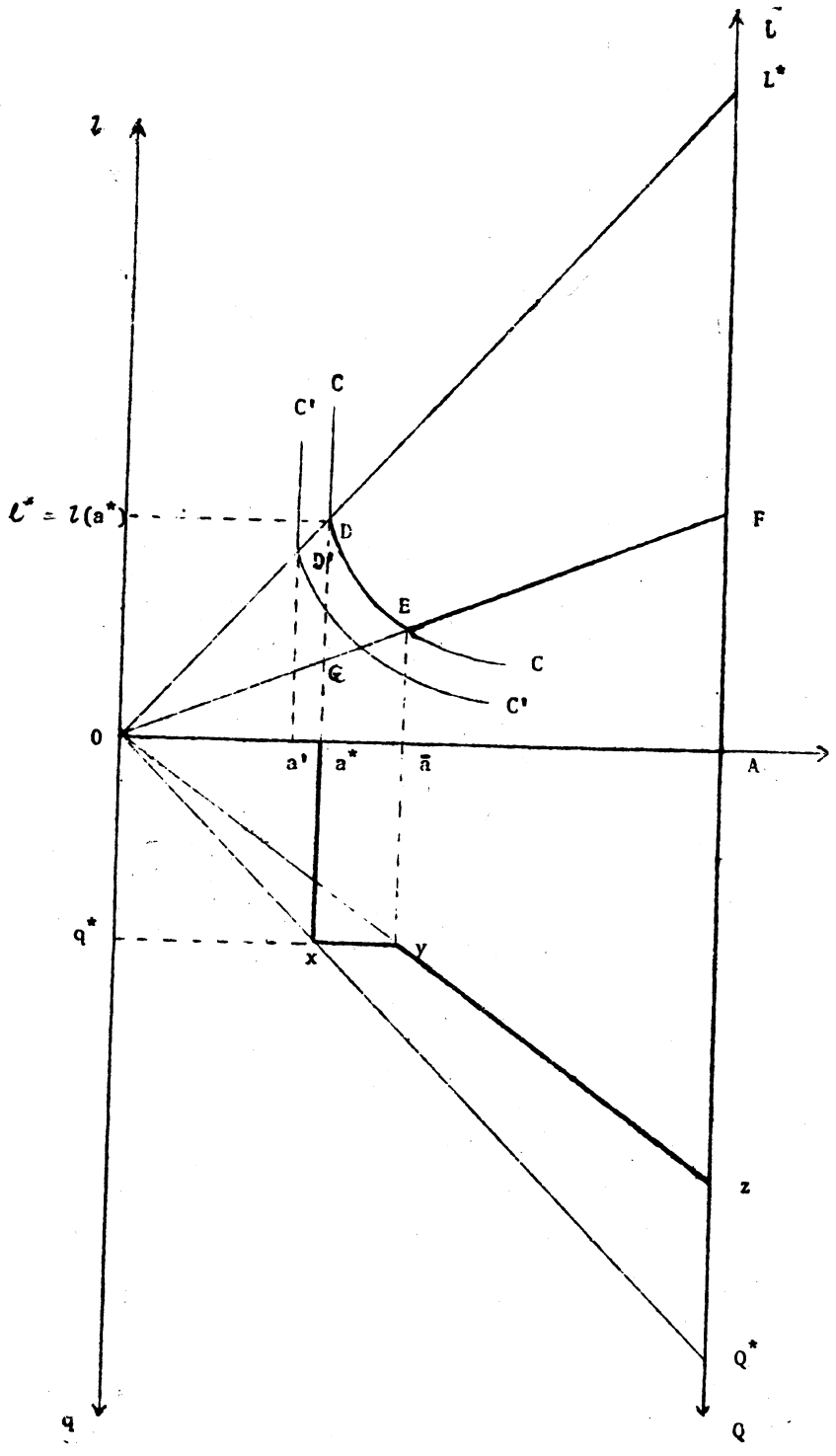
$$\text{and } q_l(a, l) = 0 \qquad \ldots (3)$$

In other words, a* is a plot which is so small that, to earn a subsistence income T from it, the tenant requires to apply enough labour so that the marginal product of labour goes to zero.

From this it can be proved that $a = a^*$ maximises the landlord's rental, i e, a* is the solution to (1). The rigorous mathematical proof is relegated to an appendix which may be skipped by the less fastidious reader. In Figure 2 we give a geometric demonstration of the result.

Let cc be the isoquant for the out-

FIGURE 2



put level q(a, l) = $\frac{1}{1-r}$ T; i e, if a share-tenant operates on cc he will be earning a subsistence income. Such an isoquant will be called the subsistence isoquant. Let D be a point on cc where the marginal product of labour becomes zero. Then a*, as defined by equations (2) and (3) is as shown in the figure. If a tenant was given a* acres of land, he would work so as to be at point D.

If E is a point on cc where the marginal product of labour is equal to $\frac{b}{(1-r)}$, then (since q(a, l) is homogenous of degree one) all along the ray OEF the marginal product of labour is equal to b/(1-r).[7]

Hence, if the tenant was a simple maximiser of (1-r) q(a, l) — bl, he would always choose l such that ql (a, l) = $\frac{b}{1-r}$ i e, given any a, he would choose a point on OEF vertically above that a.

For any size of plot between a* and ā, he would by this argument choose a point on GE, but that would give him a below-subsistence earning since GE lies below cc. Hence, the tenant will choose a point on DE.

For all a $>$ ā the tenant will clearly choose points on EF. Hence the line DEF — which we shall refer to as the "Tenant Labour Supply Curve" — shows the function $l = l(a)$. The curve xyz in the lower quadrant of the figure shows the function q = q [a, l(a)] — which we shall refer to as the "Tenant Output Curve" — indicating the output from the tenant farm for different plot sizes.

We now have all the ingredients for describing the equilibrium. Since r is constant, the solution to (1) the landlord's total rental is the same as the solution to the maximisation of the tenant's total output: Max a $\frac{A}{a} \cdot q(a, l(a))$. The value of the latter is easily depicted in the figure: for any size of plot, a, the output from each plot is given by the "Tenant Output Curve" (xyz) and all we have to do to get the total output from all tenants is to multiply this by $\frac{A}{a}$ This is done by drawing a line from the origin through that point on the tenant output curve which is vertically below a — and then extending it to the axis AQ. The distance from A to such a point gives the total output on the landlords entire estate: $\frac{A}{a}$ q(a, l(a)). Note that the point A on the horizontal axis shows the total land owned by the landlord.

For example, if a landlord parcels out his land in plots of size a*, each tenant will choose to put in l(a*) units of labour. The output from each tenant's plot will be q* (which is, in fact, equal to $\frac{T}{(1-r)}$, and the total output on the landlord's entire estate is given by Q*.

The landlord's optimum parcelisation is now immediately obvious. It is clear that a = a* maximises the landlord's total rental $\left(\frac{A}{a}\right)$ r q [a, l(a)]. Hence a rational landlord would parcel his land into $\frac{A}{a}$ number of pieces.

Note that, at equilibrium, the labour input on the landlord's estate, A, is maximised at AL*. The total labour input corresponding to different degrees of parcelisation may be derived from the figure by drawing rays though DEF and extending these to the AL ordinate.

The landlord's exercise in parcelling land to maximise his total rental has certain significant implications for the relation between farm size and land productivity. It can be shown that the

size of parcel leased out is dependent upon the quality of land that the landlord owns.

Variations in land quality are caused, as recent agronomic studies have pointed out, more by the soil moisture content of the land than by differences in soil texture or quality. Moreover, soil moisture differentials are much higher and tend to occur at the village level, while soil quality changes only over much larger distances and are therefore less relevant [see Roy, 1979].

In terms of simple production function, differences in the quality of land can be treated as follows:

If $f(a, l)$ is the production function when land is more productive, then $f(a, l) = q(\lambda a, l)$ for some $\lambda > 1$.

The formal proof of the inverse relation can be rather complex geometrically. Thus we prove it mathematically in the appendix. A sketch of the steps involved can, however, be given here. For $f(a, l)$ the subsistence isoquant will lie to the left of cc, and it can be shown that the point where the marginal product of labour is zero will be to the left of D. Thus, the new a* will be to the left of the one shown on the diagram, thereby implying that with better quality land the landlord will parcel out his land into even smaller sizes. This would explain the inverse relation between farm size and land productivity, which has been observed on tenant farms (see Table 1). In passing, it should be noted that the arrow of causality does not go from smallness to productivity but other way around. For large tenant farms, however, the inverse relation breaks down, because the nature of the tenancy contract is very different as mentioned earlier.

It is possible that the data in Table 2 on farm size and rainfall (a greater amount of rainfall being a very crude index of a higher soil moisture content) could be a consequence of the above

TABLE 2: PERCENTAGE AREA TAKEN ON LEASE UNDER FIVE ACRES IN DIFFERENT STATES

State	Percentage Area under 5 Acres	Rainfall in Inches
Kerala	92.4	116.4
Assam	87.8	92.0
Maharashtra	65.3	3.48
Madhya Pradesh	56.0	48.0
Gujarat	54.5	37.0
Rajasthan	45.7	19.2

Source: cf Roy [1979].

kind of interaction between landlords and tenants.

One important question concerns the effects of policy decisions which alter r. If a government raises the share going to the tenant by law, the short-run and long-run effects would be very different. The short-run consequences are obvious: the share tenants will become immediately better off and the landlords will be worse off. This is easily seen in Figure 2 where a lowering of r implies that the subsistence isoquant will shift to the left, c'c'. In the short run a* remains the same, and the tenant achieves his subsistence but with less labour input, $l(a)$ [$< l(a^*)$]. The total output falls and the landlord's share falls.

In the long run, however, the landlord will be tempted to reduce the farm size to a'. This will push the tenant labour back onto the ray OL* and output levels rise again to AQ*. Although, the landlord's total rental rises from the short run level, he is worse off than before the policy decision changing r. In the long run, the tenants' share of total output rises but not in the form of each tenant earning more, but simply because there will now be a larger number of tenants. The consequence of lowering r is seen, therefore, not in improved conditions for existing tenants but in the employment of new tenants.[8]

What are the consequences of land improvement schemes, like new irrigation facilities, being provided by the government on landlord's farm? The answer is obvious from the above discussion on soil quality and farm size.

It should be stressed that our results do not hinge critically on the constant returns to scale assumption. Increasing returns to scale would simply bend the EF section of the tenant labour supply curve upwards to EF' with F' lying between F and L*. Of course, EF' will not be straight line any more. Similarly, yz will curl up to yz' with z' further away from A than z.

Now as long as z' is less than Q*, our entire analysis goes through. Thus the inverse relationship is compatible with some limited increasing returns to scale. Of cource, if there are very strong increasing returns to scale then z' will be greater than Q* and it would not be worthwhile for the landlord to lease-out his land in small parcels.

With decreasing returns to scale, the tenant labour supply curve and the tenant output curve will curl inwards and all our results would go through.

Antecedents

The practice of share tenancy has a long history. It definitely existed in France from the thirteenth century onwards for more than five hundred years. The most common was the metayage system which involved a half-half sharing between the landlord and the tenant. As mentioned earlier, opinion about share-tenancy differed widely. Higgs summarised a lot of the pre-1890 debate on this subject. He also carried out a detailed survey of a metayage farm near Laval in France. He himself seemed to find most aspects of share-tenancy laudable. Note his description of the ethos of a region where share-tenancy was prevalent: "The standard of morality is high, and a sentiment of religion is generally diffused. The very few cases of illegitimacy which exist are viewed with reprobation".

While metyage is the most prevalent form of share-tenancy in India, some other widely divergent forms have also existed. Some of these are very complex and involve long chains of sub-infeudation. Thus it was not uncommon to find in West Bengal, before the 1953, West Bengal Estates Acquisition Act, a chain of subletting consisting of the lotdar, the patnidar, the darpatnidar, the raiyat and the under-raiyat [Ghosh, 1972]. Actually as long as the cultivating tenant keeps a *percentage* share of the gross produce to himself most of our analysis goes through.

The recent theoretical literature began with Cheung's [1968] paper. One of the most complete theoretical models of share-tenancy in the context of a Cheung, type of market structure is that of Bardhan and Srinivasan [1971]. Their main focus is rather different from that of ours. We do not assume the existence of rural labour markets. Further, they consider land parcelisation to be exogenously given. Only in a brief section do they treat the farm sizes as endogenous. But this immediately leads to trouble because, in the framework of their model, the equilibrium parcel is indefinitely small. They circumvent this problem with the arbitrary assumption that there exists an exogenously given number, m, which signifies the maximum number of plots a landlord may break his land into. There is another innocuous looking assumption in their model which, however, turns out to be rather important. In both the landlord's and tenant's maximisation problem, they assume that an interior solution occurs. This is a strong assumption and our paper viewed in the context of the Bardhan and Srinivasan work, in fact, turns out to be a non-interior situation.

Bagchi's [1973] conclusions are very

similar to ours though the reasons differ rather more often than not. The kind of tenant preference structure implied by Bagchi is not too clear from his work. We believe that our formalised statement of the tenant's preference, while not identical to that of Bagchi, does capture the essential feature of Bagchi's tenants.

While discussing the consequence of land improvement programmes of the government, Bagchi argues that, once the productivity of land rises, the landlords will raise their rentals and push the tenants back to a subsistence level. From most existing evidence, however, r is remarkably sticky. It is more likely, therefore, that the landlord will use the size of the tenants' plots as the control variable. This will, of course, occur with a time-lag, as discussed earlier.

Appendix

A Note on Marshall

We briefly touch upon a rather intriguing theoretical problem which relates to the work of Marshall on share-tenancy. As argued earlier, a share-tenant's opportunity cost of putting in one more unit of labour on his farm need not necessarily be the market wage. It could be the utility of one more unit of leisure. Actually, it will be the higher of the market wage and the utility of leisure. Marshall probably realised this, for he refrained from using the market wage as the opportunity cost of labour (see Marshall, Book IV, Chapter 3 and Book VI, Chapter 10). Cheung fails to appreciate this and to that extent his interpretation of Marshall is not unconditionally valid.

In order to focus on the problem being considered here assume that the market wage is zero, so that the opportunity cost is the marginal utility of leisure. Now let S be the supply curve of labour derived by optimising in the leisure-earnings space.[9] In the same diagram, draw the tenant's marginal earnings curve (Marshall calls this the tenant's share curve). Can we say that the tenant will work up to the point where the two curves intersect? The answer, in general, is no. This is so because the supply curve of labour does not represent the opportunity cost of work. In fact, typically, no marginal opportunity cost curve of labour exists for the share-tenant (in a similar sense in which no supply curve exists for a monopolist).

There is, however, one important exception: the horizontal supply curve of labour. If the supply curve of labour exists and is horizontal then there does exist an opportunity cost curve of labour, and in fact it is identical to the supply curve. All this is clear to us today, as a consequence of Hick's and Samuelson's path breaking contributions to the theory of utility and choice in the thirties.

In the literature on share-tenancy, it is common to draw a supply curve of labour and to describe the point where it intersects the marginal product curve as the peasant-proprietor's equilibrium and the point where it intersects the marginal earnings curve as the share-tenants' equilibrium. An upward sloping supply curve would wreck such an analysis. More fundamentally, no curve could then be drawn to explain the share-tenants equilibrium. This is where we encounter the uncanny intuition of Marshall for which he is so well-known. It is unlikely that he could appreciate the full theoretical problems of an upward sloping supply curve in analysing share tenancy. But nevertheless he, probably from intuition, steered clear of troubled waters by assuming a horizontal supply curve.

Notes

[The authors thank Amit Bhaduri and Raj Krishna for useful discussions on an earlier draft. A mathematical appendix is available on request from the authors.]

1 The quotations are taken from Higgs (1894).

2 See, for example, Cheung (1968), Bardhan and Srinivasan (1971; 1974; 1975), Bagchi (1973; 1975; 1976), Newbery (1974).

3 It has some shortcomings, though. See Newbery (1974).

4 The rationale behind his choice of share-tenancy over other forms of cultivation lies outside the realm of our analysis.

5 Strictly speaking, n should be restricted to integer values only. But since this would clutter our analysis with technicalities, we choose to ignore this problem. We also assume that

$q_a, q_l > 0, q_{aa} < 0, q_{ll} < 0$ and for sufficiently large l q_l becomes zero.

6 This amounts to assuming that as long as the tenant's income is below T his value of leisure divided by the value of income is zero. Above T the disutility of labour is equal to b units of output.

7 Since the production function is homogeneous of degree one,

$$q(a, l) = aq\left(l, \frac{l}{a}\right).$$

$$\text{Hence } q_l = a\,\frac{\partial q}{\partial l/a}\left(\frac{l}{a}\right).$$

$$\frac{l}{a} = \frac{\partial q}{\partial l/a}\left(\frac{l}{a}\right).$$

So q_l is a function of l/a and it must, therefore, be constant along any ray through the origin.

8 A piece of evidence from Taiwan may be quite revealing: In 1947, the Taiwan tenancy reform reduced the landlord's share from 50 per cent to 37½ per cent. This led to an increase in the number of tenants and the size of tenant farms fell continuously, from 0.218 hectares before the reforms to 0.155 hectares three years later.

9 We are ignoring the problems of subsistence discussed in the article.

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