A NOTE ON "LIMITED LIABILITY, WEALTH DIFFERENCES AND TENANCY CONTRACTS IN AGRARIAN ECONOMIES"[*]

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1. Introduction

In a contribution to this journal ("Limited Liability, Wealth Differences and Tenancy Contracts in Agrarian Economies," vol. 29, pp. 1-22, 1988) Sudhir Shetty has demonstrated the role of limited liability in explaining the observed positive relationship between tenants' wealth and their returns from tenancy contracts. His main contribution is the recognition of the *ex post* limited liability constraint -- for sufficiently adverse realizations of output the rent cannot be paid completely, the liability of the tenant is limited by his amount of wealth -- in determining the terms of contracts and tenants' effort levels. However, Shetty does not fully characterize the nature of tenancy contracts in his model. We provide that analysis in this note.

Basu (1992) uses the *ex post* limited liability constraint to explain the existence of share tenancy when there is moral hazard in the tenant's choice of technique. Sengupta (1997), using a slightly different model, clarifies Basu's point: moral hazard in the choice of technique is not in general sufficient, we also need moral hazard in the choice of effort to develop a consistent theory of sharecropping arising out of the limited liability constraint. Laffont and Matoussi (1995) have taken an approach close to Shetty (1988). They have shown that share contracts emerge due to an *ex ante* financial constraint -- the fixed component of the rent has to be paid in advance.

Shetty (1988) establishes that for the tenants with wealth levels sufficient to

guarantee landlords full payment for all output realizations, the optimal contract is a

fixed-rental contract. But he does not derive the structure of contracts received by the

less wealthy tenants[1]. Singh (1989) tries to address this question, but his argument that

the contracts for the poorer tenants are share contracts, with the cropshare of the tenants

between 0 and 1, has an error. Since then, there appears to be a misconception in the

literature[2]: limited liability *a la* Shetty gives rise to a separate explanation of the existence

of sharecropping. For instance, Laffont and Matoussi comment, " In a contribution which

is closest to our paper Shetty (1988) develops a model where sharecropping is explained

by an ex post liability constraint. ... Even with risk-neutral tenants limited liability

introduces non-concavities in the landlord's and tenant's payoff functions. Sharecropping

mitigates within the relationship the associated insurance problem." (pp. 382)

The purpose of this note is to clarify this confusion and demonstrate that in

Shetty's model, if the share is unconstrained, the less wealthy tenants receive contracts

with cropshare greater than one! We discuss the intuition for this striking result. Shetty

himself constrains the share to lie weakly between zero and one. Thus, our result implies

that in Shetty's model, the tenant's share is exactly one, i.e., all contracts are rental

contracts in his model. We discuss the implications of this result for Shetty's analysis.

Finally, we discuss why contracts with a marginal share exceeding one might be ruled out

by additional moral hazard considerations. We follow the notation of Singh (1989).

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[1] He does seem to implicitly assume that they will be share contracts. For example, he states, "...wealthier tenants (up to A^0) are induced to put forth greater effort since they bear more of the output risk and therefore earn higher shares of their marginal product." (Shetty, 1988, p. 13). A similar statement is on p. 12 of his paper.

[2] Sengupta (1997) is an exception that does not suffer from this misconception. See his footnote 18, pp. 405, which also credits Debraj Ray.

2. Analysis

Both the landlord and the tenant are risk-neutral. The production function is $Q = q\,Q(L)$, $Q' > 0$, $Q'' < 0$, where q is a random variable with distribution function F, $q \in [\underline{q}, \overline{q}]$ and $E(q) = 1$[3]. The tenant has wealth W and receives an income $a\,q\,Q(L) + C$ from the contract, where a is the tenant's cropshare[4] and C represents the fixed component of the contract. The liability of the tenant is limited by the amount of his wealth and let q_1 be the value of q such that the tenant cannot make the agreed-on payment, $(1-a)q\,Q(L) - C$, for any realization of q less than or equal to q_1. Formally, q_1 is defined by

$$q_1 : \begin{cases} a\,q_1\,Q(L) + W = -C \\[2mm] = \underline{q} \quad \text{if} \quad a\,\underline{q}\,Q(L) + W \geq -C. \end{cases}$$

Note that θ_1 is decreasing in W, *ceteris paribus*.

The expected earning of the tenant is $\displaystyle\int_{q_1}^{\overline{q}} \big[a\,q\,Q(L) + C\big]dF(q) + \int_{\underline{q}}^{q_1} (-W)dF(q) - L$[5],

and that of the landlord is $\displaystyle\int_{q_1}^{\overline{q}} \big[(1-a)q\,Q(L) - C\big]dF(q) + \int_{\underline{q}}^{q_1} \big[q\,Q(L) + W\big]dF(q)$. So the optimal contracting problem is:

$$\underset{\{a,C,L\}}{\text{Maximize}} \quad \int_{q_1}^{\overline{q}} \big[(1-a)q\,Q(L) - C\big]dF(q) + \int_{\underline{q}}^{q_1} \big[q\,Q(L) + W\big]dF(q)$$

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[3] This assumption simplifies the algebra, and is inessential.
[4] This seems to be the more common notation. Note that α is the landlord's share in Shetty's notation.
[5] We assume that labor is measured in disutility units. This is without loss of generality.

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subject to

(i) $\int_{q_1}^{\bar{q}} \left[a\, q\, Q(L) + C\right] dF(q) + \int_{\underline{q}}^{q_1} (-W) dF(q) - L = K^*$,

(ii) $\int_{q_1}^{\bar{q}} \left[a\, q\, Q'(L)\right] dF(q) - 1 = 0$.

Constraint (i) is the acceptance constraint, and (ii) is the incentive constraint[6].

As in Singh (1989), solving the constraints for $L(a)$, $C(a)$ and substituting in the objective function, the first-order condition for the maximization becomes

$$\int_{q_1}^{\bar{q}} \left[-q\, Q(L) + q\,(1-a)\, Q' L_a\right] dF(q) - \int_{q_1}^{\bar{q}} C_a\, dF(q) + \int_{\underline{q}}^{q_1} \left(q\, Q' L_a\right) dF(q) = 0. \qquad (1)$$

Now using (ii) we can derive from (i)

$$\int_{q_1}^{\bar{q}} \left[q\, Q(L) + C_a\right] dF(q) = 0. \qquad (2)$$

Then from (1) and (2) we get

$$Q'(L) L_a \left[1 - a \int_{q_1}^{\bar{q}} q\, dF(q)\right] = 0. \qquad (3)$$

But $Q'(L)$ and L_a are non-zero. So finally we get that the choice of a is given by

$$a = \frac{1}{\int_{q_1}^{\bar{q}} q\, dF(q)}. \qquad (4)$$

For the tenants with wealth levels high enough to guarantee full rental payments for all realizations of output, $q_1 = \underline{q}$. Hence for these wealthy tenants,

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[6] This maximization assumes that tenants compete for landlords, so tenants are driven down to their opportunity income, K*. Shetty assumes instead that landlords compete for tenants (see the discussion in the next section). This difference has no effect on the analysis of contract form; the incentive constraint (ii) is the same in either case.

$a = 1 \bigg/ \int_{\underline{q}}^{\bar{q}} q\, dF(q) = 1$, that is, they receive a fixed-rental contract. Shetty (1988) has noted

this result, which is the standard one with a risk-neutral agent.

For the less wealthy tenants, however, $q_1 > \underline{q}$. Since $\int_{q_1}^{\bar{q}} q\, dF(q) < \int_{\underline{q}}^{\bar{q}} q\, dF(q) = 1$, for

these tenants $a > 1$, that is, they receive a contract with cropshare greater than one[7].

3. Discussion

For the wealthy tenants in this model, the limited liability constraint does not bind.

So in this model with risk-neutral landlords and tenants it follows from the standard

principal-agent analysis that for these tenants the cropshare will be one, providing first-

best incentives.

For the less wealthy tenants the limited liability constraint binds. When there is a

crop failure, the landlord appropriates from the tenant his wealth and the entire amount of

crop produced (the landlord's share and also the tenant's share). Thus, since in bad states

the tenant gets no marginal benefit, his incentives are reduced. A cropshare greater than

one balances this out by paying more in good states.

Shetty himself exogenously rules out the possibility that the tenant's share is

greater than one by restricting this share to be weakly between zero and one. Since, by

our derivation in the previous section, any stationary value of the objective function has

an α greater than one, the restriction on the share implies that the tenant's share is always

one in Shetty's model!

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[7] Singh (1989) fails to get this result because he errs in the calculation of conditional expectations.

If the tenant's share is constrained to one at the optimum, the analysis of contract choice differs from that implicitly assumed by Shetty for wealth-constrained tenants. In particular, if the landlord can not increase α above one, he will choose a different fixed payment also. In this case, the tenant's labor response to variations in the share becomes irrelevant, and, in the optimization of section 2, the landlord is worse off with the additional binding constraint on the share.

In Shetty's model, landlords compete and receive their opportunity income. This opportunity income is determined by the fixed number of plots of land, and the requirement that the marginal tenant receives zero expected income -- Shetty's equation (16). If the binding constraint on the tenant's share is recognized, this reduces the landlords' opportunity income in equilibrium. Hence, somewhat surprisingly, tenants may be made better off with the additional binding constraint on the share, though not enough to outweigh the landlords' loss.

Why might α be restricted in such situations? Shetty suggests that the landlord promising a marginal share greater than one can not be counted on to deliver. Certainly this is a possibility: keeping a share of output is different from actually receiving more than one has produced (at the margin). The latter perhaps relies more on the landlord's goodwill to deliver. The problem may be more severe, however. In sharecropping (when α is between zero and one) both landlord and tenant benefit from more output, so neither has an incentive to destroy output. But if the tenant's cropshare is greater than one then the landlord is worse off from having more output, *ex post*. So he has an incentive to destroy output. For example, he could send a gang of thugs at night to steal the crop

when it is ripe enough to harvest[8]. This might be another reason why contracts with a

tenant's share greater than one are not observed[9].

An alternative explanation for the restriction on the share is tenant moral hazard,

which already is assumed in the model. A marginal share greater than one increases

incentives for manipulating output. The sharecropper (with share less than one) has an

incentive to hide output, akin to the motives for tax evasion. The landlord will certainly

try to detect this. The tenant with a pure rent contract has no such incentive, since he

makes only a fixed payment. If α exceeds one, however, the tenant has an incentive to

overstate output in some cases. One can think of monitoring this as being more difficult

(e.g. a neighbor's output is borrowed to stake a claim to more payment from the landlord,

or last year's stocks are used, or chaff is included with the grain). These considerations

might lead to the tenant's share being restricted to not exceed one.

A different approach is to admit that the model as it stands allows for the striking

result of super-marginal incentives, and explicitly introduce other dimensions in the model

to recover the more intuitive and empirically plausible result of a share between zero and

one. For example, risk aversion of the tenant (see Stiglitz, 1974), or moral hazard in

choice of technique (Sengupta, 1997) could restore the result that sharecropping is a

contractual outcome. But then limited liability recedes as a central issue in the

explanation of sharecropping.

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[8] This could well happen in places like Bihar.
[9] We are grateful to Kaushik Basu for these ideas.

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