INTERRELATED CREDIT AND TENANCY MARKETS
IN RURAL ECONOMIES OF DEVELOPING COUNTRIES

by

Avishay Braverman and T. N. Srinivasan

World Bank

August 2, 1979
INTERRELATED CREDIT AND TENANCY MARKETS
IN RURAL ECONOMIES OF DEVELOPING COUNTRIES

by

Avishay Braverman and T. N. Srinivasan

World Bank

Preliminary and Confidential. Not for quotation or attribution without prior clearance from the authors. We are grateful to Wilfred Candler, Gershom Feder, Luis Guasch and Pradeep Mitra for helpful discussions. Comments by participants at seminars at the University of Western Ontario, London, Ontario, and the University of Michigan, Ann Arbor, Michigan, have been very useful in revising an earlier draft.
1. Introduction

One of the features alleged to be dominant in transactions of rural households in some developing countries is their interrelatedness. As one of the many contributors to this literature put it, "It is misleading when talking about individual operators to hypothesise that each producer confronts technical data and market prices in an impersonal environment and all are equally free to take decisions in all markets. Nor is it possible to analyse the producer's behaviour in any one single market without knowing how the markets are interlinked by prize and non-price relations, for the fields of feasible choices in the different markets are not, as assumed under competition, definable a priori independently of each other." While this description is suggestive, it is by no means a complete definition of interrelatedness. After all, the typical consumer's choice problem as usually formulated in micro-economic theory implies that the consumer's actions in the market for each of the set of goods are interlinked through his budget constraint. Similarly in a typical producer's choice problem, profit maximisation links his choice of inputs and outputs given his technology. In any case, at the economy-wide level general equilibrium implies simultaneous equilibrium in all markets, with the supply and demand in each market being dependent on all relevant prices.

A possible definition of inter-connected transactions could be the following: transactions between the same pair of individuals in more than one commodity or service at the same time, the transactions being

---

linked in an essential way. In other words, transactions between a pair of individuals in two or more commodities that are linked by coincidence, i.e., transactions that could as well have taken place at different points of time, and not necessarily between the same individuals, are not interconnected in this sense. An example will make this distinction clearer: suppose a landlord and a tenant enter into a contract in which the tenant rents a piece of land, at a stipulated rent and at the same time the landlord extends the tenant credit, again on specified terms. If the transaction in land (credit) could have taken place independently of that in credit (land) with no additional cost to either party, the two transactions are not interconnected.

In other words, an essential feature or this definition is that it is infeasible or costly for the transactions to be delinked. If it is infeasible, either the two parties transact in all the relevant goods and services or do not transact in any of them. In the second case, linking lowers costs compared to not linking for at least one party without raising it for either. Many examples of linking, often found in developed countries, such as 'tie-in-sales', supplier's credit, and shopping for unrelated item in a large store perhaps result from lower transaction costs.

The infeasibility of delinking can arise either from non-existence of markets (other than through linking) for some commodity or service, which is possible to view portfolio diversification this way: non-existence of a single instrument with his desired risk-return characteristic leads an investor to achieve his desire through a suitable combination of existing instruments. Yet another example arises from the distinction, due to Lancaster, between commodities and characteristics: there are markets for commodities but not for characteristations. However, these examples do not quite satisfy the definition of linking: only the investor or consuer is linking or more precisely combining his purchases. There can be several sellers to this single consumer.
or because one of the parties has sufficient market power to insist on linking. In either case, while policy intervention either by creating non-existent markets or by eliminating market power through reform will often lead to an efficient allocation of resources as compared to the prior equilibrium with linking, the equity or distributinal aspects of such intervention will depend very much on the prior structure.

Sorn-existence of markets is the rule rather than the exception, particularly in less developed countries. As such, we cannot invoke the properties of efficiency (or resource allocation) and Pareto-optimality (of distribution) of a competitive equilibrium that depends crucially on the existence of a complete set of markets (for each commodity or service distinguished by the time period and the state of (uncertain) nature in which the transaction is to take place). Given an incomplete set of markets, each participant may be able to achieve through linking; of transactions in a set of existing markets, at least in part, what he could have achieved through transactions, not necessarily linked, had a complete set of markets existed. As long as competitive behaviour can be assumed by all participants in the existing markets, the resulting equilibrium could still be efficient (and pareto-optimal) given the set of markets, though certainly not so, compared to what could be achieved with a complete set of markets. As was said earlier, an intervention in the form of creating a subset of, and not all, the non-existent markets, may improve efficiency of resource allocation, but the distributional issue is another matter. This is another manifestation of the well-known "second-best" proposition.
that is, in an environment characterised by 'market' distortions, a move towards eliminating a subset of distortions, need not be welfare-improving.

There is yet another context in which linking may occur, that is when there is some imperfection or segmentation in a market. For instance, if the capital market is imperfect in the sense that the cost of capital from different sources is not the same and not everyone has access to each source on an equal basis, it is possible that access to a particular source may be conditional on the borrower agreeing to a transaction with the lender in some other commodity or service. If wage labour in peak agricultural seasons is either uncertain in its availability or its cost, a landlord may wish to employ a permanent or attached farm labourer whose services are available to him throughout the year. In this case, the linking is in the transactions relating to peak season and off-peak season labour: an attached labour contract is an agreement to buy and sell labour in both seasons. The unlinked alternative is to hire wage labour in each season separately. Landless rural households endowed with the labour of women and children for which there is no market or because social taboos prevent them from working for others, often lease in land. The leased in land is famed mostly by non-marketable family labour, while those members of the household who can work as wage Labourers outside the household farm do so, to a significant extent. In this case, transactions in land and family labour get linked, though this is more a case of non-existence of markets rather than of their imperfection. There are several other examples of linkage, arising out of non-existence of markets of services of draught animals, of a tenant’s managerial input, etc. that are of a similar nature.
In the present paper we concentrate on a model of linkage between land, labour and credit transactions in the context of share cropping. In order to explore the implications of policies such as land reform, subsidized credit and outlawing of money lending by landlords, we take it as given that the only form of tenancy is share cropping. Another crucial assumption is that a potential tenant is precluded, as part of the tenancy contract, from working outside the farm as a part-time wage-labourer. The main result of the paper is that, as long as the landlord can vary the size of the plot given to a tenant and there are enough potential tenants, the equilibrium will be characterised by 'utility-equivalent' contracts. That is, in equilibrium, a tenant's utility obtained through share-cropping will be the same as that he could have obtained as a full-time wage labourer. This result, also implies policies other than land reform (i.e., reform that confers ownership to the tenant of the piece of land he is cultivating) will leave the welfare of each potential tenant unaltered while affecting the level of output, extent of tenancy and the welfare of landlords. This model however, provides a theoretical underpinning for two almost polar opposite phenomena that are sometimes observed: low interest consumption loans from landlord to tenant and its opposite, high interest low volume loans.

2. The Model

2.1 The Tenant

All potential tenants are identical. Each is offered a plot of land, of size \( H \) hectares for cultivation, in return for which he agrees to pay the landlord a 'share' \((1 - a)\) of the harvest and to obtain a proportion \( \nu \) of his borrowings from his landlord at an interest rate \( r_T \) per season. He obtains the remaining proportion \((1 - \nu)\) of his borrowings from an alternative source at an interest rate \( r_A \). Be treats \( j, r_T, r_A \) as parameters over which he has no influence. At the beginning of each
season he borrows his entire consumption needs over the coming season and repays his loan with interest at the end of the season after harvest. He does not store any grain from one season to the next nor does he have any investment opportunity.

Labour provided by the tenant for cultivation (including all operations from land preparation to harvesting) is denoted by $eL$, where $L$ denotes the number of man-years per season and $e$ denotes the effort per man-year of labour. Thus, $eL$ represents labour in efficiency units. Output $Q$ is a concave function, homogeneous of degree one in $H$ and $eL$.\[1\] Thus:

$$Q = f(H, eL)$$

(1)

Assuming the number of man-years, $L$, (i.e., labour in natural units) to be exogenously fixed, we can set (without loss of generality) $L=1$. Thus we can rewrite (1) as:

$$Q = \frac{1}{x} f(1, ex) = \frac{f(ex)}{x}$$

(2)

where $x$ is man-years of labour per hectare of land. Given that the tenant is endowed with one man-year of labour, $x$ represents the reciprocal of the size of the plot he is allotted. The function $f$ represents the average product per hectare of land. By assumption $f'$ is positive and $f''$ is

\[1\] Bell and Braverman [1978] show that landlords will prefer cultivation with wage labour to share-cropping, if the production function is of constant returns to scale and there is no uncertainty. Since we do not allow the landlord the option of self-cultivation with wage labour, the Bell-Braverman result does not apply to our analysis for this and other reasons having to do with the modelling tenant's effort and behaviour.
negative where the primes (single and double) denote the first and second derivatives of \( f \), respectively. The tenant's snare of the harvest \( Q \) is \( a \) and his income is therefore \( aQ \).

By our assumption that the tenant borrows his entire consumption needs at the beginning of the season and has no carry-over stock or investment opportunities, it follows that his consumption \( c \) in any season equals his income \( aQ \) at the end of the season, discounted by \((1 + i)\) where \( i \) is the effective interest rate on his borrowing. Of course, \( i \) equals \( vr_T + (1 - v)r_A \). Thus,

\[
c = \frac{aQ}{1 + vr_T + (1 - v)r_A} \equiv \beta Q.
\] (3)

where \( \beta = \frac{a}{1 + vr_T + (1 - v)r_A} \equiv \text{discounted snare of the tenant.} \) (4)

We assume that the tenant's utility function \( U \) is additively separable in consumption and effort, so that:

\[
U(c, e) = u(c) - v(e)
\] (5)

The tenant's choice or control variable is \( e \). He sets \( e \) at a value which maximizes \( U(c, e) \) subject to (2) and (3), given \( X, a, v, r_T \) and \( r_A \). He will not choose to work as a tenant unless the maximized value \( U^* \) of \( U(c, e) \) is at least as large as \( \bar{U}, \) the utility he could have assured himself by working as a wage labourer. We assume \( U(c, e) \) to be concave and twice differentiable, with positive marginal utility \( u'(c) \) of consumption and disutility \( v'(e) \) of effort. Concavity of \( U \) implies that \( u''(c) < 0, v''(e) > 0 \).
It is immediately obvious from (2)-(5) that the parameters \( v, r_T \) and \( r_A \) enter the tenant's constraint set and his utility function only through their effect on his discounted share \( \beta \). By substituting (2), (3) and (4) in (5), maximizing with respect to \( e \) and assuming an interior maximum, we get the first order condition:

\[
\beta u'(c) f'(ex) - v'(e) = 0 \tag{6}
\]

The second order condition is easily seen to be satisfied from our concavity assumptions on \( u, f \) and \(-v\). It can also be seen that (6) can be solved uniquely\(^1\) for \( e \) to yield

\[
e = e(x, \beta) \tag{7}
\]

For later reference let us derive (through differentiating (5)) the following

\[
\frac{\partial e}{\partial x} = -\frac{\beta f'u' - 3f'u''(f - exf')/x^2}{\beta xf''u' + (\beta f')^2u'' - v''} \tag{3}
\]

\[
\frac{\partial e}{\partial \beta} = -\frac{xu'f' + \beta u''f}{x(\beta xf''u' + (\beta f')^2u'' - v'')} \tag{9}
\]

\[
\frac{\partial (ex)}{\partial x} = \frac{-ev'' + \beta^2 f''u'/x}{\beta xf''u' + (\beta f')^2u'' - v''} > 0 \tag{10}
\]

Denoting by \( U^*(c, e) \) the maximized value of \( U(c, e) \) it can be shown (noting (6)) that:

\[
\frac{\partial U^*}{\partial x} = -\frac{u'f}{x} \tag{11}
\]

\[
\frac{\partial U^*}{\partial \beta} = u'f/x > 0 \tag{12}
\]

\(^1\) Assume \( \lim_{c \to 0} u' = \infty \) and \( \lim_{e \to 0} v'(e) = 0 \).
2.2 The Landlord

With infinitely elastic supply of identical tenants, maximizing profits is equivalent to maximizing profits per hectare. Hence, our model yields the same results whether different landlords possess different amounts of land or not. Therefore, without loss of generality, we assume that all landlords are identical and possess one hectare of land each, which they divide into plots of size \( \frac{i}{x} \) to give each of \( x \) tenants.

As stated earlier, the landlord requires that each of his tenants get a proportion \( v \) of his borrowings from him at an interest rate \( r_L \). Assuming an alternative use of funds would have earned the landlord an interest of \( r_T \) per season, his income \( G \) from each tenant is:

\[
G = \frac{(1 - a)f(ex)}{x} + v(r_T - r_L)c
\]

\[
= \frac{(1 - a)f(ex)}{x} + v(r_T - r_L)\beta \frac{f(ex)}{x}
\]

using (2) and (3)

\[
= \frac{f(ex)}{x} [(1 - a) + v(r_T - r_L)\beta]
\]

\[
= \frac{f(ex)}{x} [1 - \beta(1 + vr_L + (1 - v)r_A)]
\]

using (4)

Multiplying by the number, \( x \), of tenants we get a landlord's total income as:

\[
G = [1 - \beta(1 + vr_L + (1 - v)r_A)]f(ex)
\]

(13)

It is clear from (13) that the interest rate \( r_T \) charged by the landlord on his loans to his tenant affects his income only through its effect on \( r_L \).
The landlord maximizes \( G \) with respect to his choice variables given the tenant's effort function \( e(x, y) \). The choice variables include the plot size \( 1/x \), the tenant's crop share \( a \) (if the landlord is a monopolist in the landmarket), \( v \) (if there are no laws against the landlord providing credit) and \( r_T \) the rate of interest charged.

3. Equilibrium

For the moment, let us focus only on choice of \( x \) (the number of tenants or equivalently the plot size per tenant), thus keeping \( z \) fixed in particular. It is obvious from (13), that since \( f \) is an increasing function of its argument and from (10) that \( ax \) is an increasing function of \( x \), landlord's income increases with \( x \). On the other hand from (11), it follows that the tenants utility \( U^* \) in share cropping decreases as \( x \) increases. Thus, if at any value of \( x \), the tenant's utility exceeds his utility \( \bar{U} \) in the alternative use of his labour (so that he chooses to be a tenant), the landlord, by increasing \( x \), can increase his income while pushing the tenant towards \( \bar{U} \). As long as there are enough potential tenants, that is, as long as there is no upper limit on \( x \), the landlord's choice \( x \) will be so as to push the tenant to an utility level equalling \( \bar{U} \). 1/ This leads to:

Proposition 1: The equilibrium in the landmarket will be characterised by utility equivalent contracts.

1/ One could also argue that if at an initial \( x \), \( y^* \) is less than \( \bar{U} \), the potential tenant will not choose share cropping. As such for getting someone to cultivate his land, the landlord will have to increase the plot size, i.e., reduce \( x \). We are ignoring the fact that a tenant is "indivisible" while land is divisible.
It is to be noted that proposition 1 does not depend, for its validity, on the presence or absence of any linkage between tenancy and credit transactions. The landlord's use of plot size as an instrument variable results in the model of Cheung (1969), the tenant receiving the same income as he would have earned as a wage labourer. There is also some empirical evidence to suggest that landlords believe that smaller the plot size the greater the effort that a tenant will put in cultivation.

Proposition 1 enables the determination of \( x \) as a function

\[
x(\beta) \text{ of } \beta \text{ through}
\]

\[
U[c, e(x, \beta)] = \bar{U}
\]

(14)

where \( c = \beta e(x, \beta) \). Using (14) and (6) we can show that

\[
x'(\beta) = \frac{fx(\beta)}{\beta[f' - \beta x' u(\beta)]} > 0
\]

(15)

\[
\frac{de}{d\beta} = \frac{3e}{3x} \frac{dx}{d\beta} + \frac{3e}{3\beta}.
\]

Using (8) and (9)

\[
= -\{ux' + 3u''x''\}/x' - \frac{fx(\beta)u'(\beta) - \beta x'u' + \beta x'u'' - \beta f' x''}{\beta x'u' + (\beta f')^2 u'' - v'}.\]

\[
= -\frac{u'f'(f - ex') + u'f''x}{\beta x'u' + (\beta f')^2 u'' - v'} (f - ex')
\]

(16)

\[
= -\frac{u'}{\beta x'u' + (\beta f')^2 u'' - v'} + \frac{f'(f - ex') + f''x}{(f - ex')^2}
\]

1/ Stiglitz [1974] and Newbery-Stiglitz [1978], who introduced this model of share cropping (without linkage to the credit market), used the utility equivalence result without providing a proof for its validity. They claimed that competition between landlords will drive the inequality \( U^* > \bar{U} \) to equality. Clearly, the utility equivalence outcome results from profit maximization and not from competition.
Let \( \sigma \) be the elasticity substitution between land and labour. By definition \( \sigma = -\frac{f'(f-ex)}{ff' ex} \). By substituting in (16) we get:

\[
\frac{de}{d\theta} = \frac{u'f'}{\beta uf' u'' + (\beta f')^2 u'' - v'} \left( \frac{1 - \sigma}{\sigma} \right)
\]

Hence:

Proposition 2: The tenant's effort \( e \) increases, stays the same, or decreases as his discounted share \( \beta \) in output increases, according as the elasticity of substitution \( \sigma \) is greater than, equal to or less than unity.

This result was obtained earlier by Newbery and Stiglitz [1978] in a model that did not feature credit.

Turning now to the other choice variables \( (a, v, r_L) \) of the landlord, it is seen by writing his income as

\[
G = (1 - \beta \theta) f(ex)
\]

where \( \theta = 1 + vr_L + (1 - v)r_A \), that \( (a, v, r_L) \) enter \( G \) only through their effect on \( e \) and \( \theta \), since \( e \) and \( x \) are functions of \( \beta \). Now

\[
\frac{\delta G}{\delta \theta} = -\beta f < 0
\]

This means that an income maximizing landlord will choose his optimal \( \theta \) to be

\[
\theta^* = \text{Minimum feasible } \theta \text{ for any given } \beta
\]
and then choose $3$ to maximize $(1 - 3a^*)f(e)$. From (18) it is clear, that since $3$ depends only on $v$ which lies between $0$ and $1$, if the given value of $3$ does not restrict the choices of $0$ and $1$ for $v$, then:

$$
\begin{align*}
3^* &= (1 + r_L) \quad \text{and} \quad v^* = 1 \quad \text{if} \quad r_L \leq r_A \\
(1 + r_A) \quad \text{and} \quad v = 0 \quad \text{if} \quad r_L > r_A
\end{align*}
$$

(21)

By definition, $\beta = \frac{a}{1 + vr_T + (1 - v)r_A}$. The range for $\beta$ for feasible $(a, v, r_T)$ (i.e., $0 < a < 1$, $0 < v < 1$, $r_T \geq 0$) is $[0, 1]$. And any $\beta \in [0, 1]$ can be reached by suitable choice of $(a, r_T)$ if $v = 1$. This holds true even if there is an institutionally specified floor $a^*$ on $a$. Thus, in the case $r_L \leq r_A$, the landlord can set $v^* = 1$ and $3^* = 1 + r_L$ and choose $\beta$ (that is $a$ and $r_T$) to maximize $G$. In essence, what is happening is that, with $r_L \leq r_A$ the landlord is the cheaper source of credit and by linking tenancy to credit (setting $v^* = 1$) the landlord ensures that the tenant uses the cheaper source of credit. If $v = 0$, values of $\beta > \frac{1}{1 + r_A}$ are unattainable through choice of $a$, since with $v = 0$, $r_T$ is not relevant.

Now with $v = 0$, any $\beta$ in $[0, \frac{1}{1 + r_A}]$ can be reached by suitable choice of $a$ as long as there is no floor on $a$. And $\beta > \frac{1}{1 + r_A}$ is irrelevant for maximizing $G$ when $r_L > r_A$ since then $\beta > 1 + r_A - r_A \Rightarrow \beta > 1$ making $G \leq 0$. Thus we can assert, using (21), that the landlord's optimal choice is $v^* = 0$ if $r_L > r_A$. Thus once again the landlord ensures that the tenant gets credit from the cheaper source. We can therefore state:
Proposition 3: The landlord, with no restriction on his choice of crop shares, will ensure that the tenant gets credit from the cheaper source. In the case he is the cheaper source \( r_L \leq r_A \), he does this by linking tenancy contract with credit. In the case \( r_A > r_L \), he does this by not offering any credit to the tenant.

Remark: As discussed earlier, in the case of \( r_L \leq r_A \) where linking is optimal, it remains optimal even if there is an institutionally imposed floor on tenant's crop share, the reason being that with full linking, any given \( \beta \) (and a fortiori the optimal \( \beta^* \)) can be achieved with an infinite number of pairs \( (a, r_T) \), of which, another infinite set will meet the required floor.

Proposition 3 is consistent with empirical observations (Bardhan and Rudra (1978)) that landlords often offer interest free loans to their tenants. For, in the case of \( r_L \leq r_X \) and linking \( (v^* = 1) \), the interest rate \( r_T \) charged by the landlord is essentially arbitrary, and it could as well be zero.

Returning to the case where there is no floor on \( a_r \), we have seen that if \( r_L \leq r_A \), \( \theta^* = (1 + r_L) \) and with \( G = [1 - \beta(1 + r_L)]f(\varepsilon) \), the range for \( \beta \) is \( [0, 1/(1 + r_L)] \). If \( r_L > r_A \), \( \theta^* = (1 + r_A) \), with \( G = [1 - \beta(1 + r_A)]f(\varepsilon) \), the range for \( \beta \) is \( (0, 1/(1 + r_A)) \). In either case, \( G \) being a continuous function of \( \varepsilon \), defined over a compact set, attains its maximum.\(^1\) If this maximum is attained at an interior point, we have

\[^1\] We are assuming that the function \( x(\beta) \) relating \( \beta \) to the inverse of the plot size that ensures utility equivalence, is differentiable.
\[
\frac{\partial G}{\partial \beta} = -\frac{\partial F + (1 - \beta \theta) F'}{\partial \beta} - (ex) = 0
\]

\[-\frac{\partial F + (1 - \beta \theta) F'}{\partial \beta} [e^{d \frac{dx}{dx} + e^{de}}] = 0
\]

or

\[
\frac{\beta \theta \beta}{1 - \beta \theta} = \frac{\beta F'}{F} \left[ e^{(e - \beta F)} \right] + \beta \frac{F'}{F} \frac{de}{db}
\]

or

\[
\frac{\beta \theta \beta}{1 - \beta \theta} = \frac{S}{1 - S} + \beta \frac{F'}{F} \frac{de}{db}
\]

where \( S = \frac{ex'}{f} \) is the imputed share of labour in crop output. Using proposition 2, we can assert that

\[
\beta \theta \beta \leq S \quad \text{according as} \quad \sigma \geq 1
\]

In the case \( r_L \leq r_A \), \( \theta = (1 + r_L) \) and \( \beta' = \frac{\alpha}{1 + r_L} \),

and in the case \( r_L > r_A \), \( \beta = (1 + r_A) \) and \( \beta' = \frac{\alpha}{1 + r_A} \).

Since in the first case \( r_T \) can be chosen to be \( r_L \), \( \beta \theta \beta \) becomes the crop share \( a^* \) in either case. So using (22) we can state

**Proposition 4:** If there is no restriction on the landlord's choice of instruments \( (\alpha, \gamma, r_T) \), an optimal strategy for him involves his offering his tenant a crop share \( a^* \) such that \( a^* \leq S \) according as

\[
\sigma \geq 1
\]

**Remark:** In the case of \( r_L \leq r_A \) since \( \beta \theta \beta = \frac{\alpha (1 + r_L)}{1 + r_L} \), by choosing \( (a^*, r_T) \) with \( r_T \) sufficiently less (greater) than \( r_L \), the landlord can offer an \( a^* \) which is less (greater) than \( S \), even if \( a \) is greater (less) than unity.
Newbery and Stiglitz [1978] established proposition 4 for their model without bringing in credit or its linkage to tenancy. In the above remark, we are able to derive a more general result for the case where linkage is optimal.

4. Policy Analysis

4.1 Tenancy Reforms

First, consider reform which imposes a floor, \( a_F \), on the tenant's share \( a \) of the harvest. This is a common feature of many agrarian reform laws in India. As remarked earlier, in the case where \( r_L < r_A \) and hence full linking, if in an equilibrium \( (a^*, l, r^*) \) prior to the promulgation of the reform law the landlord was offering a crop share below the legal floor \( a_F \), he will raise the crop share after its promulgation to \( a_F \) and at the same time raise the interest rate to \( r_T^{**} \) so that in the new equilibrium \( (a_F, l, r_T^{**}) \),

\[
\frac{a_F}{1 + r_T^{**}} = \frac{a^*}{1 + r_T^{**}} = \beta^*.
\]

Since output depends only on \( \beta^* \), it is unaffected by reform. Given utility equivalence, the tenant's welfare is unaffected anyway.

Suppose, now, the legal floor is imposed, either in an initial equilibrium in which the landlord is not the cheaper source of credit, i.e., \( r_L > r_A \) so that \( \gamma^* = 0 \), \( \beta^* = \frac{a^*}{1 + r_A} \) with \( a^* = a_F \), \( c^* \) even though initially \( r_L < r_A \) and \( \gamma^* = 1 \), \( \beta^* = \frac{c^*}{1 + r_T^{**}} \) with \( a^* < a_r \), as part of tenancy reform, the interest rate on tenant's alternative source of credit is brought below \( r_L \). In other words along with the floor \( a_F \), there is a change in \( r_A \) which brings it below \( r_L \). This joint reform of tenancy and credit, could be viewed as if it is a sequence of two consecutive reforms, first a credit reform with no tenancy reform, so that the
landlord switches to the equilibrium with one asterick from one with two astericks and then a tenancy reform imposing a floor. This way, it is enough to discuss only the tenancy reform.

In a technical sense, even in this case, the tenancy reform may be made ineffective. For, consider a sequence of contracts offered to the tenant, the sequence indexed by \( n: (a^n = \alpha, \gamma^n = (\alpha - \beta^*(1 + r_A))/n, r_T^n = n). \)

Clearly, \( \gamma^n > 0 \) since in the initial equilibrium \( \beta^*(1 + r_A) = \alpha < a \) and for large enough \( n \), \( \gamma^n \) will be less than one. Thus, for large enough \( n \), each member of the sequence is a feasible contract. Now \( \beta^n = a^n/(1 + \gamma^n r_T^n + (1 - \gamma^n) r_A) \). The plot size sequence is \( x(\beta^n) \). As \( n \to \infty \), \( a^n \) converges to \( \alpha \), \( \gamma^n \) converges to zero, \( \beta^n \to \beta^* \) and \( r_T^n \to \infty \). By choosing \( n \) sufficiently large (thereby making \( r_T^n \) large, but finite), the landlord can remain as close as he wishes to his income prior to the imposition of the floor even after the reform. What this argument suggests is that, after the reform there is no optimal policy for the landlord, but there exist policies that will give him an income as close as he wishes to his income prior to reform. Since, prior to reform he was maximising his income without the floor constraint on tenant's crop share, that income provides an upper bound to his income after reform. Since policies exist, which get as close as one likes to this upper bound, this upper bound is the least upper bound.

The implication of the above discussion is that, if linking is permitted, the landlord can reduce the tenancy and credit reform to insignificance. Suppose now, the government bans linking, along with

\[1/\] This is perhaps a rationale for empirical observations of tenants being charged high interest for rather small loans.
tenancy and credit reforms: clearly the landlord's income will decline, while the tenant's welfare continues to be at the level he could have achieved while working as a wage labourer. What about the effect on output? Since the landlord no longer has the instrument by which he can maintain the re-reform discounted snare, $\beta^*$, of the tenant, the reform will raise $\delta$. Since we know that $\frac{d(ex)}{d\delta} > 0$, we can assert that output $f(ex)$ will go up.\(^1\) Thus:

**Proposition 3**: A tenancy reform which imposes a floor on tenant's share of the crop with or without credit reform (to make credit available to the tenant at a rate lower than the landlord's opportunity cost of capital), will have no effect on output. If it is coupled with a ban on linking of credit and tenancy transactions, it will raise output.

A ban on linking of credit and tenancy is, of course, meaningless when the landlord is not the cheaper source of credit, since no linking will be observed any way. Suppose the ban is imposed when there is linking, i.e., when $r_L < r_A$ and $v^* = 1$. Clearly, this immediately raises the cost of credit to the tenant to $r_A$. In the landlord's income maximization problem, fixing $v$ at zero (i.e., preventing linking), fixes $\delta$ at $(1 + r_A)$, i.e., raises $\gamma$ from its optimal value of $1 + r_L$ prior to the ban to $(1 + r_A)$. Since $G$ is a monotonic decreasing function of $\gamma$, at any value of $\delta$, $G$ is lower than before. Clearly, even with the optimal value

---

Some care is needed in interpreting this result. An increase in $\gamma$ raises the number of efficiency units of labour, i.e., $ex$ supplied by each tenant and increases the number of tenants through a reduction in plot size. If the elasticity of substitution is less than unity, effort per tenant will decline, so that output per tenant will decline.
of $\beta$, $G$ is lower. This means that landlord's income **definitely** goes down. What about output? As long as $f(\text{ex})$ as a function of $\beta$ is concave, optimal $\beta$ for any specified $i_3$ is a decreasing function of $i_3$. Hence, as $\theta$ is increased from $(1 + r_L)$ to $(1 + r_A)$, optimal $i_3$ goes down. This means that firstly, the optimal plot size increases thereby reducing the number of tenants and secondly, output goes down since $f(\text{ex})$ is an increasing function of $\beta$.

4.2 Land Reform

Suppose starting from an initial equilibrium $[a^*, v^*, r^*_T]$ and $x(\beta^*)$, each tenant is given the ownership of the plot he cultivates and he has to forego the opportunity to borrow from one landlord. Clearly, tenant's welfare improves, or, if $r_L = r_A$, $v^* = 3$ and $\beta^* = \frac{a^*}{1 + r_A}$. With reform $a$ becomes unity, $r_A$ remains unchanged so that the tenant's (now a land-owning peasant's) discounted share $\beta$ increases, while the size of the plot remains the same. Hence, without changing his effort (and its disutility) level $e$, he will gain in consumption and, hence, total utility. By optimally adjusting his effort to changed $i_3$, he can raise his utility even further.

Now if $r_L < r_A$, initially $v^* = 1$. Since, the landlord is indifferent in this case between alternative combinations of $(c, r_T)$ that result in his optimal $\beta^*$, we can view the land reform, as if it first changed the interest rate charged by the landlord to $r_A$ with a corresponding change in $z$ to maintain the same $\beta^*$ and, then raised
the tenant's crop share to unity. The two moves together imply that the tenant's post-reform discounted share is higher. From this point, the argument is the same as in the previous case.

What about the effect of land reform on output? Land reform, increases the discounted share $\beta$ while keeping the plot size fixed. Thus output is $f[e(\beta)x]$ where $x$ is fixed. Since the former tenant will choose $e$ to maximize his utility, given any $\beta$ and $x$, we know from (9) that $\frac{\partial e}{\partial \beta} = \frac{-xf'[u' + \frac{f}{x} u'']}{x(\beta x u' + (\beta f')^2 u'' - v''})$. Now $\frac{\partial f}{x}$ is the consumption c of the tenant. Hence $\frac{\partial e}{\partial \beta} > 0$ according as $-u''c/u' > 1$. $\frac{\partial e}{\partial \beta} < 0$ implies that output increases, remains unchanged or decreases as $\beta$ increases. Thus:

**Proposition 7:** A land reform which confers ownership to the plot of land that a tenant used to cultivate in snare-cropping contract with a landlord will increase, not change, or decrease output, according as $-u''c/u' > 1$. $\frac{\partial e}{\partial \beta} > 0$

The negative of the elasticity of marginal utility $\left(\frac{u''c}{u'}\right)$ is defined by Arrow [1971] as the measure of relative risk aversion. The intuitive explanation for the value of this elasticity to be of relevance is our case, even though there is no uncertainty, is the following: On the one hand, an increase in $\beta$ increases tenant's income. Hence, the marginal utility of income declines relative to the marginal disutility of effort, and ceteris paribus, the new landowner would like to reduce his effort. On the other hand, his share in the marginal productivity of effort increases, with increasing $\beta$, thus creating an incentive for more effort. Whether the income effect or the marginal productivity effect is the dominant force depends solely on the elasticity of the marginal utility.
Where land reform distributes the land to more owners than the original cultivators, it may increase total output even if \(-\frac{u''c}{u'}\) > 1 since \(ceteris\ paribus\), output per acre increases with decreasing plot site.

4.3 Taxation and Technological Progress

Suppose the government imposes a proportional output tax at the rate \(t\) on tenants and landlords (i.e., the rural community) to raise the food to feed the urban workers. At any choice \((a, v\text{ and } r_t)\) the landlord's income is:

\[
G = (1 - t)[1 - B\theta]f(\text{ex})
\]

where \(e\) and \(x\) are functions of \((1 - t)\) since the tenant's after tax discounted share is \((1 - t)\). If the elasticity of substitution is unity, the tenant's effort is independent of \((1 - t)\), (see (17)), so that compared to the pretax situation, tenant's consumption will go down if the plot size is unchanged. As such, his utility will fall below his utility in his alternative occupation. In order to retain him as a tenant, the landlord will have to raise the plot size after the tax is imposed, to bring the tenant back to his pretax utility level. Raising plot size reduces the number of tenants. Output is reduced since \(\frac{d}{dt}f(\text{ex}) = f'e\frac{dx}{dt}\), \(a\) is unaffected and \(\frac{dx}{dt} < 0\) is the change in the number of tenants. It is easily seen using (22) that optimal \(a\) is unaffected by the tax. Thus:

**Proposition 8:** If the production function is of the Cobb-Douglas type, imposition of a proportional output tax on landlords and tenants will leave the discounted share unaltered, increase the plot size per tenant and reduce the number of tenants as well as total output.
Modeling a Hicks neutral technical change is equivalent to modeling a proportional output tax, i.e., a Hicks neutral technological change is a shift in where the production function is $Af(x)$. The only difference is the direction of the impact. However, for the Cobb-Douglas case, all factor augmenting technical changes are equivalent to Hicks neutral ooes. Thus considering irrigation as a land augmenting technical change and applying proposition 8, we obtain:

**Proposition 9:** If the production function is of the Cobb-Douglas type, irrigation will leave the discounted share contract unaltered, decrease the plot size per tenant and increase the number of tenants as well as total output.

### 4.4 Increase in the Tenant's Utility Level in an Alternative Occupation

Suppose, for example, through an increase in non-agricultural wage rate, the utility that the tenant could obtain (i.e., $\bar{U}$) in an alternative occupation increases. Assuming once again a Cobb-Douglas production function, so that the tenant's effort is independent of $x$, it is clear that the landlord can meet the higher $\bar{U}$ only through raising the plot size, thus reducing the number of tenants and output.

Equilibrium $\delta$ is unchanged. Hence:

**Proposition 10:** If the production function is Cobb-Douglas, any increase in the utility that the tenant can obtain in an alternative occupation will raise the equilibrium plot size, reduce the number of tenants and output, while leaving the discounted crop share unaltered.
5. Conclusions

We briefly summarise and relate our results to the literature. We use the model introduced by Newbery-Stiglitz [1978]. Our main result is that in a world in which (i) production takes place under constant returns to scale in land and labor in efficiency units, (ii) where a landlord can subdivide his land into as many plots as he chooses to, (iii) a tenant chooses his effort, given the size of the plot and cost of consumption credit so as to maximise his utility, equilibrium will be characterised by utility equivalent contracts. In other words, even if a landlord has no power over crop shares or terms of credit by choosing the plot size appropriately, he will force the tenant to a utility level equal to that which he (the tenant) could have obtained in an alternative occupation as loop as there are enough potential tenants. He is able to do this because there is a perfectly elastic supply of tenants at this 'reservation' utility level, so to speak. This result is equivalent to that of Cheung (1969), in a model in which the tenant's "effort" per unit of his raw labour is invariant. Cheung shows that landlords will provide

---

1/ This result excludes the possibility of excess applicants equilibrium which say occur if only the output share and the plot size is the control variable of the landlord. A well-known case of excess applicants equilibrium was generated under the efficiency wage hypothesis (e.g., see Leibenstein [1977], Mirtlees [1976] and Stiglitz [1976]). In this equilibrium, as well as in the share cropping case, the landlord does not possess an instrument completely orthogonal to effort so as to reduce $U > \bar{U}$ without affecting effort. In the "efficiency wage" case, the landlord has the wage instrument. In our case, he has three instruments (plot size, share and interest rate). But even if he has only the plot size instrument, this instrument by itself, although non-orthogonal to effort, guarantees the utility equivalent contract equilibrium.
each tenant a plot of land on which tenant can earn no more than he could have earned in an alternative occupation. Whereas, in a Cheungian world enforcement of tenant's labour input is necessary, in our model, it takes a different form: it ensures that the tenant does not split his working time between share cropping and an alternative occupation.

In this world of utility equivalent contracts, we probe the impact of alternative arrangements for consumption credit to the tenant. It is shown that, if there are no interventions in the system, it will be in the interest of the landlord to ensure that the tenant gets his credit from the cheapest source. Thus, if the landlord's opportunity cost of capital is lower than that charged by the local money lender, by offering a linked tenancy-cum-credit contract landlord can ensure that the tenant gets credit at the cheapest interest cost. Unlike in the models of Bhaduri (1973, 1977, 1979) linking of credit with tenancy is not an instrument of extracting a surplus that would otherwise have accrued to the tenant: linking, where optimal, raises output and landlord's income compared to non-linking through reducing the plot size per tenant, thereby increasing the number of tenants, while leaving the utility of each tenant unchanged. Each tenant, thus cultivates a smaller plot of land devoting less effort per unit of his labour. *Ipso facto*, a ban on linking, when it is optimal, will reduce landlord's income and output. In the debate between Srinivasan (1979) and Bhaduri, the issue was the alleged lack of incentive for the landlord to introduce yield-raising innovation, given linked tenancy-cum-credit contracts. Srinivasan showed that: as long as borrowing was not an 'inferior' good to the tenant (which it was not in
the Shaduri model), there was no such disincentive. In our model, borrowing is by definition, non-inferior since it equals the tenant's discounted income. And linking is not imposed, but chosen, only if it is optimal. The tenant is ground-down to his alternative utility level, not by the credit instrument, but by plot size variations.

Finally, in our model, given that the landlord ensures (through plot size variations) that the tenant gets the same utility as he would have got in an alternative occupation, nothing short of land reform will affect the tenant's welfare, as long as he is a tenant. Indeed, other reforms, such as a floor on tenant's share of the crop, or making credit available to the tenant at a cost below the opportunity cost of capital to the landlord or a ban on linking credit and tenancy either have no effect on the equilibrium at all or have their effect on the number of tenants, output and the landlord's income.

Our model did not include production credit and did not allow any bargaining power to the tenant given the infinitely elastic supply of tenants at \( \bar{U} \). Braverman and Guasch (1979) extend our model to include production credit and cost sharing, and Bell and Zusman (1973) discuss interlinked credit and tenancy markets in a bargaining setting, using the Nash cooperative solution.
REFERENCES


Leibenstein, H. [1957], Economic Backwardness and Economic Growth, Wiley.


