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ON THE FIXED NATURE OF SHARECROPPING CONTRACTS*

Franklin Allen

Newbery and Stiglitz (1979) suggest four stylised facts of sharecropping which theories should attempt to explain. The first is the persistence of sharecropping and its coexistence with fixed rental and wage markets under a variety of conditions over centuries of time. The second is that in modern developed economies there appears to be a decline in share tenancy. Thirdly share tenancy is often but not always associated with lower productivity than fixed rental land. Finally, in many economies contracts involve shares of around one half for landlord and tenant. This does not vary from contract to contract and does not seem to be the object of negotiation.

Smith (1776) and many subsequent authors have likened sharecropping to a tax. They argue that under this type of contract tenants choose their labour supply to equate their marginal disutility of labour with their proportionate share of the marginal product instead of the full marginal product. They therefore regard sharecropping as an inefficient form of land tenure. However, this view is difficult to reconcile with the first observation: given the coexistence of fixed rent and share contracts, it is reasonable to expect that if share contracts were relatively inefficient they would quickly die out. This does not appear to have happened.

More recently it has been argued, most notably by Cheung (1969), that if there is certainty and transactions costs are the same for all contracts, then provided a share contract specifies the labour supply of the tenant it leads to the same efficient allocation of resources as a fixed rent or wage contract. Cheung has used this result as the basis of an explanation for coexistence. He suggests that the transaction costs for share contracts are higher than for wage and fixed rent contracts. However, share contracts have the advantage that they allow the risk to be shared between the landlord and tenant whereas with fixed rent contracts the tenant bears all the risk and with wage contracts the landlord does. Given varying degrees of risk aversion among landlords and tenants it is possible that for some parties the risk-sharing advantages outweigh the transaction cost disadvantages so that they will prefer share contracts whereas with others the reverse is true. One problem with this argument raised by Stiglitz (1974) and Newbery (1977) is that given constant returns to scale the risk-sharing properties of share contracts can be attained with mixtures of fixed rent and wage contracts. If these do indeed have lower transaction costs, share contracts would not then be observed.

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A more serious objection to Cheung’s theory is its inability to explain satisfactorily the other three observations and in particular the fourth one. In the long run, wage and fixed rental rates have been fairly volatile in most areas: in contrast, share proportions have remained fixed. Moreover in many diverse circumstances share contracts involve a fifty-fifty split.

A number of theories have been put forward to explain this constancy of shares and the prevalence of the fifty percent division. Bell and Zusman (1976) have suggested a Nash bargaining solution formulation of the problem in a model with no uncertainty. They argue that for plausible values for production elasticities the division of output will involve a share of around one half for both. Apart from all the standard objections to the Nash bargaining solution as a positive theory (see, for example, Luce and Raiffa (1957)) this explanation is difficult to reconcile with the coexistence of fixed rent and share contracts: indeed, to arrive at their result they assume a tenant’s alternative if he does not enter into a share contract with the landlord is working for a wage. If a fixed rent contract were available as an alternative then tenants and landlords would almost always strictly prefer different contracts and fixed rent and share agreements would not coexist.

Hurvitz and Shapiro (1978) have analysed a model where the landlord sets the rental share but his only information about the utility function and productivity of the tenant is that these belong to broadly specified a priori admissible classes. They are able to show that under these circumstances the landlord’s optimal strategy is to set a share of one half. This theory is again difficult to reconcile with coexistence. If fixed rent contracts are available then these should be chosen since they are Pareto efficient, which the above scheme is not, and in the case of fixed rent it does not matter that the landlord is unaware of the tenant’s characteristics (see Allen, 1982).

Marshall (1920) pointed out that a constant share percentage is consistent with coexistence for a wide range of fixed rents and wages provided sidepayments are possible. Share contracts typically contain many stipulations, which vary considerably between contracts, about who is to provide such inputs as seed, fertiliser and so on, and it can be argued these are essentially sidepayments. The problem with Marshall’s theory is that it does not explain the predominance of fifty-fifty splits and is difficult to reconcile with the second and third observations.

In summary, existing theories are not satisfactory when it comes to explaining what is typically observed.

The approach taken in this paper is different from those outlined above. Its starting point is the fact that implicit in tenancy contracts where the payment for the use of the land is made after harvest, is a loan. The tenant gets the use of the land for the year and does not have to make any payment until after he has finished using it to produce with. There is therefore an enforcement problem: how does the landlord ensure that the tenant makes the payment and repays the implicit loan?

In explicit loan markets in underdeveloped rural areas of the type where sharecropping is prevalent, collateral is only rarely used and default, which is usually not due to crop failure, is widespread. For example, Bottomley (1975)
quotes evidence (p. 284) that a significant majority of rural debt in underdeveloped countries is unsecured. As far as default is concerned Desai (1979) gives evidence (p. 51) that for India as a whole the default rate on rural debt is around 40%. In a detailed study of default in the Indian province of Rajasthan, Dadhich (1977) found that with a default rate of 44% (p. 5) only between 8 and 14% of defaults (p. 131) were due to crop failure with the lower figure being the more plausible. This evidence suggests that given the implicit loan involved, the prevention of intentional default on tenancy agreements is a major problem. If tenancy contracts involve money payments, as is often the case, then enforcement is very similar to explicit loans. If payment is in the form of the commodity grown, default may be somewhat more difficult as tenants must dispose of the output. The ease with which this can be done without the landlord realising what is happening and stopping it, depends on the precise opportunities open to the tenant. However, landlords and moneylenders usually have similar information on what tenants are doing: if demanding payment in the form of the crop grown made enforcement significantly easier, then moneylenders should also adopt this practice. The fact that, even given this option, the default rate on explicit loans is so high, suggests that payment in kind does not make it significantly easier to directly prevent default.

The model that is developed below focuses on the problem of making sure that tenancy contracts are such that the tenant has the correct incentives actually to make the payment to the landlord at the end of the production period. It is shown that this theory of enforceable contracts, in contrast to previous theories outlined above, is capable of simultaneously explaining all four of the empirical observations concerning share contracts given initially.

The model used is related to that introduced in Allen (1981; 1983). Landlords are taken to be of two types: those who hire labour to farm their own land and those who hire it out to be farmed by tenants. The output of people as tenants is taken to depend on their ability. This ability cannot be observed by landlords until after there has been production for one period.

People whose ability is so low that their output as tenants is insufficient to cover both the opportunity cost of the landlord’s land and their own labour have two alternatives: they can either become wage earners or they can become tenants, then default, and move to another location. To prevent the latter happening, the amount of land given to people whose ability is unknown must be sufficiently small to ensure that the low ability people prefer to become wage earners. After their ability is identified the high ability can then be given more land.

This necessity for having a reduced amount of land during the screening period means that if a high ability tenant defaults and moves to another location to avoid any direct penalties, he still faces the indirect penalty that he must be rescreened since his ability will be unknown to the landlords in his new locality. It is this indirect penalty which allows contracts to be enforced: provided the payment in any period is less than the loss in earnings from having to be rescreened, it will be worth while for a tenant to make the payment.

The main result of the paper is to show that if the enforcement constraint
binds the optimal contract requires that the payment to the landlord be a share of around one half of the output produced, together with a sidepayment and that the percentage division of output depends only on the tenant's rate of time preference. If the enforcement constraint does not bind then the optimal contract is shown to be a normal fixed rent one.

The model used is described fully in Section I. In Section II the equilibrium and optimal tenancy contracts are derived. Section III examines the consistency of the model with the four observations mentioned above. Finally, Section IV contains concluding remarks.

I. THE MODEL

There is a fixed exogenous distribution of land among landlords. These are of two types: the first farm their own land by hiring labour at wage rate \( w \) and the second rent out their land to tenants at an opportunity cost of \( r \) per acre. The markets for the services of both labour and land are taken to be competitive.

People who don't own land are taken to differ in their ability \( A \). There is a continuum of different ability groups with a lower bound of zero and an upper bound of \( A_u \). For simplicity everybody's labour supply is taken to be fixed at unity. People's output as tenants, \( Y \), can then be written as a function of their ability and the amount of land \( K \) they have:

\[
Y = Ay(K).
\]  

(1)

The function \( y \) has the usual properties:

\[
y' > 0; \quad y'' < 0; \quad y(0) = 0.
\]  

(2)

Uncertainty is excluded from the production function. In any model of this type, it is clear that for every fixed rent contract there is always an equivalent share contract which yields the same payments to landlord and tenant. In such cases, the distinction between the two is that with a fixed rent contract, payment is a fixed amount per unit of land and taking this price as given, the tenant is content with the amount of land chosen; with a share contract the payment depends on the amount of output produced: the amount of land is specified by the landlord and is such that the tenant would always like more. It is shown below that only tenants whose ability is such that enforcement of the tenancy agreement is a problem, will face share contracts.

Each person knows his own ability but this cannot be observed by anybody until they have seen him produce for one period. It is then known to all the landlords in the locality of production. However, if the person moves, landlords in the distant locality will again be unaware of his ability initially.

Time is divided into discrete production periods with inputs being supplied at the beginning and outputs produced at the end. The length of the period will usually be one year but in places where there is more than one crop a year it will be less. Initially landlords and tenants agree on a contract. At the end of each period the output is produced. The tenant then decides whether or not to fulfil the contract with the landlord by making the necessary payment. If he defaults he goes away to another geographical location. It is taken to be prohibitively
costly for the landlord to prevent him directly from doing this. There are no effective criminal penalties for the default but if the tenant ever returned to the locality of the landlord he defaulted from, then the latter can force him to work until the amount he defaulted on is repaid.

People are risk neutral and infinitely long lived. Since their labour supply is taken to be fixed their utility can be written as a function of their discounted consumption:

\[ U = \sum_{t=1}^{\infty} \delta^{t-1} C_t, \]  

where \( C_t \) is the consumption in the \( t \)th period and \( \delta(<1) \) is the discount factor.

Every period a small proportion of those without land change their geographical location for exogenous demographic reasons. The distribution of ability among this group is the same as that for the population as a whole.

Finally there are no possibilities for the use of savings or wealth as collateral or any other form of direct enforcement mechanism.

II. EQUILIBRIUM

In this section the determination of which people become tenants rather than wage earners and the type of contracts they use is considered. The focus of the analysis is on people who do not own any land and so \( r \) and \( w \) are taken as given. A complete model would in addition describe the technology available to landlords and would allow \( r \) and \( w \) to be determined endogenously. Such an addition would not be difficult but for ease of exposition is omitted.

The section proceeds as follows. First the notation used to describe the contracts is defined. Secondly the maximisation problems which the optimal contracts must satisfy are given and the constraints explained. A proposition describing the optimal contracts is then stated, proved and discussed and an example is considered.

There are two stages of contracts. In the first period of production in a locality, which will be called the screening period, the ability of the tenant has not been directly observed. The payment and amount of land used in these cases are denoted \( \phi_s(A) \) and \( K_s(A) \). In general these depend on \( A \) because although ability cannot be directly observed, tenants know their own ability and the possibility exists that optimal contracts will involve self-selection so that they are structured so the tenant's best course of action is to reveal his ability. In the second and subsequent periods the person's ability will be known in the locality and the contract he is offered will consist of a payment \( \phi(A) \) for \( K(A) \) of land.

It is assumed that landlords cannot make directly enforceable long term contracts which tie tenants to them. Also since once workers have produced for one period their ability is known to other landlords in the locality there is no informational constraint which ties them to particular landlords. The screening contracts and the contracts where ability is known are therefore determined independently. It is assumed that each contract is determined with the others taken as given. The screening contracts are considered first. In equilibrium
competition will ensure that the following Pareto optimal contracts will be offered to people whose ability is unknown:

\[
\text{Max} \quad Ay[K_\alpha(A)] - \phi_\alpha(A)
\]

subject to

\[
\phi_\alpha(A) \geq r K_\alpha(A),
\]

\[
A_0 y[K_0(A_0)] - \phi_\alpha(A_0) + \frac{\delta}{1 - \delta} \{A_0 y[K(\hat{A})] - \phi(\hat{A})\} \geq \frac{w}{1 - \delta},
\]

\[
A_0 y(K_0) = w,
\]

\[
K_\alpha(A) \leq K_0(A_0),
\]

\[
Ay[K_\alpha(A)] - \phi_\alpha(A) = \text{Max}_A \{Ay[K_\alpha(\hat{A})] - \phi_\alpha(\hat{A})\} \quad \text{for all } \hat{A} \geq A_0,
\]

\[
\phi_\alpha(A) \leq \delta \{Ay[K(\hat{A})] - \phi(\hat{A}) - [Ay[K_\alpha(A)] - \phi_\alpha(A)]\},
\]

\[
K_\alpha(A) \geq 0,
\]

where \(K(A), \phi(A)\) and \(\phi_\alpha(\hat{A}), K_\alpha(\hat{A})\) for \(\hat{A} + A\) are taken as given.

In equilibrium it must not be possible to make both tenants and landlords better off. Contracts in the screening period must therefore maximise the tenants' utility (4) subject to the constraint (5) which requires that landlords cover their opportunity cost of land. They must also satisfy a number of other constraints.

Equation (6) with an equality defines the level of ability \(A_0\) such that a person is indifferent between being a tenant and being a wage earner; it is shown below that for \(A < A_0\) a wage contract is best and for \(A \geq A_0\) tenancy is best. Equation (7) gives \(K_0(A_0)\) which is the amount of land a person of ability \(A_0\) needs to just cover his opportunity cost of labour if he undertakes a screening contract, defaults and moves to another area. If any landlord were to offer a contract with \(K_\alpha(A) > K_0(A_0)\) then not only would he obtain some of the people with \(A \geq A_0\) who had just moved for exogenous reasons but he would also attract people with ability \(A < A_0\). These people would come with the intention of defaulting since they are better off doing this than earning a wage. Since only a small number of people move in any particular year but the number of people with \(A < A_0\) who would be attracted by such a contract is relatively large, the vast majority of people who accepted such an offer would default. The return on such a contract would therefore be virtually zero. Constraint (8) is necessary to prevent this.

Since tenants know their own ability, it is possible that they can be made to self-select during the screening period by offering them a contract which is optimal for their particular ability level but may not be optimal for other levels of ability. Equation (9) represents this self-selection constraint. Including this cannot make the screening contract any less profitable since it is always possible to offer everybody the same contract, which is what would happen if (9) were not included and landlords had no information on abilities; moreover, in some cases the information on abilities might permit a more efficient allocation of
resources so that the contract is strictly better. In fact it is shown below that it is optimal for \( \phi_\delta(A) \) and \( K_\delta(A) \) to be independent of \( A \).

Constraint (10) ensures that the contract is enforceable. It must be worthwhile for tenants to make the payment to the landlord. This requires that the benefits of default are less than or equal to the costs (it is assumed throughout that if a person is indifferent between defaulting and not defaulting he does not default). The left-hand side of (10) represents the benefit of default, namely the payment. The right-hand side is the cost which consists of the loss of earnings due to the necessity of being rescreened after the move to the new locality.

Finally (11) represents the impossibility of tenants having a negative amount of land.

Once people’s ability becomes known they are offered contracts which satisfy the following:

\[
\begin{align*}
\text{Max} & \quad Ay[K(A)] - \phi(A) \\
\text{subject to} & \quad \phi(A) \geq rK(A), \\
& \quad \phi(A) \leq \delta(Ay[K(A)] - \phi(A) - \{Ay[K_\delta(A)] - \phi_\delta(A)\}), \\
& \quad K(A) \geq 0,
\end{align*}
\]  

(12)

(13)

(14)

(15)

taking \( K_\delta(A) \) and \( \phi_\delta(A) \) as given.

The justification for (12)–(15) is similar to that for (4)–(11). The difference here is that ability is known so that the equivalents of constraints (6)–(9) are unnecessary. Equations (13)–(15) are the counterparts of (5), (10) and (11) respectively and are necessary for the same reasons given there.

It is shown below that the crucial determinant of whether a share or fixed rent contract is best is whether (14) binds or not. Since optimality requires (13) to be satisfied with an equality, if (14) does not bind then a fixed rent contract is used for tenants: the amount of land specified in the contract is such that marginal product is equated to \( r \) and is denoted \( h(A) \) where

\[
Ay'(h) = r.
\]  

(16)

Since at the optimum (5) and (8) are equalities, whether (14) binds or not depends on the sign of

\[
f(A, A_0) = rh(A) - \frac{\delta}{1 + \delta} Ay[h(A)] + \frac{\delta}{1 + \delta} \{Ay[K_0(A_0)] - rK_0(A_0)\}.
\]  

(17)

If \( f(A, A_0) > 0 \) then it binds and the amount of land in the contract is determined by the constraint: this is denoted \( g(A, A_0) \) and is the highest value of \( K \) such that

\[
rK = \frac{\delta}{1 + \delta} Ay(K) - \frac{\delta}{1 + \delta} \{Ay[K_0(A_0)] - rK_0(A_0)\};
\]  

(18)

if no \( K \) satisfying (18) exists \( g(A, A_0) = 0 \).

The \( n \) values of \( A \) above \( A_0 \) which are such that \( f(A, A_0) = 0 \), are denoted \( A_i \) \( (i = 1, \ldots, n) \) where \( A_1 < A_2 < \ldots < A_i < \ldots < A_n \) and \( A_{n+1} = A_w \).

It is now possible to state the following proposition relating ability and contract form.
Proposition 1. In equilibrium people do one of three things depending on their ability:
(i) For people with $A < A_0$ a wage contract is optimal and $w$ is earned every period.
(ii) For people with $A \geq A_0$ tenancy is better than being a wage earner. In the screening
period for all $A \geq A_0$:

$$\phi_s(A) = rK_0(A_0),$$

(19)

$$K_s(A) = K_0(A_0).$$

(20)

In the second and subsequent periods:

(a) for $A$ such that $A_0 \leq A \leq A_1$ and any other $A_i \leq A \leq A_{i+1}$ for which $f(A, A_0) > 0$ a share contract is optimal:

$$\phi(A) = \frac{\delta}{1 + \delta} A y[g(A, A_0)] - \frac{\delta}{1 + \delta} \{Ay[K_0(A_0)] - rK_0(A_0)\},$$

(21)

$$K(A) = g(A, A_0);$$

(22)

(b) if a value of $A_2$ exists then for $A$ such that $A_1 \leq A \leq A_2$ and any other $A_i \leq A \leq A_{i+1}$ for which $f(A, A_0) \leq 0$ a rent contract is optimal:

$$\phi(A) = rh(A),$$

(23)

$$K(A) = h(A).$$

(24)

The proof is shown in the Appendix.

The proposition indicates that, depending on ability and whether the enforce-
ment constraint binds, three types of contract can be optimal. For high-ability
people for whom the enforcement constraint does not bind (23) and (24) imply
a standard fixed-rent contract, where the amount of land rented is such that the
marginal product is equated to $r$, is optimal. For people who are constrained by
the requirement that contracts be enforceable, such as those with abilities between
$A_0$ and $A_1$, it can be seen from (21) and (22) that once their ability is known to
landlords, the optimal contract requires the tenant to pay a share $\delta/(1 + \delta)$ of the
output to the landlord together with a negative sidepayment. The amount of
land the sharecropper can hire is rationed below the level that equates marginal
product with the landlord’s opportunity cost. For people with low ability it is
better to supply labour to landlords and work under their direction rather than
become tenants.

To see the type of situation that can arise, consider the special case

$$y(K) = K - \frac{K^2}{2}.$$  

(25)

Here

$$h(A) = 1 - \frac{r}{A}.$$  

(26)

$$f(A, A_0) = \frac{2 + \delta}{2(1 + \delta)} \left( r - \frac{r^2}{A} \right) - \frac{\delta}{2(1 + \delta)} (A - r)$$

$$+ \frac{\delta}{1 + \delta} \left[ A \left( K_0 - \frac{K^2}{2} \right) - rK_0 \right],$$

(27)

$$f_A(A, A_0) = \frac{2 + \delta}{2(1 + \delta)} \frac{r^2}{A^2} - \frac{\delta}{2(1 + \delta)} + \frac{\delta}{1 + \delta} \left( K_0 - \frac{K^2}{2} \right),$$

(28)

$$f_{AA}(A, A_0) = -\frac{2 + \delta}{1 + \delta} \frac{r^2}{A^3}.$$  

(29)
It can be seen that \( f(A, A_0) \) is a concave function. Since from (A 6) and (26), \( K_0 < b(A_0) < 1 \), (28) implies that for sufficiently high \( A \), \( f(A, A_0) \) will be negative. This means that provided the range of abilities in the population is sufficiently large all three types of contract will be used. If, for example, \( r = 1, w = 0.2 \) and \( \delta = 0.95 \) then it can be shown \( A_0 = 2.92, K_0 = 0.0710, K(A_0) = 0.297 \) and \( A_1 = 3.59 \). The form of \( f(A, A_0) \) for this case and the relationship between the type of contract used and ability is shown in Fig. 1.

![Diagram](image)

**Fig. 1.** Contract form and ability.

![Diagram](image)

**Fig. 2.** Income and ability.

If contracts could be directly enforced by the use of collateral or some other means then fixed rent contracts would be used for all those with abilities of 1.86 and above since they are able to cover both the opportunity cost of their labour \( w \) and the opportunity cost of land \( r \); wage contracts would be used for all abilities below 1.86. Hence the inefficiency resulting from contracts not being directly enforceable, is that instead of using fixed rent contracts, those with abilities from 1.86 to 2.92 have to work for wages and those from 2.92 to 3.59 have to work as sharecroppers with an amount of land such that marginal product is strictly greater than opportunity cost.

Fig. 2 illustrates the relationship between income and ability for the example. Between 0 and \( A_0 \), \( w \) is earned. At \( A_0 \) there is a discontinuity in income. If
contracts were fully enforceable people from 1.86 to 2.92 would rent: however, there do not exist values of $A_0$, $K_0(A_0)$ and $K(A_0)$ which would give tenants the correct incentives to make payments; it is only at $A_0 = 2.92$ that this becomes possible. At this level of ability sharecroppers earn strictly more than wage earners so there is a discontinuity. Beyond $A_0$ tenant income increases and at $A_1$ the function changes from being concave to being convex. In this particular case it can be seen that the income of sharecroppers is always below that of renters.

Fig. 3 shows the relationship between land productivity and ability. Productivity falls as ability increases for sharecroppers but rises with ability for renters. For low-ability renters productivity is less than for sharecroppers but for those with high ability the reverse is true.

![Fig. 3. Land productivity and ability.](image)

![Fig. 4. Tenant income and land productivity.](image)

Finally Fig. 4 gives the relationship between tenant income and land productivity. For sharecroppers productivity falls with a rise in income but for renters it rises with income.

The model underlying the proposition has a number of simplifying assumptions to make the analysis of optimal contracts tractable. Among these are the use of a non-stochastic production function and the assumption of risk neutrality. It is
likely that if these do not hold, the optimal contract will, in general, involve a payment which is a nonlinear function of output. Another important assumption is that the indirect penalty from being rescreened does not vary from region to region. If different regions have different production functions, the optimal contract will depend on a tenant's possibilities in the region where the indirect penalty is lowest. In all these cases, optimal contracts will be much more complex and difficult to implement than those in Proposition 1. However, provided the assumptions are not violated too drastically, fixed rent and share agreements of the type given in (21), (22) and (23), (24) may not be very inefficient; moreover given the underdeveloped rural setting of the model, any such inefficiencies are likely to be more than outweighed by the greater ease of implementation of these simple contracts. In order to give some insight into the role of uncertainty, risk aversion and differing indirect penalties, in determining the relationship between contract form and ability, the effect of relaxing the assumptions one at a time is considered.

The main difference if a stochastic production function were included would be that the default decision would be made after the level of the current harvest is known, but the penalty associated with having to be rescreened would depend on the probability distribution of outputs and payments in the next period. Default will occur with fixed rent contracts, when the level of the current output is too low to cover the payment, and with share contracts when output is so high that the payment is greater than the expected loss involved in being rescreened. Whether fixed rent or share contracts are used more or less than Proposition 1 suggests, will be determined by which of these problems is the more severe.

Assuming there are no possibilities for savings, the effect of tenants being risk averse will be to make the extra consumption associated with defaulting in the current period, less attractive relative to the reduction in consumption involved in having to be rescreened next period. This means it will be possible to use fixed rent contracts in a greater number of instances than with risk neutrality. If savings were possible, the analysis would be similar to the risk-neutral case since tenants would be able to equate the marginal utilities of consumption in the two periods and all that would matter would be the present value of savings: however, such savings possibilities are likely to be incompatible with the assumption that collateral cannot be used.

Finally, if the lowest indirect penalty from being rescreened in a neighbouring region is lower than in the local surrounding area, the right-hand side of (14) will be reduced and fixed rent contracts will be used less than the above analysis would suggest; the reverse is true if the lowest indirect penalty in neighbouring regions is higher.

III. EXPLAINING THE STYLED FACTS

In this section it is shown why the equilibrium considered in Section II is consistent with the four stylised facts mentioned in the introduction.

The first was the persistence of sharecropping and its coexistence with fixed rent and wage markets over centuries of time. It can be seen from Proposition 1
that the model is quite consistent with this observation. Low-ability people will
always become wage earners and provided only that \( y \) is such that \( f(A, A_0) \) can
be either positive or negative both share and fixed rent contracts will be used
as well.

The second observation was that in modern developed economies there
appears to be a decline in share tenancy. One of the crucial assumptions of the
model was that direct enforcement mechanisms such as saving and the use of
collateral could not be used. If there is a direct mechanism to guarantee pay-
ments then share contracts will no longer be necessary. In the economies where
there has been a decline in share tenancy these institutions usually do exist,
whereas in the economies where share tenancy is observed they either do not
exist or exist only in a primitive form. The theory is thus not inconsistent with
this observation.

The third stylised fact was that share tenancy is often, but not always,
associated with lower productivity than fixed rental land. It follows from
Proposition 1 and (A 10) that with fixed rent contracts:

the total return received by the tenant

\[
\geq \left(1 - \frac{\delta}{1 + \delta}\right) Ay(K) + \frac{\delta}{1 + \delta} [Ay(K_0) - rK_0],
\]

(30)

the total return received by the landlord \( = rK \).

(31)

Since the total sum of these returns must be equal to the output it follows

\[
\left[\frac{Ay(K)}{K}\right]_{\text{rent}} \geq \frac{r(1 + \delta)}{\delta} + \frac{Ay(K_0) - rK_0}{K}.
\]

(32)

For share contracts it can be similarly shown

\[
\left[\frac{Ay(K)}{K}\right]_{\text{share}} = \frac{r(1 + \delta)}{\delta} + \frac{Ay(K_0) - rK_0}{K}.
\]

(33)

Now if \( [Ay(K_0)/K]_{\text{rent}} > [Ay(K_0)/K]_{\text{share}} \) then it will definitely be the case

\[
\left[\frac{Ay(K)}{K}\right]_{\text{rent}} > \left[\frac{Ay(K)}{K}\right]_{\text{share}}
\]

(34)

so the productivity of the fixed rent land is higher. However, if \( [Ay(K_0)/K]_{\text{rent}} <
\left[\frac{Ay(K_0)}{K}\right]_{\text{share}} \) which is possible, then the reverse may be true. The case shown
in Fig. 3 illustrates that both rankings of productivity and contract form are
possible; thus the observation that the productivity of fixed rent land is often,
but not always, greater than that of sharecropped land does not contradict the
model.

The fourth feature of share contracts which has perhaps been the most
puzzling is the prevalence of share contracts with an approximately fifty-fifty
split. This percentage division is observed in widely differing circumstances and
has persisted in many places for a considerable length of time. Indeed the French
and Italian words for sharecropping, *metayage* and *mezzadria* respectively,
literally mean splitting in half. Sometimes other shares which involve the
landlord receiving proportionately less and the sharecropper more are observed but these are much less common. Perhaps the most interesting feature of the theory presented above is its ability to explain this phenomenon.

It can be seen that the payment schedule (21) is such that the share of output going to the landlord is $\delta/(1 + \delta)$. For discount factors close to unity which would be expected to be the usual case the corresponding shares are around one half. For lower discount factors (higher discount rates) the landlord’s share will be lower.

The schedule (21) also implies that there is a negative sidepayment. In reality a wide variety of sidepayments are observed. However it has so far been assumed that when the tenant defaults there are no costs for moving to the new location. If this simplifying assumption is relaxed and there are taken to be moving costs of $z$ it can easily be shown that (21) is altered to

$$\phi(A) = \frac{\delta}{1 + \delta} Ay[g(A, A_0)] - \frac{\delta}{1 + \delta} \left[ Ay[K_0(A_0)] - rK_0(A_0) \right] + \frac{z}{1 + \delta}. \tag{35}$$

It follows from this that if $z$ is sufficiently large then the sidepayment can also be zero or positive.

The other effect of allowing for moving costs is that they may be sufficient on their own to make contracts with low-ability tenants enforceable. In such cases the amount of land these people receive in the screening period will be the same as that in subsequent periods.

The view that the percentage division of output in share contracts is determined by long-standing custom rather than by competition as with the prices in fixed rent and wage contracts is a very old one. Mill (1848) (pp. 348–9) quotes Sismondi (1814) (pp. 41–2) who wrote of Tuscany where he was himself a sharecropper or metayer landlord:

This connexion (of input commitments) is often the subject of a contract, to define certain services and certain occasional payments to which the metayer binds himself: nevertheless the differences in the obligations of one such contract and another are inconsiderable; usage governs alike all these engagements, and supplies the stipulations which have not been expressed: and the landlord who attempted to depart from usage, who exacted more than his neighbour, who took for the basis of the agreement anything but the equal division of the crops, would render himself so odious, he would be so sure of not obtaining a metayer who was an honest man, that the contract of all the metayers may be considered as identical, at least in each province, and never gives rise to any competition among peasants in search of employment, or any offer to cultivate the soil on cheaper terms than one another.

The observation by Sismondi that landlords who tried to obtain a higher than customary share would obtain dishonest tenants is consistent with the theory above.
IV. CONCLUDING REMARKS

There is considerable evidence that default on money loans is a major problem in underdeveloped rural areas. This suggests that the direct enforcement of contracts in such settings is difficult. A theory of tenancy contracts based on the endogenous prevention of default was therefore developed. In contrast to previous theories, this is capable of explaining the widespread use of share contracts with a fifty-fifty split and is consistent with the coexistence of wage, share and fixed rent contracts, the demise of sharecropping in more developed economies and the fact that share tenancy is often but not always associated with lower productivity than fixed rental land.

Much of the previous literature on sharecropping has been concerned with policy issues. Proponents of the tax equivalent approach to sharecropping have argued vigorously for policies to abolish it. Smith (1776) himself, for example, advocated that taxes be used to induce landlords to adopt other types of tenancy arrangement. The analysis of this paper suggests that, in comparison to an ideal world where all contracts are directly enforceable, share contracts are undesirable because the marginal product of land is not equated to its opportunity cost. However, in situations where direct enforcement mechanisms are unavailable the use of share contracts can be optimal. Thus, rather than simply outlawing share contracts, the theory above indicates policy should be directed toward developing institutions which permit the direct enforcement of contracts at a low cost, so that efficient fixed rent agreements can be used for all tenants.

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APPENDIX

Proof of Proposition 1

It is easiest to start by looking at tenancy contracts. Consider first the case where the constraints in the maximisation problem (4)–(11) bind as follows; it is shown below that this configuration is the only way in which the constraints can bind at the optimum. Inequality (8) is taken to be satisfied with an equality and (10) with a strict inequality. Also only solutions where \( K_s(A) > 0 \) are of interest since if \( K_s(A) = 0 \) people will definitely become wage earners.

Clearly

\[
\phi_s(A) = rK_s(A) \tag{A 1}
\]

since otherwise holding \( K_s(A) \) constant it would be possible to increase the objective function while at the same time satisfying all the other constraints, by reducing \( \phi_s(A) \). Taking (A 1) together with the equality of (8) it follows immediately (9) will be satisfied. The screening contract is therefore given by (19) and (20).

Consider next the solution to the problem (12)–(15). As before solutions where \( K(A) > 0 \) are of interest. Also it must be the case that

\[
\phi(A) = rK(A), \tag{A 2}
\]
since otherwise it would again be possible to increase the objective function without violating any of the other constraints by reducing \( \phi(A) \). Substituting for \( \phi(A) \) using (A 2) the problem (12)–(15) simplifies to

\[
\text{Max } Ay[K(A)] - rK(A)
\]

subject to

\[
rK(A) \leq \frac{\delta}{1 + \delta} Ay[K(A)] - \frac{\delta}{1 + \delta} \{Ay[K_0(A_0)] - rK_0(A_0)\}.
\]

If \( \lambda(A) \) is used to represent the multiplier for (A 4) the first-order condition for the choice of \( K(A) \) is

\[
Ay'[K(A)] - r + \lambda(A) \left( r - \frac{\delta}{1 + \delta} Ay'[K(A)] \right) = 0.
\]

The other first-order condition for the problem is (A 4) which displays complementary slackness with its multiplier \( \lambda(A) \). Since the objective function (27) is concave in \( K(A) \) and the constraint (A 4) is convex it follows that these first-order conditions are not only necessary but are also sufficient for an optimal solution.

If (A 4) does not bind then (A 5) simplifies to (16) and \( \phi(A) \) and \( K(A) \) are given by (23) and (24). However if (A 4) does bind then \( K(A) \) is determined by (28) with an equality so that \( \phi(A) \) and \( K(A) \) are given by (21) and (22). It can easily be checked that both cases are in fact possible. Also it can be seen that given (19) and (20) whether the constraint binds depends on the sign of \( f(A, A_0) \).

It remains to show that the configuration of inequalities assumed initially for the maximisation problem (4)–(11) is in fact optimal. Now from (6)–(8) it can be seen

\[
K_0(A_0) < K(A).
\]

Also

\[
h'(A) = -\frac{y'[K(A)]}{Ay'[K(A)]} > 0,
\]

\[
g_A(A, A_0) = \frac{[\delta/(1 + \delta)] \{y[g(A, A_0)] - y[K_0(A_0)]\}}{r - [\delta/(1 + \delta)] Ay'[g(A, A_0)]} > 0,
\]

where \( g_A \) denotes the derivative of \( g \) with respect to the first argument \( A \). The properties of \( y \) given in (2) imply \( h'(A) \) is positive. It follows from (A 6) that the numerator of (A 8) is positive. Since (18) is convex in \( K \) and \( g(A, A_0) \) is the highest value of \( K \) such that (18) is satisfied the denominator cannot be negative. Hence \( g_A(A, A_0) \) is positive.

The inequalities (A 6)–(A 8) imply

\[
K_0(A_0) < K(A) \quad \text{for all } A \geq A_0.
\]

The concavity of \( y \) and the form of the enforcement constraint (A 4) mean that if \( f(A, A_0) > 0 \) then

\[
g(A, A_0) < h(A).
\]

Taking this together with (A 9)

\[
Ay'[K_0(A_0)] > r \quad \text{for all } A \geq A_0.
\]
Hence reducing $K_0(A)$ below $K_0(A_0)$ cannot be optimal, so that (8) must be satisfied with an equality. Also (A 9) implies that, given (14) is satisfied, (10) must be satisfied with a strict inequality.

As far as the range of abilities for which the different types of tenancy contract are used, is concerned, it is shown in Proposition 2 below that a value of $A_0$ such that (6) is satisfied always exists. The optimal value of $A_0$ is the minimum value such that (6) is satisfied, since otherwise it would be possible to reduce $A_0$ and hence from (7) increase $K_0$ and $K_0(A)$; combining this with a change in $\phi_0(A)$ so that (5) were still satisfied, (A 11) implies it would be possible to increase the objective function. It is also shown in Proposition 2 that this minimum level of $A_0$ (which is denoted $A_0^{**}$) is such that $f(A_0, A_0) > 0$ so that a share contract is used for $A$ between $A_0$ and $A_1$. If a value of $A_0$ exists then a fixed rent contract is used for $A$ between $A_1$ and $A_2$. Differentiating (17) it can be shown using (16) and (A 7)

\[
f(A, A_0) = \frac{1}{1 + \delta} \left( \delta [y[K_0(A_0)] - y[h(A)] - y'[h(A)]^2, \right)
\]  

\[
f_{AA}(A, A_0) = -\frac{h'(A) y'[h(A)]}{1 + \delta} \left[ 2 + \delta - \frac{y'[h(A)] y''[h(A)]}{y'[h(A)]^2} \right].
\]

Since no restrictions are placed on $y''(K)$, $f(A, A_0)$ may alternate signs a number of times as ability increases and many values of $A_i$ may exist. There can therefore be several ranges of ability where share contracts are used, interspersed with ranges where fixed rent contracts are.

Finally it must be demonstrated that for $A < A_0$ a wage contract is optimal and for $A \geq A_0$ a tenancy contract is. Utility as a tenant $V$ is given by

\[
V(A) = Ay[K_0(A_0)] - rK_0(A_0) + \frac{\delta}{1 - \delta} \{Ay[K(A)] - rK(A)\}.
\]

Differentiating,

\[
V'(A) = y[K_0(A_0)] + \frac{\delta}{1 - \delta} y[K(A)] + \frac{\delta}{1 - \delta} \{Ay'[K(A)] - r\} K'(A).
\]

Now for $f(A, A_0) \leq 0$, $K(A) = h(A)$ so that the last term is zero and hence $V'(A)$ is positive. For $f(A, A_0) > 0$, $K(A) = g(A, A_0)$ and $K'(A)$ is given by (A 8). This together with (A 10) implies the last term is positive, so $V'(A)$ is again positive. Thus utility as a tenant is a monotonically increasing function of ability. For people with ability $A < A_0$ it follows from this and (6) that a wage contract is optimal but for $A \geq A_0$ a tenancy contract is optimal.

Hence the proposition is proved.

**Proposition 2.** A level of ability $A_0$ such that (6) is satisfied always exists. For the minimum feasible such level, denoted $A_0^{**}$, $f(A_0^{**}, A_0^{**}) > 0$ and a share contract is used.

**Proof.** It is shown first that if a fixed rent contract is used at $A_0$, the minimum value of $A_0$ such that (6) is satisfied, denoted $A_0^*$, entails $f(A_0^*, A_0^*) > 0$ so the fixed rent
contract will not be enforceable. Given that a share contract is used at $A_0$ it is then shown $A_0^{**}$ exists and is such that $f(A_0^{**}, A_0^{**}) > 0$.

If a fixed rent contract were used at $A_0$ then

$$K(A_0) = h(A_0). \quad (A\ 16)$$

It follows that for people of ability $A_0$ lifetime utility as a tenant is

$$l(A_0) = A_0 y[K_0(A_0)] - rK_0(A_0) + \frac{\delta}{1 - \delta} \{A_0 y[h(A_0)] - rh(A_0)\}. \quad (A\ 17)$$

Let $A_0$ be the ability $A_0$ such that

$$K_0(A_0) = h(A_0). \quad (A\ 18)$$

It is clear from the definitions of $K_0(A_0)$ and $h(A)$ that such a value exists. It can also be seen that

$$l(A_0) < \frac{w}{1 - \delta}. \quad (A\ 19)$$

Now for $A_0 \geq A_0$, $l$ is continuous. Differentiating (A 17) and using (7) and (16) it can be shown

$$l'(A_0) = \frac{r y[K_0(A_0)]}{A_0 y[K_0(A_0)]} + \frac{\delta}{1 - \delta} y[h(A_0)] > 0. \quad (A\ 20)$$

Since $l'(A_0)$ is positive and does not tend to zero as $A_0 \to \infty$ it follows that for any positive $r$ and $w$ there always exists a value $A_0^*$ such that

$$l(A_0^*) = \frac{w}{1 - \delta} \quad (A\ 21)$$

and this is the minimum value of $A_0$ which satisfies (6).

Using (7), (17), (A 6), (A 17) and (A 21) it can be shown

$$f(A_0^*, A_0^*) = \frac{r}{1 + \delta} [h(A_0^*) - K_0(A_0^*)] > 0. \quad (A\ 22)$$

Hence a fixed rent contract cannot be used at $A_0^*$ since it will not be worthwhile for a person of ability $A_0^*$ to make a payment $rh(A_0^*)$ if he is allocated $h(A_0^*)$ of land. In order for it to be worthwhile for the tenant to pay, his land must be restricted to $g(A_0^*, A_0^*)$. In such cases the lifetime utility of a tenant with ability $A_0$ is

$$m(A_0) = A_0 y[K(A_0)] - rK(A_0) + \frac{\delta}{1 - \delta} \{A_0 y[g(A_0, A_0)] - rg(A_0, A_0)\}. \quad (A\ 23)$$

Now for $A = A_0 = A_0^*$, (A 10), (A 11) and (A 17) imply

$$m(A_0^*) < \frac{w}{1 - \delta}. \quad (A\ 24)$$

If at $A_0^*$ no value of $K$ such that (18) is satisfied, exists, then $g(A_0^*, A_0^*) = 0$. Increasing $A = A_0$ in (18) it can easily be seen that a value $A_0^{**}$ will be reached such that a strictly positive $g(A_0^{**}, A_0^{**})$ exists. If $m(A_0^*) = w/(1 - \delta)$ then $A_0^{**} = A_0^*$. If $m(A_0^*) < w/(1 - \delta)$ or if $g(A_0^*, A_0^*) > 0$ it remains to show a value of $A_0^{**}$ exists.
In these last two cases it can be seen $m$ is continuous for $A_0 \geq \bar{A}$ and $\bar{A}$ respectively. Differentiating $m$ and defining

$$G(A_0) = g(A_0, A_0),$$

(A 25)

gives

$$m'(A_0) = \frac{r_0[K_0(A_0)]}{A_0 y'[K_0(A_0)]} + \frac{\delta}{1 - \delta} \frac{y'[G(A_0)]}{A_0 y'[G(A_0)]} + \frac{\delta}{1 - \delta} \{A_0 y'[G(A_0)] - r\} G'(A_0).$$

(A 26)

Now provided $f(A_0, A_0) > 0$, (A 10) implies that $A_0 y'[G(A_0)] > r$. Also using (18) it can be seen

$$G'(A_0) = \frac{\delta}{1 + \delta} \left\{ \frac{y'[G(A_0)] - \frac{r_0}{A_0 y'[K_0(A_0)]}}{A_0 y'[K_0(A_0)]} \right\} > 0.$$  

(A 27)

It follows from (A 6) that $K_0(A_0) < G(A_0)$; this together with (A 10) implies the numerator must be positive. The denominator is non-negative by a similar argument to that used in the signing of the denominator in (A 8). Hence $G'(A_0)$ is positive. Thus overall provided $f(A_0, A_0) > 0$, $m'(A_0)$ is positive; moreover it does not tend to zero as $A_0 \to \infty$.

There are then two possibilities. Either $f(A_0, A_0) > 0$ for all $A_0 > A_0^*$, in which case it follows immediately that there exists an $A_0^{**}$ such that

$$m(A_0^{**}) = \frac{w}{1 - \delta}.$$  

(A 28)

so (6) is satisfied and $f(A_0^{**}, A_0^{**}) > 0$. The second alternative is that as $A_0$ increases from $A_0^*$ there eventually comes a value $\bar{A}_0$ such that $f(\bar{A}_0, \bar{A}_0) = 0$. In this case $G(\bar{A}_0) = h(\bar{A}_0)$. Now since $\bar{A}_0 > A_0^*$, $v(A_0)$ is positive for $A_0^* < A_0 \leq \bar{A}_0$ and $l(\bar{A}_0) = m(\bar{A}_0)$ it follows that

$$m(\bar{A}_0) > \frac{w}{1 - \delta}.$$  

(A 29)

Hence since $m$ is continuous and upward sloping it again follows there must exist an $A_0^{**}$, between $A_0^*$ and $\bar{A}_0$, such that (A 28) and (6) are satisfied and $f(A_0^{**}, A_0^{**}) > 0$. Thus there always exists a value $A_0^{**}$ such that (6) is satisfied and $f(A_0^{**}, A_0^{**}) > 0$ so that a share contract is used at $A_0^{**}$. Hence the proposition is proved.

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