1-1-1979

Production and Distribution in Agrarian Economies

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CENTER DISCUSSION PAPER NO. 309

PRODUCTION AND DISTRIBUTION IN AGRARIAN ECONOMIES

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January 1979

The economists' characterization of production and distribution of output in agrarian economic systems, based upon the neoclassical competitive model, has differed rather sharply from the point of view stressed by many non-economists. The alternative view centers around the idea of a powerful landlord class subjugating and exploiting a large but powerless peasant labor class.[1] As if this attack from the distributional perspective were not enough, social reformers were joined by eminent economists who argued that one widely used agrarian institution, sharecropping, is productively inefficient.[2] This two tiered attack upon an economic institution so prevalent in virtually all regions of the world throughout the history of organized agricultural production could not coexist peacefully with received economic doctrine. The reason being that neither exploitation nor inefficiency have a place in competitive markets. Recently there have been a collection of spirited defenses of the institution of sharecropping within the framework of competitive markets.[3] The first attack upon the common view was put forth by Steven S. Cheung. Cheung essentially argued that since exploitation and inefficiency could not persist in a competitive market, and sharecropping did exist, it must not be

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[1] A representation of such viewpoints can be found in Breman [2] and Feder [5].

[2] The list begins with Adam Smith. Among contemporary economists, we find A.K. Sen, P.K. Bardhan, and T.N. Srinivasan.

[3] See Cheung [3] and Reid [14].

inefficient. The only task that had to be faced was to show how sharecropping could be efficient within the framework of a competitive model. The source of the putative inefficiency, as pointed out by Adam Smith, was that since a sharecropper would receive only a fraction of the total fruits of his labor he would quite naturally undersupply labor to sharecropped land. However, Alfred Marshall, and later D. Gale Johnson pointed out that if the landlord could stipulate and enforce the labor supply of the tenant this inefficiency might not exist.[4] This was the procedure taken by Cheung who along with others produced evidence that contractual stipulation and enforcement of tenant activities is precisely what landlords did. Under the assumption that landlords can costlessly enforce stipulated tenant labor supplies to leased land, Cheung and others have developed models showing that sharecropping is efficient. One by-product of Cheung's approach is the proposition, stated by David M.G. Newberry, that Cheung's sharecropping equilibrium is exactly equivalent in its efficiency and distributive effects to a competitive equilibrium. This result is hardly surprising since the Cheung competitive approach has landlords choosing the contractual parameters of a sharing arrangement subject to the constraint that accepting tenants receive an income, or more generally an expected utility level, greater than or equal to that they could earn by working for a <u>competitively</u> determined wage.

Using Cheung's notation let each farm have the production function $q = q(h,T)$, where q is output, h land, and T labor. Let H equal landowners

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[4] [9,8]. In fact, in a footnote I discovered after writing this paper, Marshall comes close to anticipating some of the major points of this paper. See below.

total landholding and m the number of tenancies leased so that $h = \frac{H}{m}$. Suppose that w is a competitively determined wage available to the tenant and (1-r) the tenant's share of output. Cheung has the landlord maximize

$$\max_{\{m,r,T\}} \; R = m \cdot r \cdot q(h,T)$$

$$\text{subject to } wT = (1-r)q(h,T).$$

Even before the Lagrangian is formed and the maximization taken it is a foregone conclusion that the wage will equal the marginal product of labor and rent per acre will equal the marginal product of land. David M.G. Newberry using essentially Cheung's model allows tenants to maximize own income by choosing over all landlords offerings. But the tenant's representation in this process is superfluous. Tenant's make no real choices as to labor supply, but simply choose over the various all or nothing offers made unilaterally by landlords. In a command society an income maximizing dictator will choose an efficient allocation too. The role of the wage in Cheung's analysis is just to ensure efficiency. The model is ad-hoc. Why do not the landowners simply offer tenants the competitive wage?

Cheung's approach has not escaped criticism from other quarters. P.K. Bardhan and T.N. Srinivasan (B-S) argue that the approach which has landlords choosing the contractual terms subject to acceptance constraints is in the spirit of monopolistic competition rather than perfect competition. I concur with this view. But it must be recognized that the alternative model offered by B-S is as they admit not at all satisfactory. The major problem with their model is that they attempt to treat the share of output accruing to the tenant as a price-like parameter taken as market

given by all participants. Unfortunately, as Newberry points out this parameter cannot be treated like a price. It is closer in concept to a contingent claim on output and in that sense resembles more a commodity or asset which might have a price rather than be a price itself.[5] In the first section of this paper I present a competitive sharecropping model that seems to me to be as close as possible to the spirit of competition envisioned by economists. All agents are assumed to be contract takers in a way perfectly analogous to price taking assumptions. It is shown in that section that a sharecropping contract equilibrium is identical to a competitive equilibrium. This result is in no way ad hoc. It can be obtained even in the case where there does not exist a competitive wage or any other competitive parameter other than contracts. In that sense the model illustrates precisely why the sharecropping competitive equilibrium equivalency result must go through.

The equivalence of sharecropping and competitive wage-rental markets establishes the productive efficiency of sharecropping, but it creates a new problem at least as big as the one it solves. In light of the equivalency result one may certainly ask why do any agents choose sharecropping as opposed to the wage-rental system. The following section briefly discusses the traditional explanations for the use of the institution of sharecropping and finds them lacking. Put succinctly sharecropping is an irrelevant institution in the context of competitive markets.

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[5] This essential aspect of the problem is made clear by both Newberry [12] and Stiglitz [17].

This means that any attempt to explain the incidence of sharecropping must be based on the existence of some market imperfection. In the third section of the paper it is shown that if capital is used in the production process and landlord and tenant share in the cost of capital, efficiency requires that each receives a share of output equal to his share of capital costs. If the market for capital is imperfect, capital rationed landowners and capital holding tenants will both gain by entering sharecropping arrangements. Thus the explanation of sharecropping offered here is based upon a model of capital rationing. In the major section a very simple model of agrarian production in the presence of an imperfect capital market is presented. A few basic propositions of the model are derived and it is argued that these implications fit the known empirical evidence much better than the conclusions reached by assuming perfect competition.

Competitive Contracting

In this section I develop and analyze a simple agrarian economy with sharecropping under assumptions which I believe conform as closely as possible to the economists' notion of perfect competition. The sine qua non of perfect competition is the assumption of price-taking behavior. If the price-taking assumption is satisfied one need not make any additional assumptions about the number of agents and the market power of each. As discussed above share claims to output are not price like parameters so we must find an alternative to the price taking hypothesis. It seems that the parallel assumption in the present context is a contract-taking assumption. A few definitions and assumptions are required before the analysis can continue.

Assumption 1: All farms produce a homogeneous consumption good with inputs land d, and labor L. Each farm uses the same constant returns production function

$$F(d,L) \quad \text{with intensive form} \quad f(\tfrac{L}{d}),\ f'>0, f''<0.$$

Definition 1: A share contract is a triple $\{\alpha,d,L\}$

Where α is the share of final output accruing to the tenant, d is the amount of land leased to the tenant, and L is the stipulated labor supply of the tenant.

Under constant returns landlords are indifferent to offering m contracts (α,d,L) with $md = D$; or stipulating contractual terms (α,ℓ) and signing N contracts (α,d^i,L^i) $i=1,\ldots N$ with

$$\frac{L^i}{d^i} = \ell = \frac{L}{d} \text{ and } \sum_{i=1}^{N} d^i = D.^6$$

If workers do not have identical preferences the latter arrangement will not only be preferred by the market, but will be necessary if efficiency is to result.

Let

$$C = \{\alpha^j,\ell^j\} \qquad j=1,\ldots M$$

be the union of the set of all contracts offered by landowners. Let $\bar{C}$

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6 With an increase in notational complexity the analysis below could have been done using contracts $\{\alpha,d,L\}$. In equilibrium it is easy to prove all such contracts would satisfy the $\{\alpha,\ell\}$ condition above.

be the set of all contracts that could possibly be offered. If $\pi[\hat{c},C]$ $\hat{c}\epsilon\bar{C}$ is the profit obtained by a landlord who offers the contracts $\hat{c}$ given that other landowners have offered C the problem of each independent landlord is to

$$\underset{\hat{c}\epsilon\bar{C}}{\text{Max}} \quad \pi[\hat{c},C].$$

This is a fair characterization of how a nonauctioneered (hence more realistic) market might operate. But an appropriate solution concept is not the competitive equilibrium. Some simple variant of this model is no doubt the proper way to proceed. However, economists have the paradigm of hypothesizing price taking or in this case contract-taking behavior and arguing that the resulting equilibrium allocations are good approximations of the allocations that would occur in the nonauctioneered case. In this section I stay within the confines of that paradigm which turns out to have quite a-lot to teach us. I assume there is given to the market at any time, a set of contracts C_a, completely defined by a function $a:[0,\infty) \to [0,\infty)$. That is for each C_a $(\alpha,\ell)\epsilon C_a$ if and only if $\alpha = a(\ell)$.

Assumption 2: $a'>0$ for all $a(\cdot)$ considered.

Landlords

The landlords studied in this section are assumed to do no work. They maximize the income from their land. Under the competitive contract taking assumption each landlord taking the set of contracts C_a, and there-

fore $a(\ell)$ as parametrically given must choose that subset of contracts in C_a that maximizes her profit. Let D^j be the total amount of land owned by the jth landlord and $p(\ell)$ equal the percentage of land leased under the share contract $(a(\ell),\ell)$. Under assumption two there exists for each $a(\ell)$ a well defined inverse function $\ell(a)$ mapping the unit interval into an interval of the real line with zero as its left end point. The profit of landlord j will be;

$$\pi[a(\cdot),P(\ell)] = \int_0^1 D^j[1-a(\ell(x))]f(\ell(x))P(\ell(x))dx.$$

The income maximizing problem of a landlord is;

$$\underset{P(\cdot)}{\text{Max}} \quad \pi[a(\cdot),P(\cdot)] \quad \text{subject to} \int_0^1 P(\ell(x))dx = 1.$$

This is a classical problem in the Calculus of Variations. In the present case it is easy to determine that the optimal solution is degenerate.[7] The Euler-Lagrange first order condition is

$$[1-a(\ell)]f(\ell)D^j = \lambda$$

where λ is the lagrange multiplier associated with the constraint. As should be expected the landlord's income should be equal on every contract offered. Therefore, the problem is the far simpler one of

$$\underset{\ell}{\text{Max}} \quad [1-a(\ell)]f(\ell)D^j = \pi(a(\cdot),\ell).$$

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[7] The optimal $P(\cdot)$ satisfies $P(\ell^*) = 1$ for some ℓ^* and $P(\ell) = 0$ otherwise.

The first order condition for this problem is;

a) $$[1-a(\ell)]f'(\ell) - a'(\ell)f(\ell) = 0.$$

The landlord equates her share of labor's marginal product to labor's marginal share of output. The first term is the landlord's gain from increasing labor on a unit of land, while the second term represents her loss on all previous acres resulting from the increase in the share to labor of final output. Landlord income maximization clearly requires equalization of these two entities. Note the extreme importance of the condition that $a'(\ell) > 0$. If $a' = 0$ the landlord would be choosing an ℓ where $f'(\ell) = 0$. Such an attempt to exploit labor by requiring large amounts of labor on small plots of land is prevented by the fact that as ℓ increases the tenant receives a larger share of output. The varying share percentage plays the role of a signalling device to aid producers in making efficient allocation decisions.

Tenants

Tenants are assumed to be homogeneous as labor inputs, but heterogeneous with respect to preferences and alternative income opportunities. The hth tenant has utility,

$$U^h(C,1-L) \qquad \text{where}$$

$$C = f(\frac{L_2}{d})d + H(L_1,h) \quad \text{and} \quad L = L_1 + L_2.$$

C is tenant consumption, L_2 the labor allocated and d the consequent land demanded in the share contract $(\alpha, \frac{L_2}{d} = \ell)$; and L_1 the labor allocated to the alternative opportunity. The alternative income activity produces income as a function $H(\cdot h)$ of labor. Assume that H is an increasing concave function of labor. Two interpretations are given below.

1) $H(L,h) = wL_1$ — workers have the opportunity of working at a wage w in a competitive market.

2) $H(L,h) = F(d^h, L_1)$. — some prospective tenants may be small landowners with land holdings d^h.

Each prospective tenant household takes C_a as given. Under the assumption of free noncooperative behavior each tenant prospect chooses α, d, L_2, L_1 subject to the market contract set. That is:

$$\underset{d, L_1, L_2}{\text{Max}} \quad U[C, 1-L].$$

The first order conditions for an interior solution are;

a') w.r. L_1 $\quad U_C H' - U_L = 0$

b) w.r. L_2 $\quad U_C(a'f + af') - U_L = 0$

c) w.r. d $\quad a'(\ell)f(\ell) + a(\ell)f'(\ell) = \frac{a(\ell)f(\ell)}{\ell}$

The first two familiar conditions state that the tenant equates his marginal rate of substitution between labor and consumption to the respective marginal returns to labor for fixed d. The third condition is that for fixed L_2 the tenant equates his total return per unit of labor (right hand side) to the marginal return to labor.

Equilibrium requires that there exist a contract set C_{a*} and associated $a^*(\cdot)$ such that for every set S_ℓ of landlords offering a contract $[a^*(\ell),\ell]$, there exists a set D_ℓ of tenants with the supply of land equalling the demand by the subset D_ℓ of consumers.

$$\text{A)} \qquad \sum_{s\epsilon S_\ell} d^s = \sum_{h\epsilon D_\ell} d^h$$

and for every contract $[a(\ell'),\ell']$ demanded by a subset $D_{\ell'}$ of tenants there exists a subset $S_{\ell'}$ of landlords with;

$$\text{B)} \qquad \sum_{h\epsilon D_{\ell'}} d^h = \sum_{s\epsilon S_{\ell'}} d^s .$$

The existence question will be tackled later in the paper. In this section I am concerned with the efficiency and income distributional properties of a competitive contract equilibrium (CCE).

Proposition 1: If $a^*(\cdot)$ generates a C.C.E. and

$\pi(a^*(\cdot),\ell)$ is strictly--quasi-concave in ℓ;

$\pi''<0$

Then the equilibrium share system is efficient.

Proof: By strict-Quasi-concavity there exists a unique ℓ^* which is profit maximal for all landlords. Therefore all landlords offer

the same contractual terms

$$(a^*(\ell^*), \ell^*).$$

Since by assumption this contract supports an equilibrium all tenants must also be selecting the same contract. From the first order conditions for profit maximization and tenant's utility conditions;

$$-\frac{U_L}{U_C} = f'(\ell^*) = F_L \quad \text{all tenants.}$$

Also choice of the same contract by all agents means

$$f'(\ell^*) = f'(\ell^*) \quad \text{on all farms.}$$

Finally; consumer's conditions a' and b give,

$$F_L = H' \quad \text{all households.} \qquad \text{Q.E.D.}$$

Corollary: A contract equilibrium is exactly equivalent to a competitive equilibrium with wages!

Proof: Set $w^* = f'(\ell^*) = F_L$.

By proposition one and concavity assumptions all first and second order optimization conditions are satisfied. From the fact that we have a contract equilibrium it is easy to see that demand and supply of labor are equated at w^*. Finally note that the income of a worker is

$$w^*L^* = f'(\ell^*)L^* = \frac{a(\ell^*)f(\ell^*)\cdot d^*}{}$$

by equations a and c. A similar manipulation shows that landlord income is equal to the competitive return to land.

Q.E.D.

One property of the model above is that it demonstrates clearly why a competitive system with sharecropping must be equivalent to a competitive system with wage labor. The intuitive idea being that if agents can freely choose among alternatives, and all are contract takers, equilibria must be efficient. Put another way we know that agent's first order maximization conditions will equate private marginal rewards and costs. If a market structure is devised so that each agent is imputed, his full costs and returns at the margin, equilibrium in the sense that all individual choices are aggregatively consistent must be Pareto efficient given convexity of preferences and production sets. This is the essence of the problem. In the model developed by Bardhan and Srinivasan the tenant's share percentage does not depend upon other contractual parameters. From equations a and c we see that if $a' = 0$ both landlords and tenants will attempt to exploit each other. The landlord requiring a zero marginal product of labor and the tenant a zero marginal product of land. As David M.G. Newberry correctly points out these two requirements mean that equilibrium in the B-S model will generally not exist.

The way out of this dilemma is to allow the share percentage to vary with the other contractual parameters. As mentioned earlier, the fact that the share increases with ℓ provides incentives for landlords to provide each tenant with bigger plots of land. They do not desire $\ell = \infty$. Alternatively, the same condition induces tenants to curtail their demand for land since

$$\lim_{d\to\infty} \quad a\left(\frac{L}{d}\right) = 0.$$

and

$$\lim_{d\to 0} \quad a\left(\frac{L}{d}\right) = 1.$$

Finally the existence of a varying share rate makes it possible (in equilibrium a fact) that the tenant receives the full value of the marginal product of labor. This condition is necessary for efficiency and impossible to achieve with a constant share rate when tenants make own labor-supply decisions.

Remark 1: The equivalency result makes it fairly easy to see that proving the existence of a CCE is trivial. If w^* is a competitive equilibrium wage, an equilibrium share function is

$$a^*(\ell) = \frac{w^*\ell}{f(\ell)}.$$

Furthermore by proposition one and its corollary, all equilibrium functions are of the above form. See figures one and two. Below we shall see that the idea that the tenants share should vary with contractual inputs generalizes in an important way.

Bardhan and Srinivasan recognized that the basic problem of sharecropping in the simple two factor production model was one of incentives. Their major result was that a <u>competitive</u> share system fails to provide appropriate incentives. D.M.G. Newberry criticized their model arguing that such a system could not be stable. The model presented here rests upon the argument that if one is willing to make the competitive assumption in the formal sense that information is perfect and market contract

Figure One

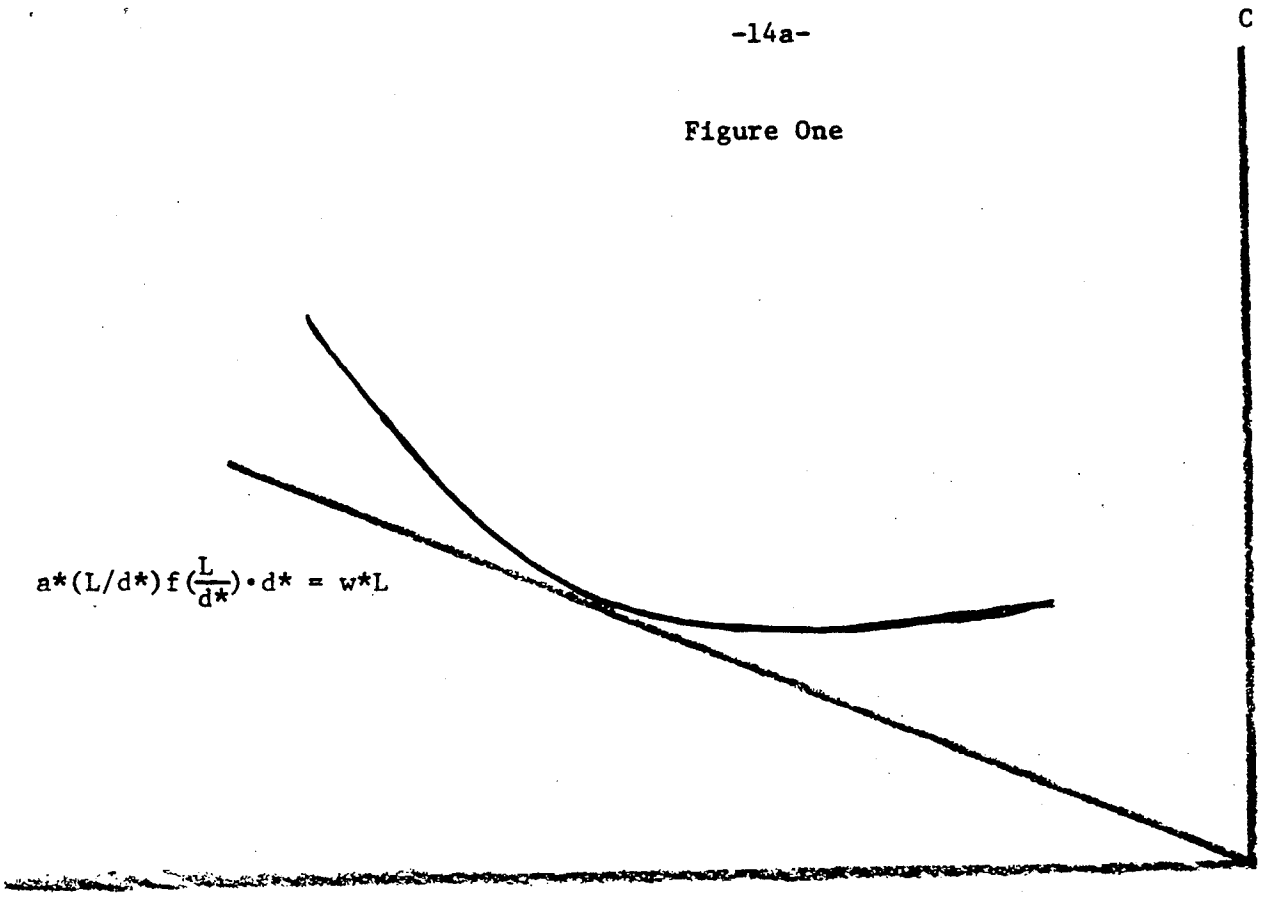
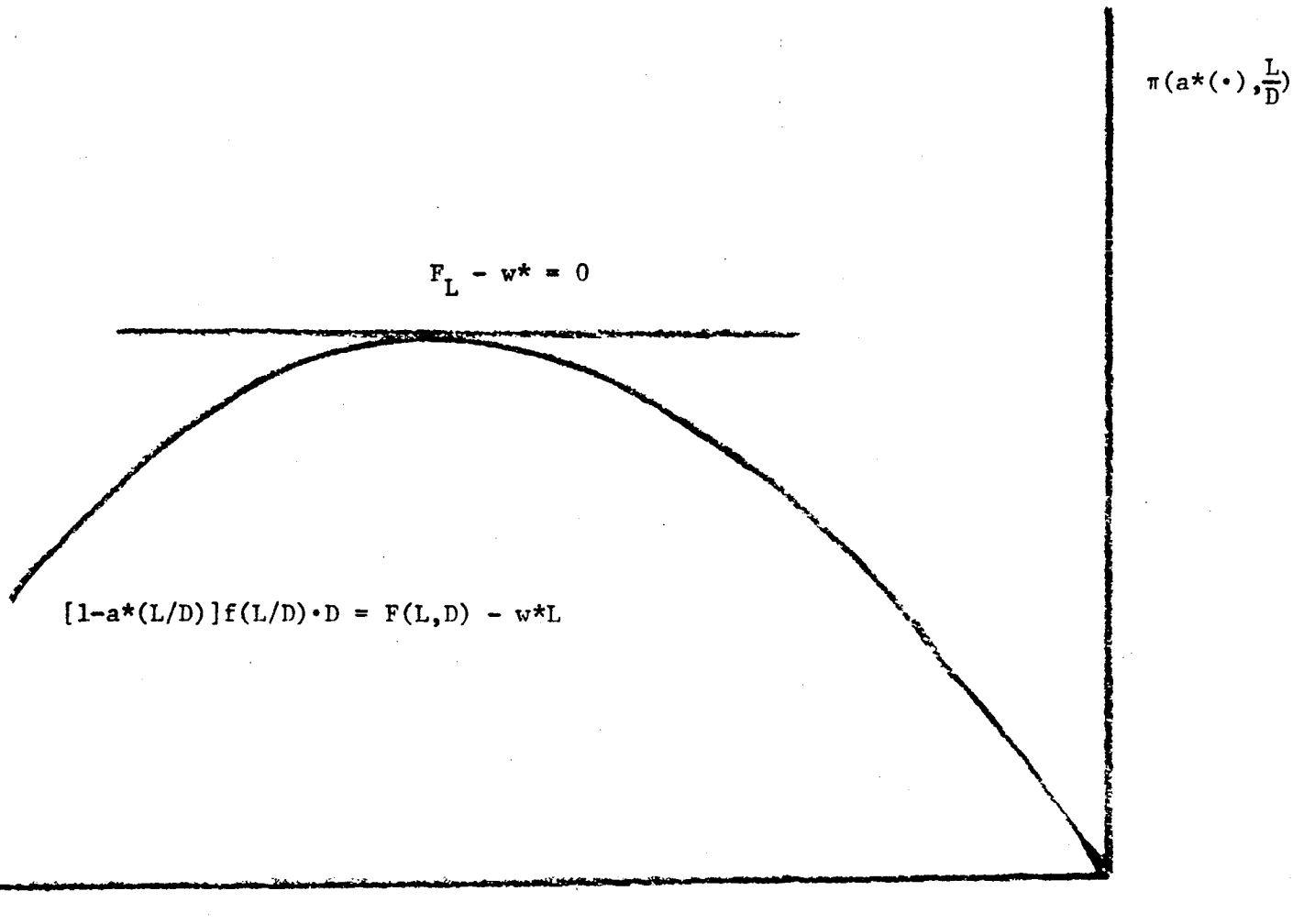


Figure Two



parameters are guided by an Walrasian auctioneer, then inefficiency will not result.

The preceeding section examined a model of a competitive share contract economy. The conclusions of the model confirmed the proposition that a competitive system with sharecropping would be efficient. Unfortunately the cost of the competitive assumption was extremely high. Since sharecropping was shown to be equivalent to a competitive wage system it is an irrelevant institution whose existence remains to be explained. The two most common explanations are that share contracts provide an efficient means of sharing risk and or an incentive payment system when supervision costs of using wage labor are prohibitively high. The risk sharing argument is disposed of rather easily. As is well known the argument is that the use of share contracts is a means by which landlord and tenant can share some of the risk of agricultural uncertainty between one another. To my knowledge it was first pointed out in a consistent way independently by Joel D. Reid and J.E. Stiglitz, in the context of a mean-variance uncertainty model, that sharecropping offers no gains for sharing risk over a competitive market with wages and rental contracts. The intuition behind this is easy to outline. Any share contract gives both the landlord and tenant a fixed fraction of both the mean and standard deviation of return emerging from a given allocation of resources. Now consider the same allocation of resources and consequently mean and standard deviation of return. Under a wage system the landlord bears all the risk, while the tenant does so under a rental system. Given a constant returns production technology any division of the mean and standard deviation between the contractors can be arranged by putting a fraction of the given resources into a wage-payment system and the remaining fraction into a rental arrange-

ment. Therefore introducing shares to a competitive wage-rental system offers no advantages.[8]

The incentives argument is not as weak on theoretical grounds. In a world where monitoring costs are prohibitive a straight wage payment system is not likely to be second-best optimal. But it is not clear that a fixed share system is second-best either. From a theoretical perspective this issue is at the heart of the matter. However, any treatment here would require a detailed digression and will not be attempted.[9] There are other problems of a similar nature. If the primary motive for offering share contracts is to provide labor incentives why does not the landlord offer a comparable rental contract which is known to have full efficiency properties? If production is risky what is needed is a second-best insurance arrangement to supplement the rental system. As alluded to above, it is not at all clear that a fixed share system provides optimal insurance. Any attempt to explain the existence of sharecropping must abandon the assumption of perfectly competitive markets. The risk-sharing and incentives arguments are both approaches in this direction. The first arguing that markets for risk-bearing are incomplete and the second that imperfect monitoring of tenants actions causes a market imperfection. Neither of these attempts to introduce market imperfections is consistent with some important facts concerning income distribution in agrarian economies. Both retain the basic competitive assumption that all laborers

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8 A more general argument is contained in D.M.G. Newberry [11].

9 I pursue this issue in a forthcoming paper.

are free to choose any form of tenure. The only constraints facing agents are price and contractual parameters. This assumption implies that in equilibrium the returns to factors working under different tenure arrangements must be identical. It is well known that in agrarian societies the social hierarchy among tenure forms is:

1) landowners
2) renters
3) sharecroppers
4) wage laborers

The free choice or competitive assumption implies that this ranking is only a social one. Labor incomes in all tenant positions must be identical. This implication is certainly contrary to the established view that the social ordering also describes the relative income ordering. The issue is a difficult empirical question to settle, but I should be very surprised indeed if it were shown that the incomes of renters and wage laborers adjusted for risk were comparable. Any theory of production and distribution in agrarian economies must provide an explanation of the tenure hierarchy.

In the next section I present a model of an agricultural economy that is endowed with an imperfect credit market. In fact I shall make the extreme assumption that no organized credit market exists at all.[10] This assumption while clearly overly strong gives results that correspond precisely to a market where the extent of credit available to any borrower

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[10] This assumption will turn out not to be as extreme as it sounds. The major argument of the paper is that a major function of share-contracts is to extend credit and substitute for an incomplete capital market.

is a function of his endowment wealth (collateral). Therefore, the reader can give the model that interpretation without my having to introduce additional definitions and symbols.

Suppose that a third productive input is introduced to the economy. Call this input capital. A good example is fertilizer.[11] Suppose that tenant and landlord share the cost of capital with respective shares of b and 1-b. Suppose further that the amount of land leased to the tenant and the required labor supply have been stipulated. Since both participants to the contract share in the cost of capital they must come to some mutual agreement about the amount to be used. Let p be the price of a unit of capital. A tenant with wealth w, will choose to

$$\underset{K^i}{\text{Max}} \quad U\left[\overline{\Sigma a^i F(d^i,L^i,K^i)} - \Sigma b^i pK^i,\ \overline{1-\Sigma L^i}\right]. \quad \text{subj. to } \Sigma b^i \cdot pK^i \leq w.$$

Here the superscript i represents the contractual parameters in the ith contract signed by the tenant. The first order condition is

$$a^i F_K = b^i p.^{12}$$

This gives immediately;

Proposition 2: If the tenant chooses the quantity of a variable input such as capital the optimal choice will be efficient if and only if the tenant's share of the input cost is exactly equal to his share of output.

This result is intuitively obvious. The tenant will choose to invest in

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[11] Actually I am retaining the assumption of a one good economy. So capital is both a consumable and an input.

[12] This assumes an interior solution. An exactly analogous result holds if the landlord chooses K^i.

capital until the marginal return to capital accruing to him is just equal to the marginal cost of capital to him. It also illuminates why, when the tenant chooses both labor and land inputs, he will generally under utilize labor. Since the tenant pays for the full cost of labor with his forgone leisure proposition 2 implies that efficient choice requires that he receive the full marginal return to labor. The great simplicity of proposition 2 makes the treatment or lack of treatment it has received in the literature extremely surprising. The point was made in a somewhat obscure paper by Earl Heady. Since then no well known paper on the subject has recognized its extreme importance. In the following section proposition two will provide the basis for an alternative theory of land tenure arrangements in agriculture. The reason behind this is not difficult to discern. Proposition two tells us that if a tenant has shared in the cost of capital efficiency requires that he also share in the return to capital, given that decisions about capital input are made jointly.

A major point to see in the model below is that although there are strong elements of competition present, the economy is not perfectly competitive. The nonexistence of a capital market, and the consequential differential capacities of agents for providing capital differentiates them in the eyes of landowners. Differences in wealth, or more generally capital endowments is one of the more important and most easily ascertainable differences among prospective tenants. Landlords attempting to maximize the return on their land, capital, and time will take cognizance of these differences with the result that tenants differing in some substantive characteristic will generally be offered different sets of contracts from which to choose. Viewed in this way markets for tenancies should be characterized not perfectly competitive, but monopolistically competitive.

Monopolistic Competition and the Choice of Land Tenure

This section provides a capital budgeting model of tenancy determination. The model is as simple as possible. Further elaborations such as the inclusion of a capital market may prove useful at some future time. However, the basic implications of the model below will prove robust except for some fairly obvious qualifications due to uncertainty.[13]

The organization of production is for the agricultural entrepreneur a formidable problem. Especially in underdeveloped regions the farmer must solve allocation problems similar to those faced by large multi-product firms, but often without the benefit of efficient competitive prices to guide decision making. If a landlord owns more land than she can work with her household's labor a decision must be made about the disposition of the extra land. We observed above that if the economy is perfectly competitive all the landlord need do is decide how much land to rent out and how much wage-labor to hire. In the presence of an incomplete or imperfect capital market the problem is more complex. A capital rationed landlord will find it highly profitable to spread the capital at her disposal optimally.

In general any prospective tenant will present several characteristics that are of concern to landlords. For example the landlord is highly inquisitive about the number of able-bodied workers in the tenants household and the number and condition of the households ploughs and animal stock. Does the household have wealth to feed itself during the production season? Can it contribute to the cost of other variable inputs? For a household with observable characteristics θ let the landlord offer a set

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[13] In the near future I plan to generalize the model to include many commodities and uncertainty. Such an undertaking is clearly desireable, but the increase in mathematical sophistication required would, in my opinion, tend to obscure the main ideas I wish to convey here.

of contracts $C(\theta)$ from which the household may choose. The problem for the landlord is to choose a set of contracts $C[\theta]$ for every vector of characteristics. In the present paper we shall allow tenants to differ only with respect to wealth.

A tenancy contract is described by six parameters, a, b, L, d, k, and R. R is a fixed payment, wage or rent, and the other terms are as used above. Numerical parameters are not the only terms in a contract. During the course of the productive season a multitude of decisions must be made. Examples are, the crop mix, choice of seed varieties, fertilization, irrigation and other technique choices. The more of these activities the landlord participates in the greater the drain on her energies and of course the less time to devote to other tenancies. In the present model the only decision of this kind to be made is the choice of capital input. Therefore, the disposition of the right of capital choice will be an important contractual point.

Suppose a set of contracts C are available on the market. Let the subset of these offered to households with wealth w be $C[w]$. Then if $U(c,w)$ represents the utility of a w-household with the contract $c \in C[w]$, we denote

$$U[C(w)] = \max_{c \in C[w]} U(c,w).$$

We further define $U[w]$ to be either a reservation utility below which a w-household will migrate, or the minimum utility consistent with biological continuance. All utility functions are assumed to be strictly concave and twice continuously differentiable in all arguments. Any agent seeking to contract with a w-household must offer a utility level no less than $U[C(w)]$. The offer curve of a w-household is defined implicitly by

$$U[aF(L,d,k) + w - bpk + R,L] - U[C(w)] = 0.$$

We solve for a in terms of the other seven variables to obtain an explicit algebraic representation of the offer curve.

$$a = a[L,d,k,b,w,R,U(\cdot\cdot)].$$

The solution to the problem

$$C) \quad \underset{L,d,k,b,R}{\text{Max}} \quad [1-a(\cdot\cdot\cdot\cdot\cdot)]F(L,d,k) - pk(1-b) - rd + R$$

is easily seen to be equivalent to the solution to[14]

$$\underset{a,L,d,k,b,R}{\text{Max}} \quad [1-a]F(L,d,k) - pk(1-b) - rd + R \quad \text{subject to}$$

$$U[aF(L,d,k) + w - pkb + R,L] \geq U(\bar{w},c)$$

which is unique since the objective function is quasi concave and the constraint set strictly convex. Denote the solution values by $a(w),L(w),d(w),b(w),k(w),R(w)$ and define

$$\pi(w,c) = [1-a(w)]F[L(w),d(\ ),k(\cdot)] - pk(\cdot)(1-b(\cdot)] - rd(\cdot) + R(\cdot).$$

This represents the maximum available gross profit attainable from a w-household. We assume that each landowner maximizes utility by choosing the number of each type of contract to offer subject to resource constraints.

In addition to land and capital availability each landlord is constrained by having only a finite amount of own labor-time. The landlords own labor time must be divided between self-cultivation, leisure, and the

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[14] r is the landlords valuation of a unit of land. If there is an organized land rental market r is the rental price of land. If there is no organized rental market r must represent an opportunity cost of land to the landlord. For example, r could be the marginal product of land when the landlord has to work his property with own labor alone. In the latter case r's would differ across landlords.

monitoring-supervision requirements of the various tenancy contracts negotiated. I am going to assume that the monitor-supervision technology depends only upon the type of tenancy and exhibits a particular kind of constant returns to scale. Define

$T_{\ell i}$, T_{si}, and T_{Ri} to be the labor

$i = d,k;$

times required to enforce and supervise a wage laborer, sharecropper, or renter operating with exactly one unit of land and capital. Then if $T(w)$ is the labor-time required for a w-tenancy;

$$T(w) = T_{id} \cdot d(w) + T_{ik} \cdot k(w)$$

depending upon whether $i = \ell$ s, or R. The labor-time required to supervise and enforce tenancy contracts is assumed to be proportional to the scale of operation. This assumption will be discussed later.

Each landlord has a utility function $v(\cdot,\cdot)$, depending on profit and labor. Let $\eta^j(w)$ equal the number of contracts offered to w-households by landlord j. Then the allocation problem undertaken is

$$\underset{\eta^j(w)\varepsilon R_+}{\text{Max}} \quad V[\Sigma\pi(w,c)\eta^j(w),\ \Sigma T(w)\eta^j(w)]$$

subject to

1) $\Sigma d(w)\eta^j(w) \leq D^j$ 2) $\Sigma p(1-b(w))k(w)\eta^j(w) \leq w^j$

This is a standard concave nonlinear programming problem with linear constraints. Denote the solution values by

$$[\eta^{j^*}(w^1, U(w^1, c)), \cdots \eta^{j^*}(w^k, U(\cdot\cdot))]$$

where $w^1, \cdots w^k$ are the available wealth levels. Let $N(w^i)$ equal the number of w^i-households and J the number of landowners. In equilibrium we require

D) $$\sum_{j=1}^{J} \eta^j(w^i, U(\cdot)) \leq N(w^i) \quad i = 1, \cdots k.$$

with

E) $U[w^i, C] \lesssim U[w^i]$ if the strict inequality holds for w^i in D.

The first set of k inequalities are the familiar demand supply relationships. The final condition requires some comment. For ordinary physical commodities if the strict inequality held in equilibrium in the first relationship we would say that the commodity is in redundant supply and in that case its' reward would have to fall to zero. The reward of required labor cannot however, fall to zero if workers are to survive for a length of time sufficient to perform the required tasks. Condition E expresses that requirement. If the supply of contracts to some w-households (the demand for w-tenants) falls short of the supply of w-tenants, the utility level of those w-households who find tenancies must be at best U(w). Note that in this case not only will the allocation not likely be equivalent to a competitive equilibrium, a competitive equilibrium may very well not exist. One of the crucial assumptions required to prove the existence of a general competitive equilibrium is that all consumers be in the interior of their consumption sets. A condition incompatible with a minimum subsistence level of utility. It is in this sense that competitive equilibrium and therefore the competitive model is incompatible with <u>extreme poverty</u>.

This is a condition that students of development economics should recognize more often.

We see that the equilibrium outcome emitted by the market process may exhibit surplus labor with thousands of households either starving or barely subsisting. Such conditions must surely foster patronage and perhaps a concomitant situation of moral and social exploitation as too many starving households seek too few available tenancies. Given such a scene it is not at all surprising that an observer might label the economic system as exploitative.

If the landlord had an exogenously given price to value own labor-time, her resource allocation problem could be formulated as a linear program with the objective

$$\underset{\eta(w)}{\text{Max}} \quad \Sigma\pi(w)\eta(w).$$

By convention I assume $\pi(w') = \bar{w}$, one unit of wealth.

In the present formulation no such price exists so the landlord will have to derive the value of own labor internally. With this in mind we assume that the objective function takes the form

$$V[\eta^1,\cdots\eta^k] = \Sigma\pi(w^i)\eta(w^i) + U[\Sigma T(w^i)\eta(w^i)].$$

With $U(\cdot)$ decreasing and concave, $V[\cdot\cdot]$ will possess a negative semi-definite Hessian matrix and thus be concave.

Distributive Properties of Monopolistic Equilibrium

We may conveniently use well known results of nonlinear programming to derive qualitative properties of equilibrium.

From the concavity of both the objective and constraint functions of the landlord's maximization problem we know that the Kuhn-Tucker conditions are both necessary and sufficient for a utility maximal vector of tenant demands. Furthermore it is straightforward to show that an optimum actually exists. Therefore we know that there exists for each landlord j a pair of nonnegative multipliers $[b_{1j}, b_{2j}]$ such that

F) $\frac{\partial v}{\partial \pi} \cdot \pi(w,C) + \frac{\partial v}{\partial T} \cdot T(w) \geq b_{1j} d(w) + b_{2j} Z(w)$ for each w with

$Z(w) = p[1-b(w)]k(w)$.

Furthermore equality holds in F if and only if

$\eta^{j*}(w,U) > 0$.

Duality theory tells us that the b_{ij} are the shadow or imputed values of land and capital to landowner j. They are in units of utility since the objective function is a utility function. $b_{1j} = \frac{\partial v}{\partial D}\Big|_{\eta^{j*}(\cdot)}$, therefore

$\lambda_{1j} = b_{1j} \Big/ \frac{\partial v}{\partial \pi}$ is in units of profit per unit of land. Define λ_{2j} in the same way with units profit per unit of capital. Finally, letting $\lambda_{3j} = \frac{\partial v}{\partial T} \Big/ \frac{\partial v}{\partial \pi}$ with units profit per unit of labor-time, the λ_{ij}'s are the imputed values of resources in terms of profit. From equation F

G) $\pi(w,C) = \lambda_{1j} d(w) + \lambda_{2j} Z(w) + \lambda_{3j} T(w)$

for all w with $\eta^{j*}(w) > 0$.

Landlord j enters into a contract with a tenant of wealth w only if the imputed value of the resources given up are just equal to the profit earned.

This is an obvious requirement since its violation would mean the landlord was not allocating his resources optimally.

Remark 2: From equation G we see that the profit earned by any landlord on each tenancy contract is just equal to the imputed value of the land, capital, and labor-time devoted to that tenancy contract by the landlord.

In order to develop distributive properties further we need the following facts.

Fact 1: If the landlord unilaterally chooses the amount of capital input then,

$$F_k = p.$$

Furthermore if the tenant agrees with the capital input;

$$a(w) = b(w) \text{ and } F_k = p.$$

Proof: For the first relationship note that the first order condition with respect to k of the landlord's initial maximization, equation C , is;

$[1-a(\cdots)]F_k - \frac{\partial a}{\partial k} F - p(1-b) = 0$. From the offer curve,

$$\frac{\partial a}{\partial k} = - \frac{aF_k - bp}{F(\cdot\cdot)}$$

From which it follows $F_k = p$.

To derive the second result note that if the choice of capital input belongs to the tenant the offer curve of a w-household is represented by

$$U[aF(L,d,k) + w - pkb, L] - \bar{U} = 0$$

$$aF_k - bp = 0.$$

a and k can be solved for in terms of the other variables, $a(L,d,b,\bar{U},w)$, $k(L,d,b,\bar{U},w)$. Computing the Jacobian of this pair of equations gives

$$\begin{bmatrix} aF_k - pb, & F \\ aF_{kk} & F_k \end{bmatrix} \begin{bmatrix} \frac{\partial k}{\partial b} \\ \frac{\partial a}{\partial b} \end{bmatrix} = \begin{bmatrix} pk \\ p \end{bmatrix}$$

hence assuming $F_{kk}<0$;

$$\frac{\partial k}{\partial b} = \frac{pkF_k - pF(\cdot)}{-aF_{kk}F} \neq 0$$

since constant returns implies

$k \cdot F_k < F(\cdot)$. also

$$\frac{\partial a}{\partial b} = \frac{pk}{F(\cdot)} .$$

A landlord choosing a contract to offer a w-household gets the following first order condition with respect to b;

$$[1-a(\cdot)]F_k \cdot \frac{\partial k}{\partial b} - \frac{\partial a}{\partial b} F(\cdot) - (1-b)p \frac{\partial k}{\partial b} + pk = 0$$

Rearranging and substituting gives

$$\frac{\partial k}{\partial b} ((1-a)F_k - (1-b)p = 0 .$$

$\partial k/\partial b < 0$ and $aF_k = pb$ implies $a = b$. Q.E.D.

If the tenant has the right of capital input choice not only will capital be applied to the soil until its marginal product equals its price, but the tenant and landlord will share the costs of capital in the same

proportions as they share output. This means that both will agree upon the amount of capital to be used. However, if the landlord chooses capital input the marginal product of capital will equal its price, but nothing can be inferred about the relation between cost and output shares. The landlord who has the power to unilaterally make input choices may force the tenant to bear a greater share of input costs than the tenant desires. We shall have more to say about this below.

We may unambiguously note that on rented land $a(w) = b(w) = 1$ so,

$$\frac{\pi(w)}{d(w)} = \lambda_{1j} + \lambda_{3j} \frac{T(w)}{d(w)}$$

Remark 3: If the supervision-monitoring costs incurred from renting land are negligible,

$$T_{Ri} = 0$$

We have that the profit per acre accruing to the landlord on rented land is just the imputed rental value of the land.

$$\frac{\pi(w)}{d(w)} = \lambda_{1j} = \frac{R(w)}{d(w)}.$$

The landlord who does not share in the cost of capital does not share in the return to capital.

Proposition 3: Profit per acre is identical on all rental tenancies leased out by a given landlord.

It also follows that

Proposition 4: Profit per acre is higher on both wage worked and sharecropped land than on rented land.

It is not possible through a-priori means to determine relative profit per acre on wage worked and share-cropped land. The reason for this is that the marginal product of labor need not be equated on all tenancies. It is straightforward to show that

Fact 2: $$F_L = -\frac{U_L}{U_C}$$

for all employed tenants.

Proof: From equation C the landlords first order condition with respect to L for maximizing the profit from a w-household is;

$$[1-a(\cdots)]F_L - \frac{\partial a}{\partial L} F = 0.$$

The tenant's utility constraint can be used to compute

$$\frac{\partial a}{\partial L} = -\frac{U_c a F_L + U_L}{U_c F}.$$

Substituting in the first order condition and simplifying gives

$$F_L = -\frac{U_L}{U_C}$$ Q.E.D.

Nothing in the model guarantees that all tenants' MRS be equated. But it might reasonably be argued that since the landlord controls the allocation of labor on his land by wage-workers and sharecroppers he will ensure that marginal products of labor are equated on each acre of land. Not doing so implies that landlords income can be increased with no loss to the tenants. In this case the marginal product of all factors are equated on land worked by wage hands and sharecroppers and it follows that each tenant on a given farm works with the same amount of capital per unit of

land.[15] Then since

$$\frac{\pi(w)}{d(w)} = \lambda_{1j} + \lambda_{2j}\frac{Z(w)}{d(w)} + \lambda_{3j}\frac{T(w)}{d(w)}$$

the assumption that monitoring-supervision costs are lower on sharecropped land implies higher profit per acre on wage worked land since for wage workers

$$a(w) = b(w) = 0.$$

In this last case it follows that output per acre is identical on all tenancies under the supervision of a given landlord.

Remark 4: The fact that the marginal product of a tenant's labor is equal to his marginal rate of substitution between consumption and labor should not mislead the reader into making the usual welfare judgement. The payment to the worker has not been determined in a competitive market of the usual sort. Therefore the wage will resemble a competitive wage only if workers of a given type are not in surplus supply. In figure 3 a wage worker has been allocated k and d capital and land to work with. The production set is represented by the shaded area. There are decreasing returns to labor with fixed capital and land. The curve cc represents the lower boundary of the agent's consumption possibility set. This set is the set of labor consumption allocations (c,L) that are biologically possible for the agent. I have assumed that cc is differentiable and that all points on or above cc and in the graph are in the consumption set. The curve c0 is the workers competitive offer curve. The locus of labor-income pairs chosen by the worker at a given wage in a setting of perfect competition. The line 0w* is a representative budget line with slope w* a competitive wage. The indifference curve $\bar{U}\bar{U}$ intersecting the offer curve c0 and tangent to the budget line at the intersection point shows the consumer's optimal choice at the wage w*. Let us assume that w* is the competitive equilibrium wage if there were perfect markets and only wage and rental contracts. In the actual imperfect economy there is a low demand for wage workers relative to their supply. The landlord faces no utility constraint in hiring wage-workers so he gives them the all or nothing offer [L*,C* = R(w)] placing them on the lower boundary of their consumption set. Note that it is to the landlord's ad-

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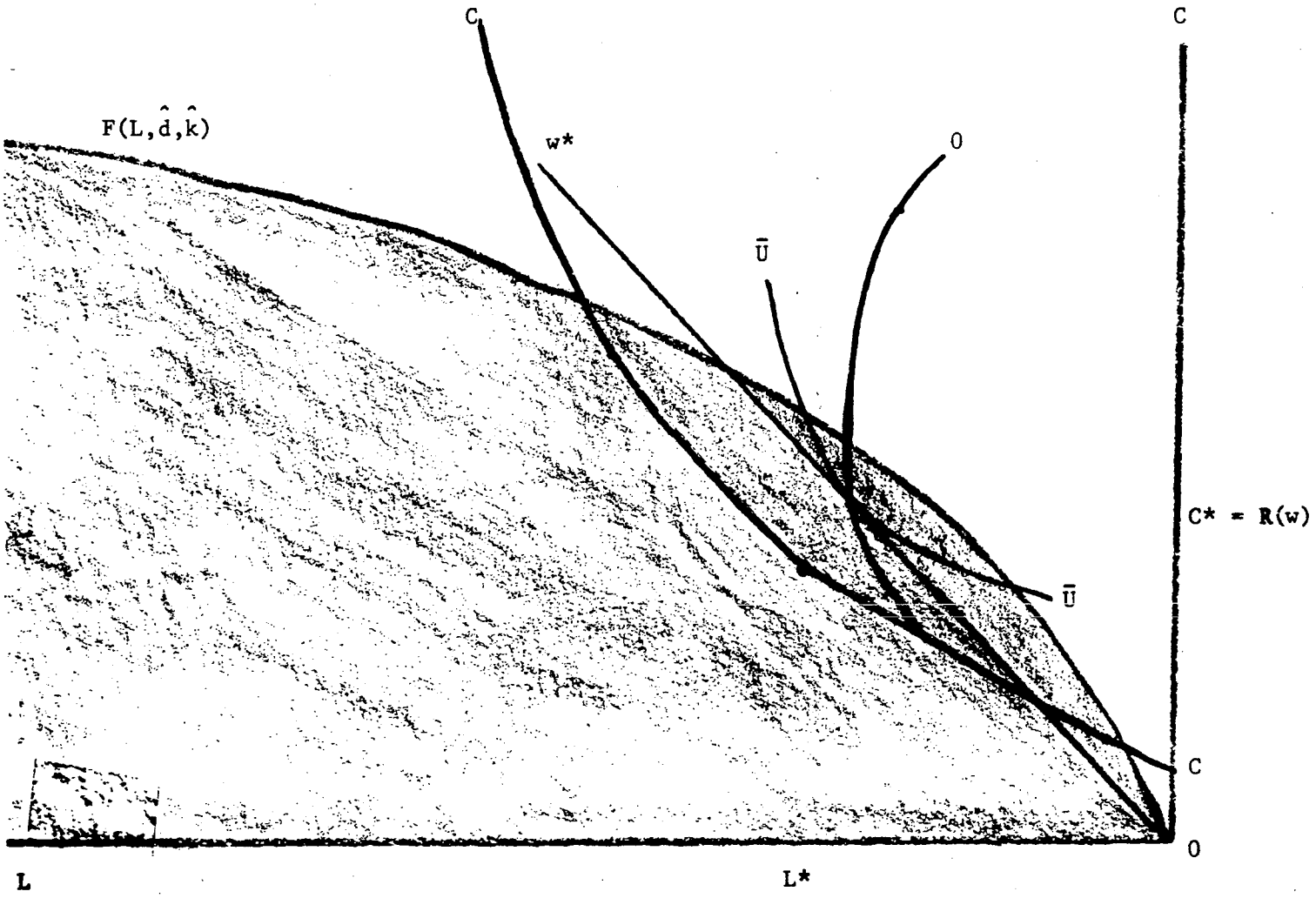
15 The last statement follows from the fact that $F_d = r$ and $F_k = p$.

vantage to place the worker at that point where the slope of cc is equal to the marginal product of labor given $\hat{k},\hat{d}$. If the landlord faced a real utility constraint the same result would follow, but cc would be an indifference curve. In this particular example the competitive equilibrium allocates the worker more income with less labor supply then the monopolistic allocation.

In the example above the worker is miserably poor and since he is allocated off his offer curve he has not been given a free choice in a market situation in the sense of a competitive equilibrium.[16]



16 This example should be compared to similar remarks made by G. Myrdal in [11] chapter 11, sec. 9. It also explains the practice of workers in India or Latin American Latifundios receiving fixed sum yearly wages. In a forthcoming paper I discuss this problem of poverty and surplus labor in a more systematic fashion.

The Choice of Contract

The model of monopolistic competition presented here offers two reasons for the existence of share contracts in the presence of wage and rental contracts. Firstly, we have argued that landlords will seek to sign share contracts with tenants who are able to provide additional capital. Working an acre of land with wage labor may be individually more profitable than leasing the acre to a sharecropper, but if the landlord is short of capital she may find entering into a share arrangement advantageous as the gains from the tenant's input of capital more than compensate for the share of output the tenant receives. One motivation for share tenancy is to provide a substitute for an imperfect credit market. If there are increasing returns to capital over relevant ranges of the production function this motivation for entering share arrangements would become very important. The second reason for entering share agreements offered by the monopolistic model relies on the assumption that the monitoring-supervisory costs of a share contract are less than the costs of wage contracts. This is really the incentives argument. One presumes that the reason for the lower costs is the fact that share tenants have incentives not to shirk. This aspect of the model explains one important empirical phenomenon. In many share contracts all the capital input is actually provided by the landlord with the tenant's share of the cost subtracted from his income at the end of the season. Why are such contracts signed? We must ask what are the possible benefits over the two alternatives? Given the incentive affects and the lower supervision-monitoring costs of share contracts there is a trade-off between higher profit per acre on wage contracts and lower labor-time disutility with share contracts. Surely for some land-

lords the tradeoff will involve the use of both kinds of contracts. However, it is reasonable to ask why the agents do not enter rental contracts. If the credit market were perfect this would be a possibility. In the absence of outside credit the tenants we are currently discussing would have no capital to add to the land. In that case the landlord would have to extend inside credit. But such credit would have to earn for the landlord its opportunity cost. The landlord would desire full return from both her capital and her land leaving the tenant only the return to his own labor. This reduces the tenant to a wage laborer and an unsupervised one at that! Therefore, the share contract is seen to offer distinct advantages.

The model explains the existence of share contracts without recourse to any arguments concerning risk sharing. To prevent any confusion on this point I have refrained from introducing uncertainty in this paper. This does have some fundamental drawbacks. To understand why credit markets are imperfect, and why tenants must be monitored and supervised one must invoke problems of assymmetric information and moral hazard. These considerations force a consideration of uncertainty. If information is incomplete and costly, and production is risky in a nontrivial way so that choice of technique and inputs can alter the distribution of output across states, a lender of capital will want some control over the disposition of that capital. Especially if there is a chance that the loan will be defaulted the lender will want some role in the investment decision. Such considerations reveal that it is no accident that landlords are often the primary source of credit in rural economies. Even in cases where the landlord is not the tenant's actual source of credit he is often something of an intermediary (co-signer), without whom credit would not be forthcoming.

If information about the tenant's activities is costly a resident landlord is likely to be in the best position to ensure that the lender's capital is used in a way favorable to the lender's position. This offers a second reason why landlords lend capital to landless and low wealth share tenants. The landlords are able to extract not only a share of the productive return to capital on the land, but are also able to charge tenants an interest fee for use of the capital. A, perhaps the major impetus to the use of share contracts is as a substitute for an imperfect credit system. This position is implicit in Alfred Marshall's short, but incisive critique of the European Metayer and American share systems. According to Marshall the share system,

> "... enables a man who has next to no capital of his own to obtain the use of it at a lower charge than he could in any other way, and to have more freedom and responsibility than he would as a hired laborer; and thus the plan has many of the advantages of the three modern systems of co-operation, profit sharing, and payment by piece-work."

Alternatively, a prospective tenant with a relative abundance of capital and little or no land will desire either to acquire more land or lend the capital. In the latter case the same reasons listed above for landlords will cause the tenant to desire some control over the use of his capital. If the capital holding is not substantial enough to support a rental tenancy a share contract allows the agent to acquire land, lend his capital, and maintain some control over its use. Again Marshall is worth quoting;

> "... the landlord can deliberately and freely arrange the amount of capital and labor supplied by the tenant and the amount of capital supplied by himself to suit the exigencies of each special case."

It seems clear to me that Marshall is in the two passages above implicitly assuming an imperfect credit market!

The argument put forth in this paper maintains that the existence of market imperfections are crucial in the determination of the organization of production and distribution in an agrarian economy. I have argued that the major impetuses to share contracting are imperfect capital markets and tenant incentives or monitoring costs. The first which is in my opinion more important, has been largely ignored in the literature. It is important to ask; what differences are there in the implications of the present model and alternatives and how do they fit the facts? The major differences are sketched below.

a) Mixed tenure	The monopolistic model not only explains the existence of share-contracts it implies that different forms of tenure will exist under the same landlord.
b) Differentiated contracts	Contracts signed by tenants differing in important economic characteristics, such as wealth, will reflect those differences. The share of output accruing to the tenant will be an increasing function of wealth and will vary precisely with the share of input costs.
c) Distribution theory	The return to landlords and tenants under alternative tenancy arrangements will not be identical.

With the exception of the model constructed by J.E. Stiglitz, I know of no other model that allows landlords to mix tenures on their property. However, the Stiglitz model relies upon differences in preferences over risk among agents to get the result. More importantly, except for the extreme case where either tenants or landlords are <u>risk neutral</u> one will <u>never</u> observe tenants working under pure wage or rental contracts in the Stiglitz model. The evidence clearly supports the monopolistic model on this point. Since no other model places a <u>major</u> emphasis upon imperfect capital markets they do not imply the wealth affect on contracts. The second quote from Marshall's <u>Principles of Economics</u> is the closest statement of the wealth affect I have

found. What evidence if any is available to support the contentions of the model? Curiously, J.S. Mill, who expressly took the view that share contracts were largely drawn up by custom offers in his chapter "on Metayers" a fair amount of evidence that the European share system admitted quite a variety of contractual arrangements. In fact it is somewhat striking to infer something of a correspondence between the share of output going to the tenant and the share of variable input costs he pays. Mill's remarks (page 303) seem to imply that the general rule was one-half-one-half with the share changing in exact proportion as the tenant contributed more or less of indivisible capital goods like livestock or ploughs. Since this is precisely what theory predicts should happen it is interesting to inquire whether this is an accident.

One time period and geographical location where the terms of land tenure contracts were subject to little legal interference and thus likely to reflect the economic power of the agents is the Southern United States cotton belt from about 1875 to 1925. The table below represents the terms of the four most common types of contracts signed. The reported arrangements seem almost to close to the theoretical predictions to be believed. I personally find it hard to believe that market participants understood the economics of the cost-share lease in the way we have discussed it in this paper. How do we explain the exact relationship between fertilizer cost and output shares? First, as I have argued throughout the paper, if credit markets are imperfect, landlords, and tenants with collateral, those with tools and stock, may find it advantageous to pool their financial re-

sources when applying fertilizer to the land. Fact one tells us that unless the landlord has considerable monopolistic power, so that he can unilaterally make all contract terms, a decision to share fertilizer costs impels the parties to share output if efficiency is to result. In the case of one-half croppers, if fertilizer increases crop yields appreciably, the landlord would not want to share the increased output unless the tenant shared costs. If the landlord cannot completely control the tenants actual input of fertilizer, it will be important for the tenant to agree on the total input.[17] More generally the incentive affects of the contract will surely depend upon whether the tenant believes he is being treated fairly.

References to share tenancy in India seems to indicate that a considerable amount of cost-share leasing is practiced. According to the examples reported by Francine R. Frankel, a strong percentage of these contracts have identical share proportions. A good deal of empirical work is called for before this question can be addressed adequately.

The differences in the distributive implications of the monopolistic model are perhaps the most basic. No other model imples that factor returns will differ under alternative tenancy arrangements. The competitive models are weakest on this point. S. Cheung states flatly that returns under alternative contracts must be identical or the less profitable ones would not be used. That statement implicitly assumes that all markets including credit markets are perfect. An indication that this is not true is the practice of renting land and then subleasing the same land under

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[17] One lack of control may be a blackmarket where the tenant could sell part of the fertilizer.

Table 1

	Share-cropping	Share-renting	Pure renting
Landlord supplies	Land, fuel, tools, cabin, work stock seed, 1/2 fertilizer, feed for stock	Land, fuel, cabin, 1/4 or 1/3 fertilizer	Land, fuel, cabin
Tenant supplies	Labor, 1/2 fertilizer	Workstock tools, seed feed for stock, 3/4 or 2/3 fertilizer	Workstock tools, seed feed for stock, 3/4 or 2/3 fertilizer
Landlord receives	1/2 crop	1/4 or 1/3 crop	Fixed amount in cash or cotton
Tenant receives	1/2 crop	3/4 or 2/3 crop	Total crop minus fixed rent

Source: Boeger, E.A. and Goldenweiser, E.A., A Study of the Tenant Systems of Farming in the Yazoo-Mississippi Delta. U.S. Department of Agriculture, Bulletin 337, 1916. Reprinted in Woofter, Thomas, Landlord and Tenant on the Cotton Plantation.

a share contract. According to Thomas J. Edwards and others this was a frequent practice in the U.S. cotton belt.

The demise of sharecropping

Why has share-contracting in agriculture declined in virtually all developed economies? Since the model gives essentially two motivations for the use of share-contracts it also gives two reasons for its demise. The process of economic development necessarily requires the establishment of well organized credit markets. In the presence of competitive credit lines the cost-sharing motive for share-contracts will disappear for both parties, but particularly for the tenant with some initial wealth. The second reason is technological change. As new production techniques and capital goods are introduced and made available, because of better access to credit the use of share-contracts may become increasingly inadequate as a means of lowering supervision-monitoring costs. In this paper, I assumed that these costs were subject to constant returns to land and capital. But the introduction of highly productive and expensive machinery is not only likely to make this assumption absurd, but will introduce increasing returns in the production function. This will make landlords very loath to share the returns to mechanized capital with landless and poor workers. Finally, the indivisibilities involved will probably cause small landowners to rent or sell their holdings to larger mechanized landowners.

Conclusions

Is sharecropping an efficient production arrangement? This has been one of the central questions addressed by those writing about systems of land tenure. The question has been misconceived. Asking whether an econ-

omy using share-contracts achieves a Pareto Efficient allocation is to completely ignore the question why do societies use share-contracts? Share-contracts are a response to the presence of significant market imperfections and questions about efficiency require that economists descend into considerations of the second-best. The analysis presented here implies that share-contract using economies will not be Pareto Efficient. Inputs and output per acre may differ across farms and marginal rates of substitution may differ across individuals. Whether or not the economy is efficient given the market and institutional constraints is not an easy question to answer.

Anyone can make the assumption that all markets exist and are perfect and pretend that allocations are efficient. Economists interested in development and agrarian policy cannot afford to confine themselves to those models alone.

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