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MIXED WAGE AND RENT CONTRACTS AS REINTERPRETATIONS OF SHARE CONTRACTS

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This note extends the result of Stiglitz (1974) and Newbery (1977) concerning the equivalence of mixed wage and rent contracts to share contracts to the case where the only assumption is that there are no enforcement or transaction costs. This is so because an equivalent mixed wage/rent agreement can always be obtained by simply reinterpreting a share agreement.

Stiglitz (1974) showed that in a model with multiplicative risk, no enforcement or transaction costs and constant returns to scale, a mixture of wage and rent contracts could achieve the same apportioning of risk as a pure share contract. Newbery (1977) generalised this to the case of non-multiplicative risk. The purpose of this note is to show that this result can be further generalised: it is not necessary to assume constant returns to scale. All that is really required is that there be no enforcement and transaction costs.

It is first shown why the two types of contract are equivalent when there are constant returns to scale and no transaction costs. The demonstration of this result is based on that in Newbery and Stiglitz (1979). It is then shown how this can be extended to the case without constant returns to scale by reinterpreting a share agreement as a mixed wage/rent agreement.

Each person has a production function expressing output as a function of land K, labour L and a stochastic variable θ, which can be thought of as something like the weather.

$$Y = Y(K, L, \theta). \tag{1}$$

Initially constant returns to scale in K and L are assumed.

Consider a share contract such that the landlord provides land K and receives a proportion σ of the output, with the remainder going to the

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tenant, which also specifies that the tenant provides labour L. Thus the contract implicitly defines the labour intensity $l=L/K$. In general the rental share will depend on l so that $\sigma=\sigma(l)$: this enables different share contracts described by $(\sigma(l), K, L)$ to offer different risk spreading opportunities.

Now if the land is divided into two parts one of which is rented by the tenant at a fixed rate r and the other of which is cultivated by the landlord hiring the worker at fixed wage w, with the labour intensity l being the same as before in both cases, then there exist values of r and w such that the tenant and landlord will be indifferent to the original share contract. In particular if the tenant supplies σL of his labour on a wage basis, rents $(1-\sigma)K$ of the landlord's land and the wage/rent ratio (w/r) is set so that

$$\frac{w}{r}=\frac{(1-\sigma)K}{\sigma L} \tag{2}$$

then by this and the constant returns to scale of (1) he receives

$$\{Y((1-\sigma)K,(1-\sigma)L,\theta)-(1-\sigma)rK\}+\sigma wL=(1-\sigma)Y(K,L,\theta). \tag{3}$$

Similarly the landlord receives

$$\{Y(\sigma K,\sigma L,\theta)-\sigma wL\}+(1-\sigma)rK=\sigma Y(K,L,\theta). \tag{4}$$

Hence the mixed wage/rent contract is equivalent to the share contract.

Furthermore (2) must be satisfied for an equilibrium to be attained in the wage, rent and share markets since if for example the left-hand side were greater than the right then landlords would prefer a mixed wage/rent agreement and tenants would prefer the share contract. Similarly if the inequality is reversed. Thus any equilibrium with share, rent and wage contracts will be identical in every respect to an equilibrium with just wage and rent contracts. However as pointed out by Newbery (1977) the reverse is not necessarily true: in order for share contracts to exist it is necessary for there to be landlords and tenants who both seek the same technique. If this is not the case share contracts which require both parties to agree to a single production technique will be less attractive than mixtures of wage and rent contracts and will never be observed in equilibrium.

The result that the outcome achieved by share, rent and wage contracts can also be attained with just rent and wage contracts can be generalised even further. All that is really necessary is that there be no enforcement and transaction costs. This can be illustrated in the simple model above but without constant returns to scale. To simplify the exposition it is initially assumed that the production technique is such that the average output of all pieces of land is the same: thus the case where the optimal technique involves

farming various parts of the land in different ways, which is quite possible given the general specification of the production function in (1), is ruled out.

An equivalent mixed wage/rent contract can be obtained by reinterpreting a share agreement. Assuming the techniques of production used remain the same then given the uniformity of output it is clearly equivalent to give a share σ of the final output to the landlord and $(1-\sigma)$ to the worker or assign the total output from σK of the land to the landlord and that from the other $(1-\sigma)K$ to the tenant. Since the landlord owns all the land and the tenant provides all the labour, the latter assignment implicitly involves an exchange of σL of labour for the use of $(1-\sigma)K$ of land. There is an implicit relative price w/r in this transaction which is the same as in (2). Given the no-enforcement and transaction costs assumption, the form of the exchange makes no difference, provided production techniques again remain the same; it is equivalent if the landlord hires $(1-\sigma)L$ at w in the labour market and the tenant hires σK at rent r in the land services market. As before equilibrium in the wage, rent and share markets requires that (2) is satisfied with an equality. The landlord and tenant are therefore indifferent to the original share contract and the mixture of wage and rent contracts.

The difference between the argument here and that of Newbery and Stiglitz (1979) is that they assume the two lots of inputs are applied in two production functions which makes the constant returns to scale assumption important. The above shows this is not necessary provided the same techniques can be applied as in a share contract; one subplot is simply called the tenant's private plot and the other the landlord's. However, it should be noted that with wage and rent agreements, the contracts may need to specify the techniques to be used. For example, if production requires the performance of a number of different tasks there may be increasing returns to scale because of the time spent switching from one to another. In such a case the equivalent wage and rent contracts will need to be formulated in such a way that the tenant will be able to cultivate both subplots as though they were one, so that having completed a particular task on the landlord's part of the land he can continue the same task on his own private plot. Similarly if there are decreasing returns to scale which for example occurs in the case suggested by Newbery (1977) where tenants have a non-tradeable factor which is imperfectly divisible, it would be necessary for the contract to specify that the ratio of land to nontradeable should be the same under the rent contract as in the equivalent share contract. Also although the result requires that rent contracts specify techniques this does not often occur in practice: such contracts are usually chosen by landlords precisely to avoid the enforcement problem.

So far it has been assumed that the production function is such that the output of land is uniform. It can easily be seen that this is not critical: the division of inputs is just more complicated in other cases. For example, if for

a given K and L the effect of the weather was such that the best method of production used two techniques so that one part of the land was cultivated in a different way from the other, output would not be uniform. The appropriate equivalent contract would involve dividing both parts using the techniques into lots. A similar method can be used in more complex situations.

Thus share contracts may occur in a number of forms which in the absence of enforcement and transaction costs are essentially the same. Landlord and tenant may share the output after it has been produced; inputs may be split into two lots, the outputs of which are assigned to the landlord and tenant respectively so that there is a direct exchange of the use of land for labour, or tenants and landlords may use a mixture of explicit wage and rent contracts.

Finally, it is interesting to note that share contracts have often occurred in the form of a direct exchange of land for labour. In the manorial system which was widespread in Europe in medieval times, villeins exchanged labour directly for land. Although in this case workers did not usually have access to wage earning opportunities at parametrically given rates so that the above analysis is not directly applicable, nevertheless implicit in the exchange is a particular wage/rent ratio and risk is shared. Homans (1960, pp. 225–226) gives the following example of this type of arrangement.

> 'Thirty-three persons held each one yardland in villeinage.... Each of the thirty-three had to do the following services: he had to do sixty works between Michaelmas (September 29) and the Gule of August (August 1). These works were in tilling the lady's demesne and in doing other labor for her profit. Beside this, each yardling had to do four special days' work of plowing on the lady's demesne with his own plow and one day's work of mowing her meadow. Between the Gule of August and Michaelmas, that is, in the harvest season, the rate of work was increased. In that time, a yardling had to do thirty-six works and three bidreaps besides. These bidreaps were days chosen by the lady when she had the right to call upon the villagers to reap her corn.'

In more recent times similar types of agreement are also widely observed. For example in Northwest Germany the Heuerling system [see Wunderlich (1961, p. 17)], in Chile the obligations of inquilinos [Landsberger (1969, p. 210)] and in Peru the duties of faenos [Landsberger (1969, p. 279)] all involve the direct exchange of labour for land.

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