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A Theory of Surplus Labour

Kaushik Basu

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World Institute for Development Economics Research
of the United Nations University
00100 HELSINKI, Finland

Delhi School of Economics
Delhi – 110007
India

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Kaushik Basu

Delhi School of Economics
Delhi - 110 007
India

CONTENTS

1. THE PROBLEM

Broadly speaking, an economy is said to have surplus labour or disguised unemployment if it is possible to remove a part of its employed labour force without causing a fall in aggregate output. The subject of surplus labour once held the centre-stage of debates on subsistence economies and agrarian structure and had generated an enormous literature.[1] However, the theoretical basis of these models was increasingly called into question and interest in the subject faded out. Indeed, a closer examination of these early works shows that explanations of surplus labour were often based on either an unwitting use of irrational behaviour on the part of agents or the use of very special assumptions concerning preferences or technology.

This paper revisits this old subject in the belief that we can rigorously define and explain surplus labour by drawing on recent advances in the theory of efficiency wage, as exemplified by the works of Mirrlees (1975), Rodgers (1975), Stiglitz (1976), Bliss and Stern (1978), and Dasgupta and Ray (1986). I am referring here to the class of efficiency-wage models which originate from Leibenstein's (1957, 1958) work and shall refer to these writings as the efficiency-wage literature.[2] The basic axiom used in this literature is that in low-income economies there exists a positive relation between the wages received by labourers and their productivity.

The suggestion that this basic axiom can explain surplus labour is not new. It was, in fact, an important motivation for Leibenstein's original exploration (see also Mazumdar, 1959; Wonnacott, 1962). However, as the efficiency-wage literature advanced, it became clear that the basic axiom cannot explain surplus labour or disguised unemployment within the context of these models. It may be true that the withdrawal of a part of the labour force causes wages to rise and this in turn would cause the remaining labourers to be more productive. But it is very easy to show (see section 5 below) that in the existing models (e.g., Mirrlees, 1975) this increased productivity can never be enough to fully compensate for the withdrawn labourers.[3] What the efficiency wage literature can explain well is open unemployment and recent focus has been in that direction (Dasgupta and Ray, 1986).

It will be argued in this paper that the basic axiom does indeed provide a basis for surplus labour.[4] The efficiency wage literature fails to explain surplus labour because whenever it uses the basic axiom it uses it in conjunction with another assumption, to wit, that the positive relation between wage and labour productivity is perceived fully by each employer. I shall refer to this as the perception axiom.

It will be argued in this paper that the two axioms are independent and there are situations where, even though the basic axiom is valid, the perception axiom is untenable. To understand this it is important to recognise that there is a time-lag, often quite long, between wages and productivity[5] (see Bliss and Stern, 1978; Dasgupta and Ray, 1987; Osmani, 1987). Hence, in markets where landlords face a high labour turnover there may be little relation between the wage paid by a particular landlord and the productivity of his workers even though the basic axiom may be valid at the aggregate level, that is, between the equilibrium market wage and average productivity of labourers.[6] The extreme example is provided by the casual labour market where labourers are hired afresh each day. I shall assume that the casual labour market is one where there is no relation between wage and productivity at the level of each landlord and model this in section 3. Not only does this provide an analytically convenient polar case, but the widespread existence of casual labour markets in reality (see Binswanger and Rosenzweig, 1984; and Dreze and Mukherjee, 1987)[7] makes this model of some practical interest.

The polar case provides a plausible and theoretically consistent explanation of surplus labour, raises some interesting policy issues (section 4) and demonstrates the importance of modelling the case that has been ignored in the literature, where the basic axiom is valid but the perception axiom is not.

What happens in between the two polar cases of the efficiency-wage literature and the model of section 3, that is, where the wage-productivity link is not totally absent at the micro-level but neither is it fully captured as required by the perception axiom? This is explored in section 5. It is shown that in this case both open and disguised unemployment can be explained. Clearly, the exaggerated view of the non-existence of disguised unemployment originated from the fact that the entire efficiency-wage literature considers the polar case, which is also the only case, where disguised unemployment cannot occur.

In the theory that is constructed in this paper, though the basic axiom is true, each employer may have little or no incentive in resisting wage cuts. This is consistent with experience (Rudra, 1982; Dreze and Mukherjee, 1987) and suggests that for explaining rigidities we may have to turn to labourers' preference and behaviour, rather than those of employers.

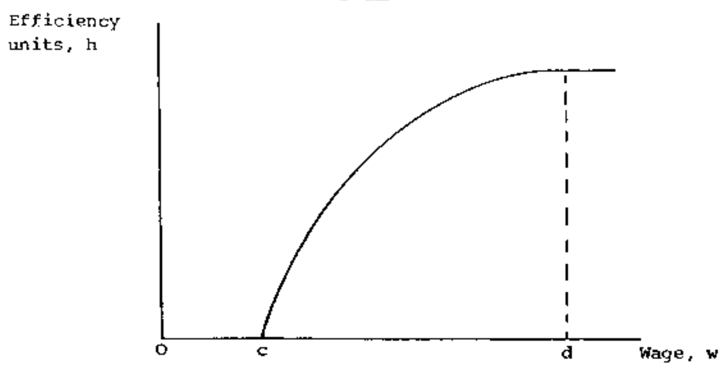
2. BASIC CONCEPTS

In this paper we need to distinguish between 'efficiency units' of labour, hours of labour and labourers.[8] Efficiency units capture the idea of labour productivity. Production depends on the number of efficiency units of labour used. The number of efficiency units that emerge from each hour of labour depends on the wage rate (per hour), w, that the labourer earns:[9]

$$h = h(w), \; h'(w) \geq 0 \tag{1}$$

This is usually justified on the grounds that w determines consumption and since we are talking of poor and malnourished labourers, it is natural to suppose that as a labourer's consumption rises so does his fitness and productivity (Leibenstein, 1957, 1958).[10] It will be assumed throughout that there exist real numbers c and d such that, for all $w \leq c$, $h(w) = 0$; for all w such that $c \leq w < d$, $h'(w) > 0$ and $h''(w) < 0$; and for all $w \geq d$, $h'(w) = 0$. In other words there is a sufficiently low wage below which a labourer is totally unproductive; and h does not rise endlessly with w. For sufficiently high wages the relation ceases to be positive. A typical h(.) function is represented in Figure 1.

Figure 1



The output produced on a landlord's farm depends on the number of efficiency units of labour that is employed. If n hours of labour is employed and each hour of labour produces h efficiency units, then output, x, is given by:

$$x = x(nh),\ x' \geq 0,\ x'' \leq 0 \qquad (2)$$

It will be assumed that, for all real number r for which $x'(r) > 0$, it must be the case that $x''(r) < 0$.

3. A SIMPLE MODEL: THE CASUAL LABOUR MARKET

Consider a poor agrarian economy with k identical landlords and t identical labourers. The model is built up in two stages. At first it is assumed that the market wage is somehow fixed at $\tilde{w}$. Each landlord believes he can hire as many labourers as he wishes at $\tilde{w}$. Using this assumption the landlord's behaviour is modelled. This is referred to as the 'partial equilibrium' model. The second stage consists of endogenously explaining the market wage $\tilde{w}$ and is referred to as the 'general equilibrium'.

3.1 Partial Equilibrium

Let $\tilde{w}$ be the exogenously given market wage. Suppose a landlord decides to employ n labour hours and decides to pay a wage of w per hour. In the conventional efficiency wage model it is assumed that the number of efficiency units that emanate from each hour of labour depends entirely on w, that is, $h = h(w)$. In this paper it is assumed that h depends on both w and $\tilde{w}$ and in this section we make the polar assumption that h depends entirely on $\tilde{w}$. This is in fact taken to be the characterizing feature of casual-labour markets. As explained in section 1, this is justified on the ground that there is a substantial time-lag between productivity and wage and the casual labour market has a high labour turnover. Thus the productivity of a landlord's labourers depends not on the wage that the landlord pays but the wage that prevails in the labour market from which he hires labour. Hence,

$$h = h(\tilde{w}) \qquad (3)$$

Assuming that the price of the good is unity, the landlord's profit, R, is given by:

$$R(n,w) = x(nh(\tilde{w})) - nw \tag{4}$$

If the landlord pays a wage below $\tilde{w}$, no labour will come to him. So his aim is to maximize $R(n,w)$ subject to $w \geq \tilde{w}$.

It is easy to see that the landlord would like to pay as low a wage as possible. Hence, he sets wage equal to $\tilde{w}$. Having done so, he chooses n to maximise $R(n, w)$. Clearly the value of n depends on $\tilde{w}$. So we write

$$n = n(\tilde{w}) \tag{5}$$

Since $n(\tilde{w})$ maximizes $R(n,\tilde{w})$, hence, using the first-order condition, we know:

$$x'(n(\tilde{w})h(\tilde{w})) = \frac{\tilde{w}}{h(\tilde{w})} \tag{6}$$

Given (5) we can compute the aggregate employment in the economy by simply multiplying $n(\tilde{w})$ by k. This completes our description of the partial equilibrium. If the wage prevailing in the labour market is $\tilde{w}$, then each landlord pays a wage of $\tilde{w}$ and hires $n(\tilde{w})$ hours of labour, where $n(\tilde{w})$ is defined implicitly by (6). Our next task is to enquire into the determination of $\tilde{w}$.

3.2 General Equilibrium

In section 3.1 we learned to compute the total demand for labour, given an exogenous $\tilde{w}$. If we do this experiment for different values of $\tilde{w}$, what we end up deriving is the aggregate demand function for labour:

$$D = kn(\tilde{w}), \tag{7}$$

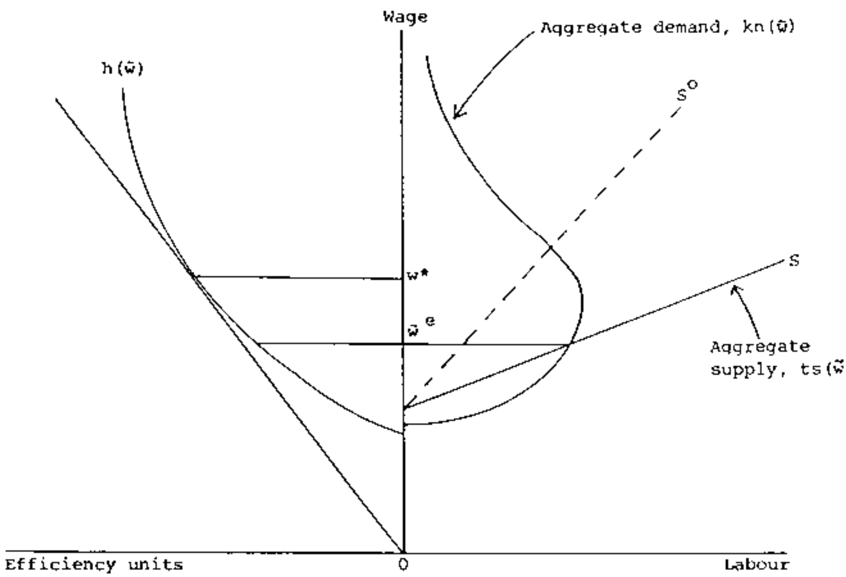
where D is the total demand for labour.

To derive the equilibrium market wage, $\tilde{w}$, all we have to do is to specify the aggregate supply curve of labour and then find the wage at which demand equals supply. Before going on to such an exercise, let us analyse the shape of the demand curve. The basic axiom renders the shape unusual and our subsequent theorems require us to appreciate this.

It is useful to begin by locating what is known in the traditional literature as the efficiency wage. This is the wage at which $w/h(w)$ is minimized. We shall denote such a wage by w^*. In the left-hand panel of Figure 2, we reproduce the h-function of Figure 1 and illustrate the efficiency wage, w^*. This is clearly the point where the 'average' and the 'marginal' of the h-function coincide.

It will now be shown that for all $\tilde{w} \geq w^*$, the aggregate demand curve is downward sloping in the usual way, that is, $\partial D/\partial \tilde{w} < 0$. Note that if $\tilde{w} \geq w^*$, then a rise in $\tilde{w}$ causes $\tilde{w}/h(\tilde{w})$ to rise. Since $x'' < 0$, it follows from (6) that as $\tilde{w}$ rises, $n(\tilde{w})h(\tilde{w})$ must fall. Since $h'(\tilde{w}) > 0$, it follows that $n(\tilde{w})$ falls. Thus $kn(\tilde{w})$ falls. This proof is easily verified geometrically on Figure 2. For $\tilde{w} < w^*$, a rise in $\tilde{w}$ would cause a rise or fall in aggregate demand for labour. The exact nature of the curve does not matter. Figure 2 illustrates a plausible case. if, for instance, x'(0) is a positive real number, it can be shown that the aggregate demand for labour goes to zero for a sufficiently low $\tilde{w}$, which is the case illustrated in Figure 2.

Figure 2.



Now, let us turn to the supply curve. Consider one of the t identical labourers. I shall assume that the number of hours of labour, s, supplied by the labourer is positively related to the wage, $\tilde{w}$, that he gets. Thus,

$$s = s(\tilde{w}), \quad s'(\tilde{w}) \geq 0 \tag{8}$$

The aggregate labour supply, s, is therefore given by:

$$s = ts(\tilde{w}) \tag{9}$$

The wage, w^e, will be described as an <u>equilibrium wage</u> if supply equals demand at w^e, that is,

$$kn(w^e) = ts(w^e). \tag{10}$$

In Figure 2, an equilibrium wage, w^e, is illustrated. In what follows I shall assume that there is a unique equilibrium wage, as in Figure 2. This is not necessary but for my purpose the additional complication of multiple equilibria is an unnecessary encumbrance. For exercises with a different motivation it may in fact be of interest to analyse such cases.

It is useful to note some properties of the general equilibrium:

(a) Though the basic axiom is valid (since productivity, h, does depend on wage) the equilibrium wage, w^e, could be above or <u>below</u> the efficiency wage. This is in contrast to the standard result in the efficiency wage literature that the wage must settle at or above the efficiency wage.

(b) There cannot be any open unemployment in the equilibrium. This is again in contrast to the standard efficiency wage models. What is interesting is that the basic axiom now manifests itself in <u>disguised</u> unemployment. This is shown in section 3.3.

(c) If the equilibrium is unique it must also be 'stable', in the sense that there is a neighbourhood of w^e such that for all w above w^e in this neighbourhood there is an excess supply of labour and for all w below w^e in this neighbourhood, there is an excess demand.[11]

3.3 Surplus Labour

From (10) it is clear that if k is fixed then we could think of the equilibrium wage, w^e, to be a function of t, the number of labourers in the economy. We shall therefore write $w^e = w^e(t)$, where $w^e(t)$ is the equilibrium wage given that the number of labourers is t. Clearly $w^e(t)$ is defined implicitly by:

$$kn(w^e(t)) = ts(w^e(t)).$$

We shall say that there is surplus labour or disguised unemployment in the economy if a fall in the number of labourers results in output rising or remaining constant. A more formal definition could be given using the functions n(w) and $w^e(t)$, as follows: An economy which has t labourers has surplus labour or disguised unemployment if there exists $t^o < t$ such that

$$X(t^o)= x(n(w^e(t^o))h(w^e(t^o))) \geq x(n(w^e(t))h(w^e(t)))= X(t),$$

where X(t) is the total output in an economy with t labourers.

To prove that there can exist surplus labour in equilibrium, note that as the number of labourers fall, equilibrium wage must rise.[12] This is obvious from Figure 2. Clearly a fall in t causes the aggregate supply curve to pivot upwards around its intercept on the wage-axis. Thus, for instance, if $t^o < t$, the aggregate labour supply curve, given t^o, will look like the broken line marked S^o. Hence a fall in t causes the equilibrium wage to rise.

As a second step, check that as long as the equilibrium wage happens to be below the efficiency wage, w^*, every rise in the equilibrium wage results in a rise in aggregate output: As already shown, it follows from the nature of the h-function that if $w^* \geq w' > w^o$, then:

$$\frac{w'}{h(w')} < \frac{w^o}{h(w^o)}$$

This and (6) imply that:

$$x'(n(w')h(w')) < x'(n(w^o)h(w^o)) \tag{11}$$

Since $x'' < 0$, (11) implies:

$$n(w')h(w') > n(w^o)h(w^o).$$

What we have established therefore is this:[13]

$$w^* \geq w' > w^o \longrightarrow kx(n(w')h(w')) > kx(n(w^o)h(w^o)) \tag{12}$$

Suppose now that t is such that $w^e(t)$ is below w^*. If a part of the labour force is removed, then, as shown above, the equilibrium wage will rise and (12) shows that output must rise as well. Thus there is surplus labour or disguised unemployment in the economy whenever equilibrium wage happens to be below the efficiency wage (and there is no reason why this cannot happen).

Finally, a comment on the amount of surplus labour. In the empirical literature the amount of surplus labour is usually defined as the maximum number of labourers that can be removed without causing output to be smaller than the original output. Let us refer to this as definition 1.

The model in this paper suggests that there can be another definition. Define t^* as the number of labourers that result in the aggregate output in the economy to be maximized. It is easy to check (using (12) and footnote 10) that t^* is defined implicitly by $w^e(t^*) = w^*$. According to definition 2, the amount of surplus labour in an economy which has t labourers is $\max\{t-t^*,0\}$.

I draw attention to these two definitions in order to argue that, although definition 1 is the popular one, 2 is conceptually more attractive. The most important reason for this is that 2 satisfies a kind of path independence property. Clearly one property that we would expect a measure of surplus labour to possess is this: Suppose in a particular situation z labourers are found to be in surplus and $m(<z)$ of these labourers are removed. In this new situation we should have $z-m$ surplus labourers. It is easy to check that definition 2 satisfies this property and 1 does not.

4. SOME POLICY ISSUES

The original interest in surplus labour arose from policy matters, especially project evaluation and planning. If labour was to be drawn from the rural sector for industrial projects, how would it affect rural production? It was realised that if surplus labour existed then this withdrawal of labour was likely to be painless.

In this section, however, I analyse some other policy issues. It would seem from the above model that in the presence of disguised unemployment the correct policy is to somehow shore up the labourers' consumption level. This could be done indirectly by giving a wage subsidy or by the direct method of giving free food rations or stamps. In what follows both these policies are analyzed. It is assumed throughout this section that the status quo equilibrium is one which has disguised unemployment.

The consequence of a wage subsidy is easy to analyse; so let us consider this first. Suppose that the government announces that for each person employed the employer will be given a subsidy of $D(>0)$. The individual employer's profit function is now a little more elaborate than (4), and may be denoted as follows:

$$R(n,w,D) = x(nh(\tilde{w})) - n(w-D).$$

The landlord maximises this by choosing n and w, subject to $w \geq \tilde{w}$. As before, he sets $w = \tilde{w}$ and chooses n so as to satisfy:

$$x'(nh(\tilde{w})) = \frac{\tilde{w}-D}{h(\tilde{w})}$$

Let $n(\tilde{w},D)$ be the solution of this. Since $x''< 0$, it follows that as D rises $n(\tilde{w},D)$ rises. Hence the consequence of giving a wage subsidy (i.e. raising D from zero to some positive number) is to shift the aggregate demand curve for labour rightwards. Hence, equilibrium wage will rise, aggregate output will rise[14] and surplus labour will fall.

Somewhat surprisingly, the effect of the direct policy of giving food rations or stamps[15] is more ambiguous. It would raise aggregate output only under certain elasticity conditions. To state these simply, let us define the elasticity of the marginal product of labour with respect to efficiency units by m. That is,

$$m = -x''(nh) \cdot \frac{nh}{x'(nh)} \tag{12}$$

Now suppose the government implements a free food-ration scheme (for example, the kind that was effective in Sri Lanka from the 1940s until the late 1970s). Each person is given f units of food. What will be the consequence of this on output and surplus labour? In the presence of such a policy an individual landlord's profit function (4) has to be modified to the following:

$$R(n,f) = x(nh(\tilde{w}+f)) - n\tilde{w}$$

Note that this takes into account the fact that the landlord will always set w equal to $\tilde{w}$. The landlord maximises this with respect to n. Hence, from the first-order condition we have:

$$x'(nh(\tilde{w}+f))h(\tilde{w}+f) \;=\; \tilde{w}. \tag{13}$$

First, we want to check the effect on demand for labour of an increase in f. Hence by treating $\tilde{w}$ as constant and taking total differentials in (13), we get:

$$h(\tilde{w}+f)x''(nh(\tilde{w}+f))\,\{nh'(\tilde{w}+f)df + h(\tilde{w}+f)dn\} +$$
$$x'(nh(\tilde{w}+f))h'(\tilde{w}+f)df \;=\; 0$$

Rearranging the terms and, for brevity, suppressing the arguments in the functions, we get:

$$\frac{dn}{df} \;=\; -\frac{nh'}{h} \;-\; \frac{x'h'}{x''h^2}$$

Since $x' > 0$, $h' \geq 0$ and $x'' \leq 0$, this cannot be signed, unconditionally. Using (13), we see that $dn/df > 0$ if and only if

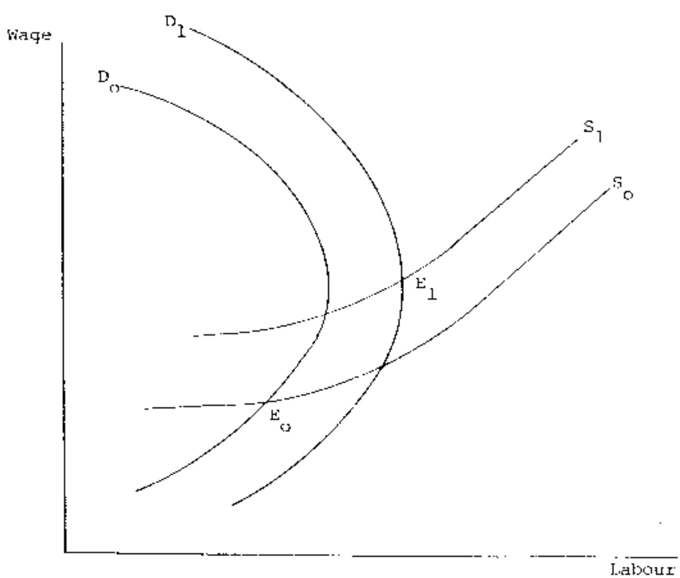
$$m < 1.$$

Hence, only if the marginal product curve is sufficiently flat would a food ration scheme cause an increase in the demand for labour, in the same way as a wage subsidy. However, unlike in the case of a wage subsidy, we have to go one more step before we can talk about the effect on employment, wages and surplus labour. This is because a food ration scheme is likely to affect the supply curve of labour as well.

Let us use the simple specification that a lump-sum subsidy decreases the supply of labour hours. That is, if an individual gets free food rations, his supply curve of labour shifts to the left. This is in keeping with the textbook theory of labour supply as long as leisure happens to be a normal good.

Now we can analyse the effect of implementing a free food ration policy. If $m < 1$, the effect of a food-ration scheme is to shift the aggregate demand curve right and supply left. This is shown in Figure 3, which reproduces the right-hand panel of Figure 1. The subscript o refers to the original position and 1 to the new one, and E_o and E_1 are the old and new equilibria. The effect of the policy is to raise wages, decrease surplus labour, and increase output.[16]

Figure 3



If $m > 1$, the effect of a food ration policy is not predictable. This is easy to check using a diagrammatic exercise as in Figure 3. So the popular intuition about what to do in the event of a 'nutrition'-based disguised unemployment (see, e.g., Robinson, 1969, p.375) is correct only conditionally. If landlords are price takers, then conditions on m are restrictions on technology. Thus the effect of this policy hinges on the nature of technology.

Finally, a comment on infrastructural investment. What would happen if the government invested in rural infrastructure? In much the same way as in the wage-subsidy case, it can be seen that this would raise the aggregate demand for labour, assuming of course that improved infrastructure raises the marginal productivity of labour.[17]

In this section I merely sketched the consequences of different kinds of policies, without attempting to rank them. The results in this section are necessary for conducting an exercise in ranking policies but not sufficient.

5. A GENERALIZED MODEL

It was mentioned above that a reason why an individual landlord may notice no relation between the wage he pays and the productivity of his labourers, is because there is a time-lag between wage and productivity and the landlord's labour may be having a positive turnover. In this section we make this explicit and allow for the fact that there may be some wage-productivity relation even at the micro level of an individual landlord.

Consider a very simple lag-structure in which a worker's productivity in period t depends on his wage r periods ago:

$$h_t = h(w_{t-r})$$

Assume that q is the fraction of the labour force that quits a firm (or landlord) each period (and are replaced by new labourers) and p (=1-q) is the fraction that stays on. There has been work on the determination of q in a general framework (e.g. Salop and Salop, 1976) and also in a developmental context (see Stiglitz, 1974; Basu, 1984); but I shall here treat q as exogenous.

Now, if a landlord employs m labourers, the number of them that will remain with him after r years is $p^r m$. Suppose, as before, that there are k landlords and the reservation wage of labour is $\tilde{w}$. Let w be the wage paid by a landlord and n the number of labour hours employed by him. Then in a steady state, the output per period that he gets is:

$$x = x(p^r nh(w) + (1-p^r)nh(\tilde{w})) \qquad (14)$$

The landlord's problem is to

$$\max_{n,w} R(n,w) = x(p^r nh(w) + (1-p^r)nh(\tilde{w})) - nw \qquad (15)$$

subject to $w \geq \tilde{w}$

To solve this, first ignore the constraint and derive the first-order conditions:

$$\frac{\partial R}{\partial n} = x'(.)(p^r h(w) + (1-p^r)h(\tilde{w})) - w = 0 \qquad (16)$$

$$\frac{\partial R}{\partial w} = x'(.)p^r nh'(w) - n = 0 \qquad (17)$$

Denote the solution of this by (n^o, w^o).

Now let us bring in the constraint on the wage.

Note that (for all $w > c$):

$$\partial^2 R/\partial w^2 = x''(.)(p^r nh'(w))^2 + x'(.)p^r nh''(w) \leq 0$$

since $h'' \leq 0$ and $x'' \leq 0$. It follows that if w^o is not attainable because of the constraint, it is profit-maximizing to get as close as possible to w^o. Hence, denoting the w which solves the landlord's problem by $\bar{w}$, we know that:

$\bar{w} = \max\ \{w^O, \tilde{w}\}$.

Inserting $\bar{w}$ in (16) we can solve for the optimum n. Call this $\bar{n}$. Since $\bar{w}$ and $\bar{n}$ depend on $\tilde{w}$, I shall write these as $\bar{w}(\tilde{w})$, $\bar{n}(\tilde{w})$.

To close the model we simply have to endogenize w. Now for every reservation wage, $\tilde{w}$, we can compute the market demand for labour, D, as before:

$$\bar{D} = k\bar{n}(\tilde{w})$$

The aggregate supply curve is the same as in section 3, i.e. supply equals $ts(\tilde{w})$ (see (9)).

We have a <u>general equilibrium</u> if the reservation wage, $\tilde{w}$, is such that:[18]

$$k\bar{n}(\tilde{w}) = ts(\tilde{w}).$$

What is interesting about the general equilibrium in this <u>generalized</u> model is that it can explain both disguised and open unemployment. Before discussing this I want to draw attention to one conceptual problem which arises when there is open unemployment and the assumption that can help us skirt the problem.

In the event of open, involuntary unemployment an individual employer would face a reservation wage which is below the wage prevailing in this market. It is then not clear why this wage should be relevant in determining the productivity of newly hired labourers, as is implicitly assumed in the production function, (14). This may be justified by assuming either that leisure serves the same role as consumption in bolstering a worker's productivity or that the worker has another source of consumption which is open to him only if he is not working for any of these k landlords and his supply price of labour is equal to this alternative consumption. It is also assumed that in the presence of open unemployment, the new recruits during labour turnover come from the pool of unemployed. This assumption could be dropped but in that case $\tilde{w}$ would have to be replaced by a weighted average of w and $\tilde{w}$ in (14) and in the subsequent analysis.

Now let us demonstrate how there could occur equilibria with disguised unemployment and equilibria with open unemployment. To demonstrate the former we need to establish a <u>lemma</u>:

Given that $\tilde{w}$ is the general equilibrium reservation wage, if $\tilde{w} < w^*$, then $\bar{w}(\tilde{w}) < w^*$.

To prove this, check that (16), (17) and the fact that w^o is a solution of (16) and (17) imply that:

$$h'(w^o) = \frac{h(w^o)}{w^o} + \frac{(1-p^r)}{p^r} \cdot \frac{h(\tilde{w})}{w^o} \, . \tag{18}$$

Therefore, $$h'(w^o) > \frac{h(w^o)}{w^o}$$

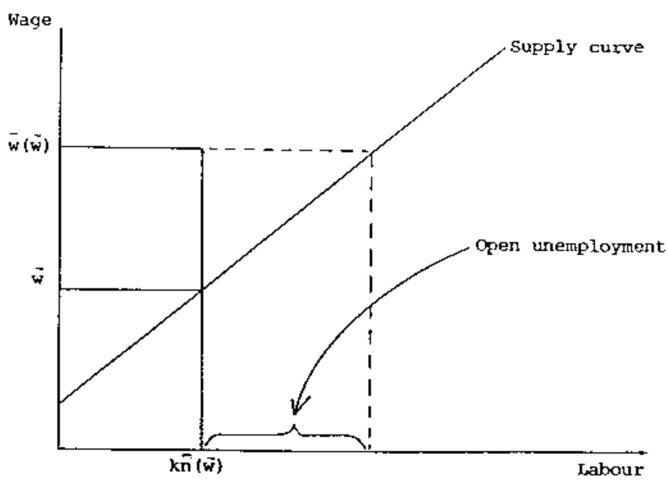
From the shape of the h-function, it follows that (since the 'marginal' is greater than the 'average' at w^o) w^o must be less than w^*. Hence $\tilde{w} < w^*$ implies:

$\bar{w}(\tilde{w}) \;=\; \max\,\{w^o,\tilde{w}\} < w^*$.

From the description of the general equilibrium it is clear that we can construct examples where $\bar{w}(\tilde{w}) = \tilde{w} < w^*$, and as t falls, $\tilde{w}$ increases. From the above lemma it follows that t can be decreased such that $\bar{w}(\tilde{w})$ increases but does not cross w^*. Hence by a familiar argument (see (12)), aggregate output must rise. This establishes the possibility of disguised unemployment.

To see the possibility of open unemployment we simply have to consider the case where $w^o > \tilde{w}$. From the definition of general equilibrium, we know that $k\bar{n}(\tilde{w}) = ts(\tilde{w})$. Since the supply curve is upward sloping and $\bar{w}(\tilde{w})$ must be equal to w^o, hence $ts(\bar{w}(\tilde{w})) > k\bar{n}(\tilde{w})$. Thus at the wage that is being paid by the landlords, the number of labour hours supplied exceeds the number of labour hours in employment.[19] Figure 4 gives a pictorial representation of this case.

Figure 4



Finally let us consider two special cases of this generalized model.

Case 1. If $p^r = 0$, then (15) collapses to (4) and we get the model of section 3.

Case 2. If $r = 0$ or $p = 1$, i.e. either there is no lag in the wage-productivity link or the labour turnover is zero, then the landlord's objective function in (15) becomes:

$$R(n,w) = x(nh(w)) - nw,$$

which is exactly the form used in the standard efficiency-wage literature, for example, Mirrlees (1975) and Stiglitz (1976). In this case it is easy to show that the equilibrium wage must be at least as large as the efficiency wage. Now, if the number of labourers diminish sufficiently the equilibrium wage can certainly rise. But in the light of what has already been proved in section 3 (see footnote 10), it follows that such a rise in wage must cause total output to decline. So, in this special case, surplus labour can never occur.

Given the demonstration in this section that surplus labour can occur if p^r is anywhere in the half-open interval $[0,1)$, it is clear that our rejection of the possibility of surplus labour may have been exaggerated by virtue of the fact that the traditional literature is entirely based on the assumption of p^r being equal to 1. Our finding is not incompatible with the empirical evidence. While it is true that the evidence is mixed, a large number of economists have reported evidence of surplus labour (for a survey see Kao, Anschel and Eicher, 1964); and not just from over-populated Asian economies but even from Latin America (de Janvry, 1981).

6. CONCLUSION

In this paper a model was constructed in which there is a positive relation between wage and labour-productivity but the relation is not fully perceived at the micro level of each individual employer. The model was used to explain the possibility of surplus labour in an economy with rational agents. It was also used to analyse the effects of some standard policy prescriptions. It was shown that wage subsidies could be used to cut down surplus labour and increase output. A policy of free food rations could achieve the same if technology was such that the marginal product of labour did not vary too much with changes in labour use.

FOOTNOTES

1. Robinson (1937); Navarrete and Navarrete (1951); Georgescu-Roegen (1960); Schultz (1964); Islam (1965); Paglin (1965); Sen (1966, 1967); Desai and Mazumdar (1970). For surveys of this labyrinthine literature, see Kao, Anschel and Eicher (1964); Mathur (1965); Robinson (1969).

2. This is a mild abuse of tradition since the term 'efficiency wage' is generally used to describe <u>any</u> model where the downward stickiness of wage is explained in terms of the employer's preference.

3. A paper by Agarwala (1979) has surveyed existing results and established this proposition under several different conditions.

4. In a lucid paper, Guha (1987) has used a similar framework to explain surplus labour, though his model is very different from the one developed here. In Stiglitz's (1976) paper also there is a case where surplus labour can occur. But this only when production is organised in family farms in which income is divided equally among the members.

5. This is well-recognized in the <u>efficiency-wage literature</u> but is ignored for simplicity. It is of course the point of this paper that the lag is not an inconsequential complication.

6. It is also possible that even though there is a link between wage and productivity at the level of each landlord, landlords do not perceive this. After all, in the theory of competitive industry we do assume that the aggregate demand curve is downward-sloping but each firm perceives price as unchangeable.

7. It is true that the duration of labourer-employer relation is usually longer than stipulated in a contract (see Bardhan, 1984, pp.83-4), but in the absence of a long-term contract it may not be in the landlord's interest to increase wage with a view to enhancing labour productivity in the long-run.

8. The importance of distinguishing between labour hours and labourers for studying disguised unemployment was recognized by Sen (1966) (see, also, Mellor, 1967). The further differentiation with efficiency units arose with the incorporation of the basic axiom in labour market theories.

9. The assumption that the relation is between h and per hour wage (instead of total wage earned by the labourer) keeps the algebra simpler. Also, it is not too strong an assumption in this model since it will be assumed that each labourer chooses voluntarily the number of hours he will work, given the per-hour wage rate.

10. Myrdal (1968) also discusses this in his chapter on "under-employment".

11. The 'neighbourhood' qualification is not really necessary if there is only one equilibrium.

12. This is always true if there is a unique equilibrium. if there are multiple equilibria then this is true for all stable equilibria.

13. Following the same method it is possible to show the following:

$$w' > w^{o} \geq w^{*} \rightarrow kx(n(w')h(w')) < kx(n(w^{o})h(w^{o})).$$

Though this is not important here, we need to refer to this in section 5.

14. This is assuming, of course, that D is not so large, that the equilibrium wage rises well past the efficiency wage. In that case it would have a depressing effect on output.

15. These policies are relevant to less developed economies, especially the South Asian ones, as there has been a long history of experimentation with alternative schemes in this class of policies (see Dreze and Sen, 1987).

16. Subject to, of course, a similar qualification as in footnote 14.

17. This is indeed an assumption. It is often taken for granted that if there are two factors of production, a rise in one increases the marginal productivity of the other. That this need not be so is easy to see: If a factory employs red-haired and green-haired labour, there is diminishing marginal productivity for each labour-type and from the point of production the colour of a labourer's hair does not matter, then clearly an increase in greens must cause a drop in the productivity of reds.

18. Implicit in this definition is the assumption that, if there is open unemployment, then the reservation wage of any unemployed labour is greater than the reservation wage of any employed labour.

19. The kind of unemployment that occurs here, namely, that all labourers would want to work more, is at times referred to as 'visible under-employment' (see Squire, 1981, pp. 69-74). At the expense of a more complex analysis it is possible to demonstrate open unemployment where some labourers fail to sell any labour, despite wishing to do so. Indeed this has been done in the efficiency wage literature.

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