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The Broth and the Cooks: A Theory of Surplus Labor

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Summary. — It had been suggested by Sen (1966) that surplus labor may exist if a decline in labor-force size results in an increase in the number of hours of work per remaining laborer. The present paper explores a new avenue where the decline in the labor force raises wages and thereby raises each worker's productivity. It is argued that the large literature on efficiency wages, while very successful in explaining open unemployment, fails to explain surplus labor. In this literature the assumption that wages can raise productivity is invariably made in conjunction with the assumption that this is true not only at the aggregate level but at the level of *each* employer. Once these two assumptions are separated out, a rigorous explanation of surplus labor becomes possible under conditions which are, in some ways, more general than Sen's model. This argument is demonstrated and then some policy issues are addressed in this paper. In particular, the consequences of food rationing and wage subsidies are examined.

1. THE PROBLEM

Broadly speaking, an economy is said to have surplus labor or disguised unemployment if it is possible to remove a part of its employed labor force without causing a decline in the aggregate output. Although the subject had distant roots (Robinson, 1937; Navarrete and Navarrete, 1951), it was given a lucid theoretical structure by Sen in the mid-1960s (Sen, 1966). The subject of surplus labor was once the center of debates on subsistence economies and agrarian structure and had generated an enormous literature.[1] These models, however, were increasingly called into question and interest in the subject faded out.

The present paper revisits this old subject in the belief that we can rigorously define and explain surplus labor by drawing on recent advances in the theory of efficiency wage. I am referring here to the class of efficiency-wage models which originate in Leibenstein's (1957, 1958) work and will 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 laborers and their productivity.

The suggestion that this basic axiom can explain surplus labor is not new. It was, in fact, an important motivation for Leibenstein's original exploration (see also Mazumdar, 1959; Wonnacott, 1962).[3] As the efficiency-wage literature advanced, however, it became clear that the basic axiom cannot explain surplus labor or disguised unemployment within the context of these models. It may be true that the withdrawal of a part of the labor force causes wages to rise and in turn causes the remaining laborers to be more productive. But it is very easy to show that in the existing models (e.g., Mirrlees, 1975) this increased productivity can never be enough to fully compensate for the withdrawn laborers (see Basu, 1984). What the efficiency wage literature can explain well is open unemployment and recent focus has been in that direction.

The basic axiom, it will be argued here, provides a basis for surplus labor. The efficiency-wage literature fails to explain surplus labor because whenever it uses the basic axiom it uses it in conjunction with another assumption, to wit, that the positive relation between wage and labor productivity is perceived fully at the level of each employer. I shall refer to this as the perception axiom.

To place the present model in perspective, it may be mentioned that there are related papers (e.g., Agarwala, 1979; Stiglitz, 1976; Guha, 1989) which manage to explain surplus labor.

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Guha (1989), for instance, has in a lucid paper used a similar framework to explain surplus labor, although his argument is different from the one developed here. In Stiglitz (1976) also there is a case where surplus labor can occur, but only when production is organized in family farms in which income is divided equally among the members.

It will be argued in this paper that the basic axiom and the perception axiom are independent and there are situations where, even though the basic axiom is valid, the perception axiom is untenable. This is true somewhat in the same way that the aggregate demand curve faced by a perfectly competitive industry happens to be downward sloping even though it is not perceived to be so by each individual firm in the industry. Note that there is a time-lag, often quite long, between wages and productivity[4] (see Bliss and Stern, 1978; Dasgupta and Ray, 1991; Osmani, 1991). Hence, in markets where landlords face a high labor turnover there may be little relation between the wage paid by a particular landlord and the productivity of his or her workers even though the basic axiom may be valid at the aggregate level, that is between the equilibrium market wage and average productivity of laborers.[5] The extreme example is provided by the casual labor market where laborers are hired afresh each day. I shall assume that the casual labor 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 the casual labor market provide an analytically convenient polar case, but the widespread existence of casual labor markets in reality (see Binswanger and Rosenzweig, 1984; Dreze and Mukherjee, 1987) makes this model of some practical interest.[6]

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

What happens 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 issue is explored in Section 5. It is argued that in this case both open and disguised unemployment can be explained. Clearly, the exaggerated view of the nonexistence 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, although the basic axiom is true, each employer may have little or no incentive to resist wage cuts. Such a possibility is consistent with experience (Rudra, 1982; Dreze and Mukherjee, 1987) and suggests that for explaining rigidities we may have to turn to laborers' preferences and behavior, rather than those of employers.

2. BASIC CONCEPTS

In this paper we distinguish between "efficiency units" of labor, hours of labor and laborers.[7] Efficiency units capture the idea of labor productivity. Production depends on the number of efficiency units of labor used. The number of efficiency units that emerge from each hour of labor depends on the wage rate (per hour), w, that the laborer earns:[8]

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

This assertion is usually justified on the grounds that w determines consumption and since we are referring to poor and malnourished laborers, it is natural to suppose that as a laborer's consumption rises so does his or her fitness and productivity (Leibenstein, 1957, 1958).[9] It will be assumed throughout that there exist real numbers c and d such that, for all $w \leqslant c$, $h(w) = 0$; for all w such that $c \leqslant w < d$, $h'(w) > 0$ and $h''(w) < 0$; and for all $w \geqslant d$, $h'(w) = 0$. In other words, there is a sufficiently low wage below which a laborer 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.

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

$$x = x(nh), x' \geqslant 0, x'' \leqslant 0 \tag{2}$$

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

3. A SIMPLE MODEL: THE CASUAL LABOR MARKET

Consider a poor agrarian economy with k identical landlords and t identical laborers. The model is built in two stages. At first it is assumed

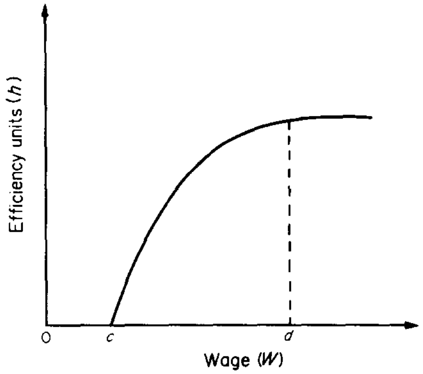

Figure 1. *Wage and efficiency.*

that the market wage is somehow fixed at $\bar{w}$. Each landlord believes he or she can hire as many laborers as desired at $\bar{w}$. Using this assumption the landlord's behavior is modeled. This is referred to as the "partial equilibrium" model. The second stage consists of endogenously explaining the market wage $\bar{w}$ and is referred to as the "general equilibrium."

(a) *Partial equilibrium*

Let $\bar{w}$ be the exogenously given market wage. Suppose a landlord decides to employ n labor 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 labor depends entirely on w, that is, $h = h(w)$. In this paper it is assumed that h depends on both w and $\bar{w}$ and in this section we make the polar assumption that h depends entirely on $\bar{w}$. This relationship is in fact taken to be the characterizing feature of casual labor markets. As explained in Section 1, this assumption is justified on the grounds that there is a substantial time-lag between productivity and wage and the casual labor market has a high labor turnover. Thus the productivity of a landlord's laborers depends not on the wage that the landlord pays but the wage that prevails in the labor market from which labor is hired. Hence,

$$h = h(\bar{w}) \tag{3}$$

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

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

If the landlord pays a wage below $\bar{w}$, no labor will come. So the landlord's aim is to maximize $R(n,w)$ subject to $w \geqslant \bar{w}$.

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

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

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

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

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

(b) *General equilibrium*

In section (a) we learned to compute the total demand for labor, given an exogenous $\bar{w}$. If we do this experiment for different values of $\bar{w}$, we derive the aggregate demand function for labor:

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

where D is the total demand for labor.

To derive the equilibrium market wage, $\bar{w}$, we have only to specify the aggregate supply curve of labor and then find the wage at which demand equals supply. Before going on to such an exercise, let us analyze the shape of the demand curve. The basic axiom renders the shape unusual and our subsequent theorems require us to examine this anomaly.

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

It will now be shown that for all $\bar{w} \geqslant w^\star$, the aggregate demand curve is downward sloping in the usual way, that is, $\delta D/\delta\bar{w} < 0$. Note that if $\bar{w} \geqslant w^\star$, then an increase in $\bar{w}$ causes $\bar{w}/h(\bar{w})$ to rise. Since $x'' < 0$, it follows from equation (6) that as $\bar{w}$ rises, $n(\bar{w})h(\bar{w})$ must fall. Since $h'(\bar{w}) > 0$, it follows that $n(\bar{w})$ falls. Thus $kn(\bar{w})$ falls. This proof is easily verified geometrically in Figure 2.

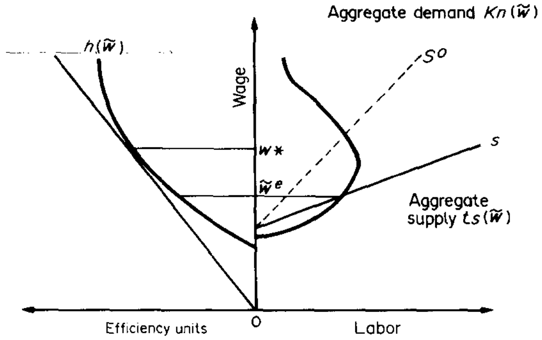

Figure 2. *Aggregate demand for and supply of labor.*

For $\tilde{w} < w^\star$, an increase in $\tilde{w}$ could cause an increase or decline in demand.[10]

Now, let us turn to the supply curve. Consider one of the t identical laborers. I shall assume that the number of hours of labor, s, supplied by the laborer is positively related to the wage, $\tilde{w}$, that he or she receives. Thus,

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

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

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

The wage, w^e, will be described as an *equilibrium wage* if supply equals demand at w^e, that is,

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

In Figure 2, an equilibrium wage, w^e, is illustrated. In what follows I shall assume that there is a unique equilibrium wage,[11] as in Figure 2. This assumption 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 analyze such cases.

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

(i) Although the basic axiom is valid (since productivity, h, does depend on wage) the equilibrium wage, w^e, could be above *or below* 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.

(ii) There cannot be any open unemployment at the equilibrium. This is again in contrast to the standard efficiency-wage models. The basic axiom now manifests itself in *disguised* unemployment and is discussed below.

(c) *Surplus labor*

From equation (10) it is clear that if k is fixed then we could think of the equilibrium wage, w^e, as a function of t, the number of laborers 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 laborers 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 labor or disguised unemployment in the economy if a decline in the number of laborers 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 laborers has surplus labor or disguised unemployment if there exists $t^o < t$ such that

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

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

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

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

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

This and equation (6) imply that:

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

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

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

We have established therefore:[13]

$$w^\star \geqslant w' > w^o \rightarrow kx(n(w')h(w')) > kx(n(w^o)h(w^o)) \tag{12}$$

Suppose now that t is such that $w^e(t)$ is below

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

Finally, in regard to the amount of surplus labor, in the empirical literature the amount of surplus labor is usually defined as the maximum number of laborers that can be removed without causing output to be smaller than the original output. We refer to this concept as *definition one*.

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

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

4. SOME POLICY ISSUES

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

In this section, however, I analyze 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 laborers' consumption level. This objective could be met 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 analyze; let us consider it 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 equation (4), and may be denoted as follows:

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

The landlord maximizes this profit by choosing n and w, subject to $w \geqslant \tilde{w}$. As before, the landlord 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. 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 labor rightward. Hence, the equilibrium wage will rise, aggregate output will rise[14] and surplus labor will decline.

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 labor with respect to efficiency units by m. That is,

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

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 such a scheme on output and surplus labor? 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 function takes into account the fact that the landlord will always set w equal to $\tilde{w}$. The landlord maximizes this factor 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 labor of an increase in f. Hence by treating $\tilde{w}$ as constant and taking total differentials in equation (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 $x' > 0$, $h' \geqslant 0$ and $x'' \leqslant 0$, it cannot be signed, unconditionally. Using equation (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 labor, in the same way as a wage subsidy. Unlike in the case of a wage subsidy, however, we have to go one more step before we can talk about the effect on employment, wages and surplus labor. A food-ration scheme is likely to affect the supply curve of labor as well.

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

Now we can analyze 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 effect is shown in Figure 3, which reproduces the right side 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 labor, and increase output.[16]

If $m > 1$, the effect of a food ration policy is not predictable. This outcome is easy to check using a diagrammatic exercise as in Figure 3. The popular intuition about what to do in the event of "nutrition"-based disguised unemployment (see, e.g., Robinson, 1969, p. 375) is thus 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, with reference to infrastructural investment, what would happen if the government invested in rural infrastructure? In much the same way as in the wage-subsidy case,

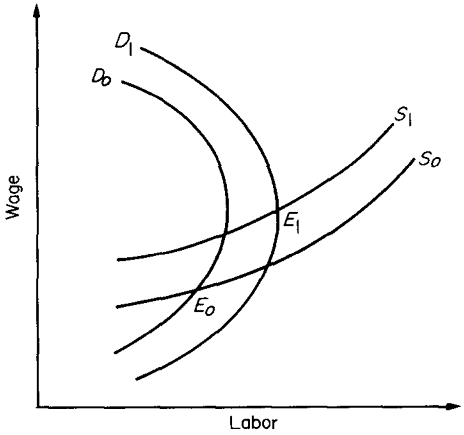

Figure 3. *The effect of food rationing.*

it can be seen that this step would raise the aggregate demand for labor, assuming, of course, that improved infrastructure raises the marginal productivity of labor.[17]

This section briefly outlined 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. TOWARD A GENERALIZED MODEL

It was mentioned above that one reason an individual landlord may notice no relation between the wage he or she pays and the productivity of laborers is because there is a time-lag between wages and productivity and the landlord's labor may be having a positive turnover. In this section we make this relation 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 or her wage r periods ago:

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

Assume that q is the fraction of the labor force that quits a firm (or landlord) each period (and is replaced by new laborers) 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 laborers, the number of them that will remain after r years is $p^r m$. Suppose, as before, that there are k landlords and the reservation wage of labor is $\tilde{w}$. Let w be the wage paid by a landlord and n the number of labor hours employed by that landlord. Then in a steady state, the landlord's output per period is:

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

The landlord's problem is to

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

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

To solve this, first ignore the constraint and derive the first-order conditions. Denote the solution of this by (n^o, w^o).

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

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

since $h'' \leqslant 0$ and $x'' \leqslant 0$. 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 equation (15) 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 $\bar{w}(\tilde{w})$, $\bar{n}(\tilde{w})$.

The model can be closed as before by aggregating the labor demand schedules of the k landlords and equating aggregate demand and aggregate supply. It is not difficult to see that under certain parametric situations there will be an excess supply of labor and in other situations there will be no excess supply and market clearing wages would be below $w^\star$. In the former situation there is open unemployment and in the latter there is surplus labor.[18]

Given that surplus labor 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 labor 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 one. This paper's theoretical 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 labor — not just from densely populated Asian economies but also from Latin America (see de Janvry, 1981; and, for a survey, Kao, Anschel and Eicher, 1964).

NOTES

1. See, for example, Georgescu-Roegen (1960); Schultz (1964); Islam (1965); Paglin (1965); Sen (1967, 1975); Desai and Mazumdar (1970); Agarwala (1979); Basu (1990). For surveys of this labyrinthine literature, see Kao, Anschel and Eicher (1964); Mathur (1965); Robinson (1969).

2. The reference here is to the kinds of models that occur in Mirrlees (1975), Rodgers (1975), Stiglitz (1976), Bliss and Stern (1978) and Dasgupta and Ray (1986). This is, the reader ought to be warned, a mild abuse of tradition since the term "efficiency wage" is generally used to describe *any* model where the downward stickiness of wage is explained in terms of the employer's preference.

3. Despite the understatement, the point is also quite clearly made by Streeten (1970) when he writes: "it is not warranted to assume that . . . consumption at low levels of hiring has no effect on productivity." Streeten goes on to suggest that a measure which cuts down the hours worked may raise worker productivity.

4. This point is well recognized in the efficiency-wage literature but is ignored for simplicity. It is, of course, the point of this paper that the lag is not an inconsequential complication.

5. It is also possible that even though there is a link between wage and productivity at the level of each landlord, landlords do not necessarily perceive this.

6. It is true that the duration of laborer–employer relation is usually longer than stipulated in a contract (see Bardhan, 1984, pp. 83–84), but in the absence of a long-term contract it may not be in the landlord's interest to increase wages with a view to enhancing labor productivity in the long run.

7. The importance of distinguishing between labor hours and laborers 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 labor market theories.

8. The assumption that the relation is between h and per hour wage (instead of total wage earned by the laborer) keeps the algebra simpler. It is also not too strong an assumption in this model since it will be assumed that laborers choose voluntarily the number of hours they will work, given the per hour wage rate.

9. Myrdal (1968) also discusses this in his chapter on "underemployment."

10. If, for instance $x'(0)$ is a positive real number, it can be shown that the aggregate demand for labor goes

to zero for a sufficiently low $\bar{w}$, which is the case illustrated in Figure 2.

11. Note also that if the equilibrium is unique, it must also be "stable" in the standard textbook sense.

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 that:

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

Although this point 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 is a long history of experimentation with alternative schemes in this class of policies (see Dreze and Sen, 1991).

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

17. This is indeed an assumption. It is often taken for granted that if there are two factors of production, an increase 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 labor, there is diminishing marginal productivity for each labor-type and from the point of production the color of a laborer's hair does not matter, then clearly an increase in greens must cause a drop in the productivity of reds.

18. A formal derivation of these is available from the author on request.

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