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STRATEGIC HOUSEHOLD BEHAVIOR IN LABOR SURPLUS ECONOMIES

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We show that when households employ the Cournot-Nash strategy in labor surplus economies, the wage rate is strictly positive, households are underemployed, household members may be openly unemployed, the labor supply curve is upward-sloping and household withdrawal but not worker withdrawal decreases output.

1. Introduction

The possible coexistence of surplus labor and a positive wage rate has attracted a good deal of attention from students of economic development. Among the early motivating ideas was the Lewis (1954) postulate of output constancy in the face of labor withdrawal. For this to happen, labor had to be a surplus which, by the ordinary labor market model, itself required a zero wage rate — a phenomenon that is never observed. Ranis and Fei (1961) introduced the idea of an "institutionally fixed wage rate" below which wages cannot fall despite the persistence of surplus labor. This wage floor is determined by social customs, traditions and laws. Sen (1966) proposed a model of peasant households isolated from the labor market which allowed output constancy with labor withdrawal provided the family utility function is separable and the marginal rate of substitution between labor and leisure is constant. The observed market wage may still be positive, provided surplus labor within the family farm does not spill over to the market. Sen, in effect, dropped "institutions" in favor of "taste" and isolation. Mehra (1966), among others, measured the degree of surplus labor in Indian agriculture in the presence of positive wage.

What many consider as the prime rival of the neoclassical market model in this area is the efficiency wage hypothesis (Leibenstein, 1957; Mirlees, 1975; and Stiglitz, 1982). Given a positive and (for some interval) increasing dependence of work effort on the wage rate, the optimum wage offer of a monopsonistic firm will exceed zero even in the presence of workers who are willing to

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bid down the wage rate. The nutritional wage variant of the hypothesis starts from an S-shaped relation between work effort and calorie intake (Mirlees, 1975). The "labor turnover" version (Stiglitz, 1974) relates higher wages to lower turnover and the "screening variant" (Weiss, 1980) holds that worker quality rises with income. All the variants seem to point to a long-term, stable relation between worker and firm. Where, however, labor is largely casual, information is low cost and labor contracts can be as short as a day as is true in most rural LDCs, these models are harder to justify (Binswanger and Rosenzweig, 1981). In addition, a sharing mechanism to sustain unemployed workers is required. More important, however, is that the efficiency wage hypothesis predicts an infinitely elastic supply curve and open unemployment, a feature which has given it greater currency as a microfoundation for rigid wages and involuntary unemployment in developed country macroeconomics (Solow, 1979; Carmichael, 1990). Empirical evidence seems to point otherwise: labor supply elasticity is less than infinite (Bardhan, 1979a, 1979b; Barnum and Squire, 1979; Rosenzweig, 1980) and underemployment, rather than open unemployment, is the dominant observation (Binswanger and Rosenzweig, 1981). Ahmed (1978) has reported on the major significance of voluntary underemployment in Bangladesh.

The approaches so far discussed can be categorized into two: (a) the explanations based on institutions or taste and (b) the explanations based on firm rationality with monopsonistic power, the presence of a wage-productivity relation and the existence of workers acting as automatons. What is strangely absent is the possibility of rational behavior on the part of the workers whose very survival, after all, is at stake. In the following, we explore the implications of strategic household behavior in a labor surplus economy paying close attention to the following stylized facts: (i) labor is surplus, (ii) observed wage is positive, (iii) the labor supply curve is upward-sloping, and (iv) the labor surplus manifests itself largely through underemployment, possibly voluntary, with a sprinkling of open unemployment. In view of Lewis (1954), Ranis and Fei (1961) and Sen (1966), we also explore the possibility of (v) output constancy with labor withdrawal. We adopt the common assumption (e.g., Sen, 1966; Katz and Stark, 1986) that the unit of decision in the rural LDC is the household and extend the Lewis distinction between workers and labor units to between households and worker-members.

2. Household Rationality

2.1 Lewis

The original conjecture being due to Lewis (1954), his definition of unlimited supply of labor bears reflection: ". . . an unlimited supply of labour may be said to exist in those countries where population is so large relative to capital and natural resources, that there are large sectors in the economy where marginal productivity is negligible, zero, or even negative . . . if some members of the family obtained other employment the remaining members could cultivate the holding just as well. . ." Output constancy may be said to have been born here. Note also the emphasis given to the role of the "family."

Returning to the idea of unlimited labor supply two decades and a lengthy debate later, Lewis (1972) hinted on worker rationality and strategic behavior with the idea that the marginal productivity of labor time is positive, but that of labor is zero. It seems that the workers are refusing to work full time and, in effect, sharing limited productive work hours. Clearly, observed wage is positive, and labor surplus manifests itself as underemployment. Furthermore, the withdrawal of part of the available labor leaves output constant. This paper proposes to flesh out the (later) Lewis program by providing the simplest possible strategy-theoretic mechanism.

2.2 The Labor Surplus Economy

Consider an economy with n households and an agricultural labor demand function given by

$$(1) \quad w = a - bL \qquad a, b > 0$$

where w is the market wage rate per labor unit and L is the total labor units hired. We assume the demand side of the labor market to be perfectly competitive. With the household as a decision unit, we let $\bar{l}_i$ be the labor units representing full-time work for household $i = 1, 2, ..., n$. Let $\bar{L} = \sum_{i}^{n} \bar{l}_i$. Let L_0 be the level of labor hired at which $w = 0$, i.e., $L_0 = (a/b)$. We say labor is surplus if $\bar{L} > L_0$. In the neo-classical tradition, households bid down the market wage rate as long as it is higher than the opportunity cost of labor which is assumed to be zero. Thus, when $\bar{L} \geq L_0$, $w = 0$.

2.3 *The Symmetric Cournot-Nash Game*

Suppose each household to be individually rational, to know (1) with certainty, and to operate independently of all the others. Suppose further that each seeks to maximize $\{wl_i - cl_i^2\}$, $c \geq 0$, where wl_i is the household wage income and cl_i^2 is the disutility of household i associated with working. Given demand for labor, (1) the problem for $i = 1, 2, \ldots, n$ is:

$$(2) \quad \max_{l_i} \{[a - b\sum_{j=1}^{n} l_j]\, l_i - cl_i^2\}, \; i = 1, 2, \ldots, n.$$

The first-order necessary conditions, assuming Cournot conjectural variations, are:

$$(3) \quad a - 2(b + c)\, l_i - b\sum_{j \neq i}^{n} l_j = 0, \; i = 1, 2, \ldots, n.$$

These constitute the Cournot-Nash conditions. The attraction of the Cournot-Nash equilibrium is that it is self-enforcing and requires no additional structure for perpetuation. The second derivative is always negative. We now assume all households to be identical in every way (including their conjectural variations assumed to be of the Cournot variety). This implies $l_i - 1_j = l$, $\forall_{i,j}$ and, after dropping the subscripts, (3) becomes

$$(4) \quad a - [2(b + c) + b(n-1)]\, l = 0$$

which directly gives

$$(5) \quad l^* = a[(n + 1)\, b + 2c]^{-1}.$$

This is the symmetric Cournot-Nash equilibrium household labor supply. The total labor supply in labor hours is:

$$(6) \quad L^* = nl^* = na[(n + 1)\, b + 2c]^{-1}.$$

The per unit labor wage rate is

$$(7) \quad w^* = a[b + 2c]\, [(n + 1)\, b + 2c]^{-1}.$$

The following now follow from (5), (6) and (7).

Claim 1: (a) The equilibrium wage rate is strictly positive for finite n even with surplus labor, i.e., $\bar{L} > L_0 > L^*$. (b) Surplus labor manifests itself as underemployment at the household level (open unemployment is possible at the level of individual household members). (c) The supply curve of labor is upward-sloping.

Proof: (a) and (b) are obvious. (c) taking the derivative of w^* with respect to "a" (demand shift) gives $(b + 2c)$ $[(n + 1)\, b + 2c]^{-1} > 0$.

In this case, the marginal productivity of labor time is positive but that of workers is zero. Clearly, the households are sharing scarce agricultural productive work-hours in such a way that every household gets something (with positive wage rate). Furthermore, the sharing mechanism is self-enforcing. The household, in turn, allocates its labor hours l^* among its members. How the household allocates l^* determines the degree of unemployment or underemployment. If the allocation is egalitarian, i.e., every adult member shares in the burden equally, underemployment will dominate. If the work norm of the area requires some full-time workers, open unemployment will obtain. The following gives the result of household withdrawal.

Claim 2: Withdrawal of some households results in (a) a rise in the wage rate, (b) a rise in the remaining household's individual labor supply, (c) a fall in the aggregate labor supply, (d) a fall in agricultural output, (e) a rise in the remaining household's take home pay (w^*l^*), (f) a rise (fall) in the total wage income (w^*L^*) if $|\in| = |\,(dw^*/dL^*)\,(L^*/w^*)| \gtrless 1$.

Proof: (a) and (b) are obvious from (5) and (6) since w^* and l^* fall as n rises. (c) Now L^* rises as n rises so withdrawal (n falls) decreases total labor supply. (d) Follows from (b) as long as labor marginal product is positive. (e) Obvious from (5) and (7). (f) The numerator of the first derivative of w^*l^* with respect to n, after simplifying, is

(8) $a^2\,(b + 2c)\,[(n + 1)\, b + 2c]\,[2c - b\,(n\text{-}1)]$

Note that from (5) and (7), $2c = (w^*/l^*) - b$. (8), thus simplifies into

$$a^2\,(b + 2c)\,[(n + 1)\, b + 2c]\,[(w^*\, l^*)\,(1 - |\in|)].$$

Clearly this is negative (positive) if $|\in| > 1$ (< 1).

Claim (2) can be tested with population proxying for n or where outmigration by households is substantial. The withdrawal of households leads to a rise in the remaining individual household's labor supply but not enough overall to offset the loss from the withdrawal, i.e., compensation is incomplete. Note that (5), (6) and (7) also explain quite naturally labor supply results that favor the neoclassical framework (e.g., Rosensweig, *op. cit.*).

The following sheds some light on the question of rural "idleness."

Claim 3: A rise in the preference for leisure ("c" rises) (a) reduces both the household supply and aggregate supply of labor (and thus raises w^*) and (b) raises household income (w^*l^*) for $|\in| > 1$.

Proof: (a) is obvious from (5) and (6) and (1). (b) $((w^*\ l^*)/c) = 2a^2[b(n\text{-}1) - 2c]\ [n + 1)\ b + 2c]^{-3}$. From the proof of claim (2), we have $(b\ (n\text{-}1) - 2c) = (w^*/l^*)\ (|\in| - 1) > 0$ if $|\in| > 1$. Thus, $(\ (w^*l^*)/c) > 0$ if $|\in| > 1$.

Thus, idleness, ordinarily regarded as reprehensible, may, at times be Cournot-Nash rational. The inverse relation between labor supply and observed wage can be easily misconstrued empirically as "backward bending supply curve," which depends on the Pigouvian falling marginal utility of money. The relation here springs from strategic behavior.

As $n \to \infty$, the wage rate approaches zero and underemployment becomes open unemployment. For very large n, the change in L^* due to a change in n is vanishingly small, i.e., $(\ L^*/\ n) = a\ (b + 2c)\ [(n + 1)\ b + 2\ c]^{-2} \to 0$. Additionally, the n households progressively become wage takers rather than makers, output response to changes in n becomes vanishingly small and the labor supply function is virtually infinitely elastic. The situation does not differ from the neoclassical surplus labor market with workers acting nonstrategically, the wage rate being zero and the supply curve being horizontal. This is not surprising since at the limit as $n \to \infty$, the Cournot-Nash equilibrium mimics the perfectly competitive equilibrium. On the other hand, when the demand curve shifts out far enough, then underemployment becomes full employment for household members. Thus, for very large n or "a", the model is virtually observationally equivalent to the neoclassical model. They differ only for finite n and for small "a". This explains why the model

will normally predict labor supply results claimed by advocates of the simple labor market model.

Constancy of output may, however, under finite n hold under worker withdrawal whenever $\bar{l} > l^*$. The worker here is understood to be an individual member of the household who is either underemployed or openly unemployed. We have the following:

Claim 4: When $\bar{l}^k < (\bar{l}\text{-}l^*)$, where $\bar{l}^k$ is the full employment labor-hours of household member k, the withdrawal of member k will not reduce agricultural output.

The withdrawal of underemployed member k makes other members step in and work more hours since l^* is optimal. Part-time engagement of underemployed rural workers in nonfarm activities need not also reduce agricultural output. Since many rural firms would try to minimize the transactions cost associated with operating with a large number of work shifts of very short duration as n becomes large (so that at the limit, workers could be doing no work at all), a market for full-time employable workers will arise offering positive wage. Thus, some household members may be openly unemployed so that others can accept fully employing jobs. The existence of fully employed workers does not violate the Cournot-Nash arrangement. Customs and practices that constrain, for example, females from competing with males for certain types of agricultural jobs (e.g., Cain *et al.*, 1979) may serve the need for the community to act strategically. And where women tend not to be workers for religious reasons (as with Moslems in Bangladesh), average wage rate for the area is higher (Rodgers, 1975).

Finally, a word on the asymmetric version of the game. It can be shown that if one household k has a lower preference for leisure, i.e., $c_k < c$, then household k works more than the other households ($l_k^* > l^*$), the aggregate labor supply ($(n\text{-}1)\, l^* + l_k^*$) is larger and the wage rate is smaller.

Conclusion

The model suggested here has n households facing a perfectly competitive labor demand and acting in a Cournot-Nash fashion, i.e., they maximize utility with respect to their own labor supply given the labor supply of other households. Distinction is made between workers and labor units on the one hand and households and member-workers on the other. The model has the neoclassical labor market model as a special case. Only the symmetric game version is

analyzed and generates the following: for finite n, the wage rate is positive despite surplus labor, the labor supply curve is upward-sloping, labor surplus is in the form of voluntary underemployment on the level of households while individual household members may be openly unemployed. Household withdrawal raises the remaining household's labor supply but the aggregate labor supply falls, leading to an output fall. Where labor demand elasticity is greater than one, a rise in the preference for leisure could raise family income. Output constancy is possible under worker withdrawal. This model appears to be a simple formalization of (later) Lewis.

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