THE NATIONAL INSURANCE INSTITUTE
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A COMMENT ON "LABOR SUPPLY UNDER UNCERTAINTY: NOTE"

by
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The author is indebted to Giora Hanoch, Marjorie Honig, Nehemia H. Shiff and Yossi Tamir for helpful comments and discussions.

In a recent note, David Sjoquist (1976) points out some incorrect results obtained by Hartley and Revankar (1974) in their model of an individual's labor supply decision under uncertainty resulting from possible unemployment. Arguing that under the assumption of a utility function with no certainty bias adopted by H-R, their method of maximizing utility of expected values should yield the same results as maximizing expected utility, he sets up the individual's problem as

$$\max_{N} EU = (1-U_n)U(\omega N+Y,T-N)+U_n U(u+Y,T) \tag{1}$$

Where EU is expected utility (satisfying the usual concavity assumptions), U_n the probability of being unemployed (unemployment rate), ω the wage rate in real terms, N the hours of labor supplied, Y non-labor income in real terms, T total time and u the unemployment insurance payments in real terms. Since it is obvious from (1) that the individual's choice of N^* does not affect his utility from the unemployment state, Sjoquist asserts that $\frac{dN^*}{dU_n} = 0$, whereas H-R conclude that $\frac{dN^*}{dU_n} > 0$ if the income effect is negative but very small[1].

In an effort to reach a more convincing result from his expected utility approach, Sjoquist suggests that hours of effort supplied but not actually

1 The discrepancy in the two results is not explained by Sjoquist. The discussion which follows is not related to this issue, however.

worked when unemployed, are considered by the individual as hours of actual work, except that the wage rate is zero. In other words, in the unemployment state the individual spends his non-leisure time looking for a job he surely will not get. Under this assumption the individual's problem is stated as

$$(2) \qquad \max_{N} EU = (1-U_n)U(\omega N+Y,T-N)+U_nU(u+Y,T-N)$$

so that by taking the first order condition and differentiating it with respect to U_n, Sjoquist shows that $\frac{dN^*}{dU_n}<0$ regardless of the individual's attitude toward risk.

Sjoquist's assumption, however, is hardly reasonable. As he himself seems to realize, hours allocated to work when employed are not necessarily identical to hours allocated to search when unemployed. More important, why would the individual spend any time at all in search of a position if he knows in advance that it will be in vain? In fact, Sjoquist's unappealing conclusion that the individual's labor supply will decline with a rise in the unemployment rate follows directly from this assumption.

A more realistic way to achieve the desired dependency of labor supply on the unemployment rate would be to assume that unemployment insurance payments are proportional, with a given rate of $0<u<1$, to the loss of earnings[2]. The individual can be assumed to apply to an official employment bureau where he declares his willingness to work N^* hours in the given period. The bureau has a probability of $1-U_n$ of finding him a suitable job at which

2 This is a common provision in many unemployment compensation programs, the proportion varying across countries. In the U.S., for example, the rate is roughly 50% of earnings; In Israel, the percent varies from 30% to 70%, decreasing as earnings increase. (*Social Security Programs Throughout the World : 1975*, U.S. Department of Health, Education and Welfare).

he will earn ωN^*, units of real income and enjoy $T-N^*$ hours of leisure. If, with a probability of Un, the bureau fails to provide him with such a job, the individual will receive a payment of $u\omega N^*$ units of real income as an unemployment compensation, having to devote his entire time T to leisure activities.[3]

Formally, the individual's maximization problem now becomes

$$\text{(3)} \qquad \max_N EU = (1-Un)U(\omega N+Y, T-N) + UnU(u\omega N+Y, T)$$

yielding as a first order condition

$$\text{(4)} \qquad \frac{dEU}{dN} = 0 = (1-Un)(\omega U_1^A - U_2^A) + Unu\omega U_1^B$$

where A and B denote the states of employment and unemployment, respectively. The second-order condition, which is assumed negative, is obtained by *differentiating (4) with respect to N as*

$$\text{(5)} \qquad \frac{d^2EU}{dN^2} \equiv D = (1-Un)(\omega^2U_{11}^A - 2\omega U_{12}^A + U_{22}^A) + Un(u\omega)^2U_{11}^B < 0$$

3 Note that the present assumption rules out the possibility that an individual will receive unemployment payments even if he willingly avoids the labor market (declares $N^* = 0$) either because he is lazy or enjoys a substantial non-labor income. A deliberate refusal of available jobs by an individual who has initially declared $N^* > 0$ can be made unattractive by rejecting his claim for compensation.

Differentiating now (4) with respect to Un yields

$$\frac{dN^*}{dUn} D = wU_1^A - U_2^A - uwU_1^B \tag{6}$$

or, by substituting (4) into (6)

$$\frac{dN^*}{dUn} = -\frac{uwU_1^B}{(1-Un)D} > 0 \tag{7}$$

That is, the individual's labor supply is positively sensitive to changes in the unemployment rate. By offering more hours of work when the unemployment rate increases, the individual in fact insures himself against the realization of unemployment.

It seems only natural now to examine how a change in the level of the unemployment compensation affects the individual's supply of labor. Whereas H-R conclude that $\frac{dN^*}{du} < 0$ if leisure is a normal good (regarding u as a flat rate benefit), formulation (1) trivially yields $\frac{dN^*}{du} = 0$. Formulation (2), adopted by Sjoquist, can be easily shown to yield $\frac{dN^*}{du} = \frac{UnU_{21}^B}{\overline{D}}$, where $\overline{D}$ is the appropriate second-order differentiation of expected utility with respect to N. To obtain in this case $\frac{dN^*}{du} < 0$, a stronger requirement than normality ($U_{21}^B > 0$) is needed. However, differentiating the first-order condition of formulation (3) with respect to the rate of unemployment insurance yields

$$\frac{dN^*}{du} = -\frac{Unw(U_1^B + uwNU_{11}^B)}{D} \tag{8}$$

so that substitution and income effects should be evaluated to determine the sign of (8). Assuming, however, that there is no income from non-labor sources ($Y = 0$), we can rewrite (8) as

$$\frac{dN^*}{du} = -\frac{U n w U_I^B}{D}\left[1 - R_R(I^B)\right] \qquad (9)$$

where I^B denotes total insurance payments in the state of unemployment and $R_R(I) = -\frac{U_{II}(I)}{U_I(I)} I$ is the Arrow-Pratt relative risk aversion measure with respect to money income.

Hence, the way in which the individual's labor supply responds to changes in the rate of the compensation payments depends upon the nature of his risk aversion. Since there seems to be a general presumption that relative risk aversion is a non-decreasing function of income, we may conclude that if $R_R(I^B)$ does not vary with income then for any value of u

$$R_R(I^B) \gtreqless 1 \Longleftrightarrow \frac{dN^*}{du} \lesseqgtr 0 \qquad (10)$$

However, if $R_R(I^B)$ rises with income then $\frac{dN^*}{du} > 0$ for sufficiently low values of u, while increases in u may eventually lead to a change in sign.

R E F E R E N C E S

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