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## THE WORK AND HUMAN INVESTMENT INCENTIVES OF NEGATIVE INCOME TAX AND WAGE SUBSIDY PROGRAMS

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## INTRODUCTION

Some economists have suggested that a wage subsidy would be preferable to a negative income tax for transferring income to the working poor [3]. The apparent appeal of a wage subsidy is that, in contrast to a negative income tax, it allegedly reinforces work effort. The implication is that the aggregate output of goods and services would be higher if a wage subsidy rather than a negative income tax were enacted.

In this paper I examine the differential work and human investment incentives of wage subsidy and negative income tax programs. I show that aggregate output might be lower, particularly in the long run, if a wage subsidy rather than a negative income tax were enacted. The policy implication is obvious. If the wage subsidy vis-à-vis the negative income tax has no productivity advantage, the selection between these two systems must be made on other criteria, and, since the alleged output advantage is the strongest argument for a wage subsidy, the case for it has been substantially weakened.

In Part I I use the conventional graphic analysis of the work-leisure choice to compare the static work incentive effects of a pure wage subsidy to a negative income tax program. Then I compare the effects of two kinds of mixed, wage subsidy-public assistance systems to a pure negative income tax system. While this first section of the paper contains no new policy-relevant conclusions, the method of analysis will, I hope, clarify some currently muddled issues. In Part II I show that while both a wage subsidy and a negative income tax would

encourage on-the-job training, the former would discourage off-the-job human investment while the latter would discourage it less and might even encourage such investment.

## I. Comparative Static Work Incentive Effects

### A. Pure Systems

It is easy to show, given conventional assumptions, that if an individual is indifferent between any wage subsidy and negative income tax plan, he will work more under the former. Similarly, if an individual's income is the same under any wage subsidy and negative income tax program he will work more and his welfare will also be less under the former. These statements are demonstrated with the aid of Figure I below.

Hours of work are measured from right to left along the horizontal axis and income along the vertical axis. It is assumed that all income is earned. The original budget constraint is given by the wage line OY. A negative income tax with a guarantee of OG dollars results in a new budget constraint OGBY. Assume the new equilibrium lies along BG at a point such as $E_1$. (The initial equilibrium is unspecified here except that it lies to the left of $E_1$ along OY.) Now consider a wage subsidy that would leave the individual indifferent between $E_1$ and a new equilibrium such as $E_2$. A wage subsidy pivots the old budget constraint or wage line OY, upwards from O, resulting in a new wage line such as OW. OW must be steeper than GB since the wage subsidy increases the net wage while the negative income tax decreases the net wage. Consequently, given indifference curves with diminishing marginal rate of substitution, $E_2$ must lie to the left of $E_1$.

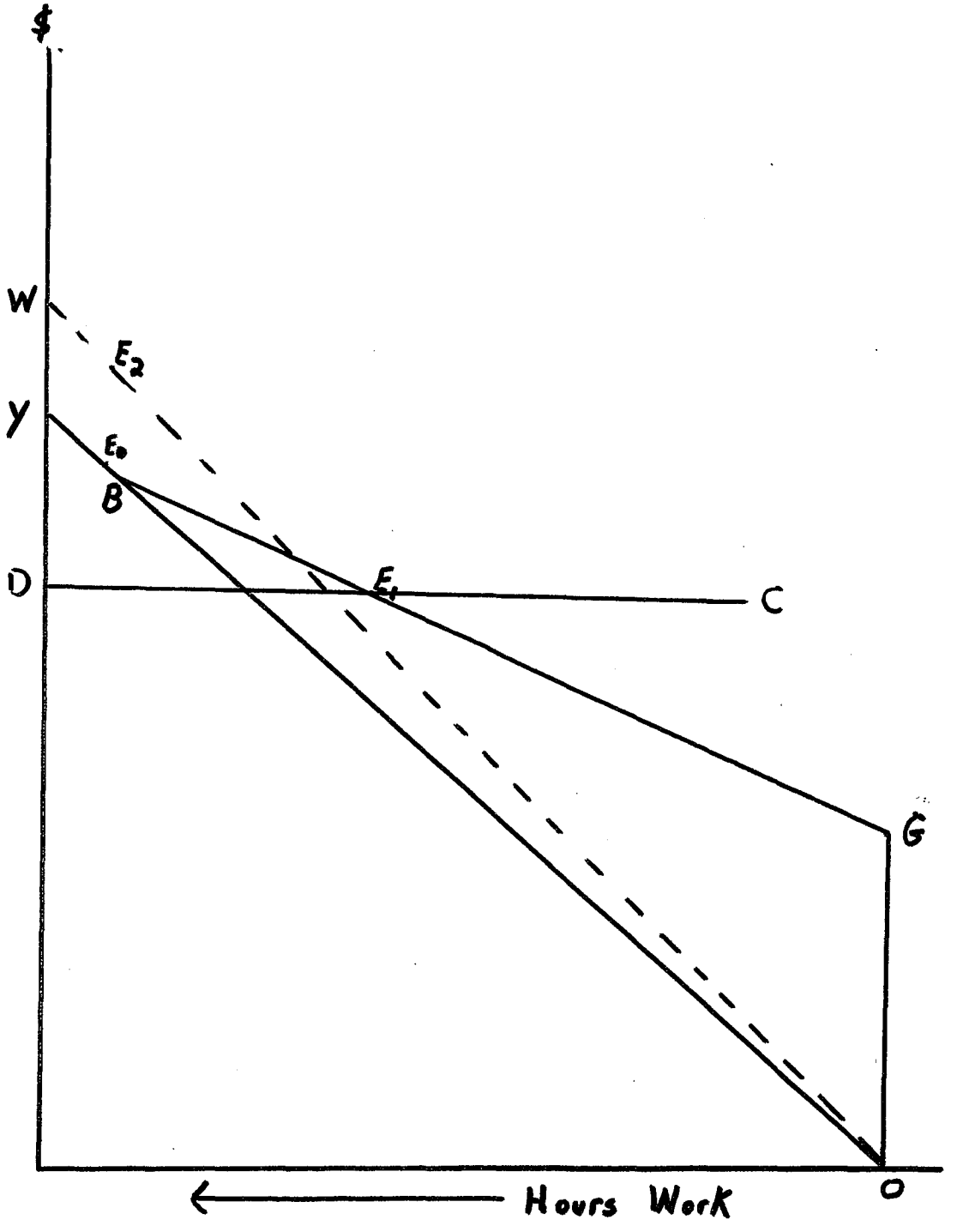


Figure I

Now consider a wage subsidy that would leave the individual with the same income as the NIT program. Equilibrium must lie along a line through $E_1$ which is parallel to the horizontal axis. Given indifference curves with diminishing marginal utility of leisure, only indifference curves to the left of $E_1$, which intersect this parallel, will be steeper than the one at $E_1$. Since OW is steeper than OG, equilibrium must lie to the left of $E_1$. The individual will work harder and be worse off under the wage subsidy.

The major problem with the foregoing analysis is that while wage subsidy and negative income tax programs can be so constructed so as to hold constant one individual's welfare or income, it is impossible to construct them in such a fashion that all individuals' welfare or income is held constant, unless wages and preferences of all individuals are identical. This is easily seen by reference to Figure I again. Imagine an individual with an initial wage of OY and an initial equilibrium at $E_0$. Suppose, however, that his tastes were such that the introduction of the negative income tax did not effect his work-leisure choice. Equilibrium would remain at $E_0$. His welfare and income would be unchanged. Introduction of the wage subsidy, however, would clearly raise his income and welfare. Even if tastes were identical so long as wages differed, the two programs could not hold everyone's welfare or income constant. This point is very important. But the conventional graphical tools can still be used to analyze the differential work incentive effects of negative income tax and wage subsidy programs.

From Figure I it can be seen that not all wage subsidy programs would necessarily entail less disincentive than all negative income tax programs. For, obviously $E_2$ can lie to the right of $E_0$. This would simply imply that the supply curve was backward bending (i.e., the income effect outweighed the substitution effect) in the relevant range.[1] While a backward-bending supply curve is a necessary condition for a wage subsidy to induce less work effort than a negative income tax, it is not sufficient. A second necessary condition is that the wage subsidy line dominate the NIT equilibrium. This can be explicated with the aid of Figure I. Consider the equilibrium, $E_1$, after the introduction of the negative income tax. Now the wage subsidy budget line OW must pass through the NIT budget constraint GBY to the left, or right of, or through $E_1$. If OW passes through GBY at or to the left of $E_1$, the new equilibrium along OW must lie to the left of $E_1$ if the indifference curves are characterized by diminishing marginal rates of substitution and by diminishing marginal utility of income. Thus, even if supply curves are backward bending, a wage subsidy will still induce more work effort than a negative income tax if the wage subsidy line does not dominate or lie to the right of the NIT equilibrium.[2]

Since some individuals might work more under a wage subsidy than under a negative income tax program and others might work less, it is impossible to specify a priori that a wage subsidy necessarily entails less static disincentive than a negative income tax program.

More important perhaps, if supply curves are not backward bending in the relevant range, any wage subsidy program will provide less

static disincentive than any negative income tax program. Consider Figure I again. If leisure is a normal good, the NIT equilibrium $E_1$ must be identical with or lie to the right of the initial pre-subsidy equilibrium $E_0$. If the labor supply curve is not backward bending the wage subsidy equilibrium, $E_2$, must lie directly above or to the left of $E_0$. It follows that $E_1$ must lie directly below or to the right of $E_2$. In other words, relative to the no-program state, if the labor supply curve is not backward bending a wage subsidy must leave work effort unchanged or induce more work effort. If leisure is a normal good, a negative income tax must leave work effort unchanged or induce less work effort. Consequently, in a static world, where supply curves are not backward bending in the relevant range, a wage subsidy can never induce less work effort than a negative income tax, and will normally induce more work effort. In the remainder of the article I will assume unless I note otherwise that supply curves are forward bending.[3]

B. Mixed Systems

In a recent paper Michael Barth and David Greenberg [1] argue that (1) a pure wage subsidy system is unlikely to replace all existing income transfer systems and in particular is unlikely to replace public assistance, (2) given the difficulty of establishing leakage-proof categories, some individuals are likely to be eligible for both wage subsidies and public assistance benefits, (3) some individuals will be able to collect both kinds of payments simultaneously, and (4) the tax rate and/or guarantee in the public assistance system are

likely to be higher than those in the negative income tax because the former would be designed to aid primarily those who could not work while the latter would be designed to aid both the working and non-working poor. The first two assumptions are undoubtedly realistic. The fourth seems plausible, even though it appears to be somewhat at odds with the third. It is certainly a case worth considering. The third assumption, however, is at best questionable.

Much of the impetus for a wage subsidy comes from the desire to avoid the alleged disincentive effects of a negative income tax. Consequently, it seems likely that every effort will be made to minimize the possibility that an individual who is potentially eligible for a wage subsidy would simultaneously be eligible for public assistance. And it is at least conceivable, and I would argue probable, that among the regulations designed to categorize potential beneficiaries would be the easily enforced stipulation that any family benefiting from one program would be ineligible for the other. It is clear, therefore, that there are at least two kinds of mixed systems: one that entails simultaneous income and wage supplementation for at least some individuals, and another dichotomous system in which individuals must choose between income and wage supplementation. The differential work incentive effects between these two systems and a pure negative income tax program are not necessarily the same.

Consider the simultaneous mixed system vis-à-vis a pure negative income tax. Public assistance is a type of negative income tax. It will simplify the discussion, therefore, to think of the mixed system

as a wage subsidy supplemented by a negative income tax. I will label the negative income tax in the mixed system as $NIT_{ws}$ and the one in the pure system as $NIT_p$. Now, if the marginal tax rate in $NIT_{ws}$ is greater than the one in $NIT_p$, clearly it is possible for the mixed system to induce greater reductions in work effort than the pure negative income tax system. For while the wage subsidy component of the mixed system increases the net wage, the marginal tax rate of the $NIT_{ws}$ component reduces it. And of course, if the marginal tax rate in $NIT_{ws}$ exceeds that in $NIT_p$, the net reduction in the wage rate may be greater in the mixed than in the pure system. Moreover, in a wage subsidy which varies inversely with wages, the higher the wage the less the wage subsidy increases the net wage. Consequently, the higher the wage the more likely that the net reduction in the wage rate from a mixed WS-NIT system will exceed that from a pure NIT system within a specified range. The importance of the qualification and several other points can be clearly understood, with the aid of a simple graph.

In Figure II hours worked per week is measured along the horizontal axis from right to left, and income is measured along the vertical axis. OY is the budget constraint for an individual with an hourly wage of $1.00, OX for a wage of $1.50, and OW for a wage of $2.00 per hour. Consider a mixed WS-NIT system in which the wage subsidy per hour is equal to one-half the difference between the individual's market wage rate and a breakeven wage rate set at $2.00; and the $NIT_{ws}$ guarantee is equal to $50.00 a week and the marginal tax rate equals 60 percent. With the aid of Figure II we can compare the work incentive effects of the mixed system to a pure NIT system which also has a $50.00 per week

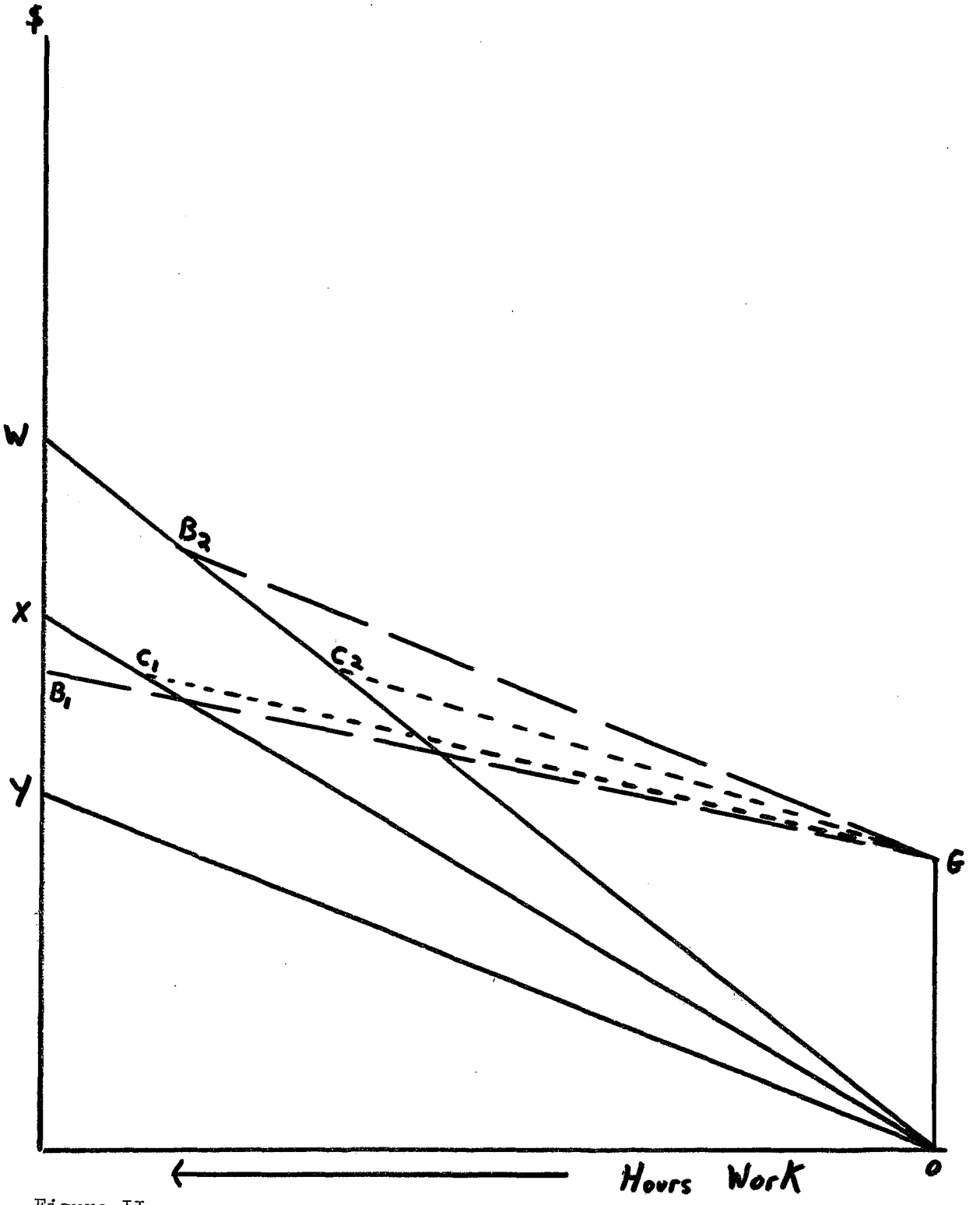


Figure II

guarantee but has only a 50 percent tax rate. For an individual with a $1.00 per hour wage the WS element of the mixed system would pivot his budget constraint from OY ($1.00/p.h.) to OX ($1.50/p.h.). The addition of the $NIT_{ws}$ would alter the budget constraint to $OGC_1X$. Along $OGC_1$ the net wage is 40 percent of $1.50 or 60¢ per hour. The budget constraint for an individual with a $1.00 per hour wage under the pure NIT system would be $OGB_1$. Along $GB_1$ the net wage is 50 percent of $1.00 or 50¢ per hour. If the supply curve generated by pivoting the wage line around G is forward bending (i.e., the substitution effect outweighs the income effect), the mixed system will induce more work effort, since $GC_1X$ is everywhere steeper than and above $GB_1$.

Now consider the individual with a wage infinitesimally smaller than $2.00 per hour. This limiting case has some nice properties. Note that the closer the wage line is to OW, the smaller will be the increase in the slope that results from the wage subsidy element of the mixed system. The limiting case allows us to treat OW as the pre- and post-wage subsidy line. The addition of the $NIT_{ws}$ alters the budget constraint to $OGC_2W$. Along $GC_2$ the net wage is 80¢ per hour, along $C_2W$ it is $2.00 per hour. The pure NIT budget constraint, on the other hand, is $OGB_2W$. Along $GB_2$ the net wage is $1.00 per hour. $GB_2$ is steeper than and above $GC_2$. Consequently, if the equilibrium resulting from a mixed system were along $GC_2$, and if supply were forward bending in this range, the pure NIT system would induce more work effort.

However, the mixed-system equilibrium might lie along $C_2W$, in which case the pure NIT system may induce more work reduction.[4] That is to say, the individual might work and earn enough to become ineligible for income supplementation from the $NIT_{ws}$ system. The higher an individual's wage, ceteris paribus, the more likely this is to be true. Consequently, it cannot be established a priori that the higher the individual's wage rate the more likely that a mixed WS-NIT system will induce more work reduction than a pure NIT system.

It should now be clear that if the guarantees and marginal tax rate of the $NIT_{ws}$ and $NIT_p$ were equal, the mixed system would always induce more work effort than the pure NIT system. For in this case the budget constraint of the mixed system would be everywhere steeper than and above the budget line of the pure system. If the tax rates are the same, but the guarantee is higher in the mixed than in the pure system, the mixed system will contain a larger leisure-inducing income effect along with a larger work-inducing substitution effect. As wages increase, the substitution effect of the wage subsidy element of the mixed system will decrease, until at some wage rate the larger income effect of the mixed system will outweigh the larger substitution effect of the mixed system and result in more reduction in work effort vis-à-vis the pure NIT system--for those individuals whose earnings are not so high as to disqualify them from $NIT_{ws}$ income supplementation. Thus if either the guarantee or the marginal tax rate or both in the $NIT_{ws}$ is greater than those in the $NIT_p$, the simultaneous mixed system could conceivably lead to greater static work reductions than the pure negative income tax.

The comparison of a dichotomous mixed WS-NIT and a pure NIT system is now straightforward. The first point to make about the relative static disincentive effects of a pure NIT and a dichotomous WS-NIT system is that if the guarantees and marginal tax rates of the two NITs were identical and supply curves were forward bending, the dichotomous mixed system could entail no more and would probably entail less disincentive than the pure system. For the only difference between the programs in the opportunities confronting any individual would be that if the individual chose to have his wages rather than his income supplemented, his net wage rate would be higher in the mixed than in the pure NIT program.

Second, if either the tax rate or the guarantee of the $NIT_{ws}$ were higher than those of the pure NIT, the former could induce a greater reduction in work effort than the latter. Those who opt for income supplementation under the mixed system will work less than they would have done under a pure NIT system, while those who opt for the wage supplementation will work more if supply curves are forward bending. A priori, it is impossible to specify the net outcome.

Third, in the dichotomous mixed system, unlike the simultaneous mixed system, it is the low-wage workers who are most likely to work less than they would have under a pure NIT system. For, ceteris paribus, the lower his market wage the more likely the individual's welfare will be higher if he chooses income rather than wage supplementation.

The fourth and final point I want to make about the dichotomous mixed system is that it is impossible to specify a priori whether it

or the simultaneous mixed system entails greater work disincentives. This follows from the arguments above that a priori, either mixed system might entail more or less work disincentive than a pure NIT system.

## II. Human Investment Effects

The supposedly superior static work incentive features of a wage subsidy relative to a negative income tax, even if they did exist, might be more than outweighed by the inferior incentives of a WS relative to an NIT to invest in human capital. While both a wage subsidy and a negative income tax would encourage on-the-job human investment, a wage subsidy would discourage off-the-job human investment, while a negative income tax would provide less discouragement and might even encourage off-the-job human investment. In the discussion which follows I will compare the pure wage subsidy and pure NIT systems.[5]

The equilibrium condition for a utility maximizing individual who is considering a human investment decision is:

$$\Sigma \frac{Bt}{(1+r)^t} = C \qquad (1)$$

That is, the individual will undertake the investment as long as the present value of the benefits exceeds the present value of the costs, where for simplicity all the costs are assumed to take place in the initial period and all the benefits are assumed to flow only in the succeeding periods. Assume that the benefit is composed of two elements: (1) the increase in the net wage rate and any increases in

nonpecuniary benefits resulting from the investment, i.e., $B = (W_T - W_0)_t + (NPB_T - NPB_0)t$ where $W_t$ = the wage rate and $NPB_T$ = nonpecuniary benefits of the job with the investment; and $W_0$ = the wage rate and $NPB_0$ = nonpecuniary benefits without the investment. Assume further that the cost is composed of two elements: (1) the direct cost, D, of the investment, such as tuition, and (2) the indirect or opportunity cost of the investment arising from foregone earnings. Foregone earnings are equal to $(H_0W_0 - H_TW_T)$ where $H_0$ = hours worked and $W_0$ = the wage rate if the investment is not undertaken; while $H_T$ = hours worked and $W_T$ = the wage rate if investment is undertaken. It is now possible to rewrite (1) as follows:

$$\Sigma \quad \frac{(W_T - W_0)_t + (NPB_T - NPB_0)_t}{(1+r)^t} = (H_0W_0 - H_TW_T) + D \qquad (2)$$

On-the-job investment or training is defined as a human investment which entails a reduction in $W_0$. Off-the-job investment is defined as an investment that entails a reduction in $H_0$. Consider the impact of a wage subsidy and a negative income tax on on-the-job training first.

To simplify, I abstract from the static effects on hours worked of a wage subsidy and an NIT. Assume initially that the pre-program wage (income) is below the WS (NIT) breakeven level. Another initial assumption is that nonpecuniary benefits do not vary with wage rates. Both the wage subsidy and negative income tax will reduce wage differentials. If the potential wage increase is not sufficient to put the new wage and income above the WS breakeven wage and the NIT breakeven income level, the amount of the reduction depends upon the marginal tax rate

on income ($\alpha$) in the NIT and the marginal negative tax rate on wages ($\beta$) in the wage subsidy where both $1 < \alpha, \beta < 0$. Both the WS and the NIT therefore reduce the net benefits of training by a multiple of $\alpha$ or $\beta$. On the other hand, the net cost of training is reduced by identical multiples by the WS and the NIT, providing there is no direct cost component to on-the-job training.[6] For, in on-the-job training, $H_O = H_T$ and the reduction in the wage rate $(W_O - W_T)$ incurred by undergoing training is reduced by $\alpha$ or $\beta$. Note that if nonpecuniary benefits vary positively with wage rates, both the WS and NIT will actually encourage on-the-job investment, since benefits would then be reduced by less than $\alpha$ or $\beta$. Moreover, even if nonpecuniary benefits do not vary with wage rates, if the potential wage increase is sufficiently large so that the new wage $W_t$ exceeds the WS breakeven wage rate, the benefits will be reduced by less than $\beta$ times, while the cost will still be reduced by $\beta$. Consequently, the WS in this case would encourage on-the-job investment. The same argument applies to a wage increase that is sufficiently large to bring post-investment earnings above the NIT breakeven point. The present value of benefits would not be reduced by as much as costs. Similarly, if the pre-program wage (income) would have been above the breakeven wage (income) in the absence of training, but below it if training were undertaken, a WS (NIT) would reduce the costs of training but not effect the benefits. Consequently, in the aggregate both the WS and the NIT will increase incentives to obtain on-the-job training. A priori it is impossible to specify which one would provide more incentive to on-the-job training.

A wage subsidy, however, would necessarily discourage off-the-job human investment, while a negative income tax might even encourage such investment. Consider the wage subsidy first. It would reduce benefits by up to $\beta$ percent by narrowing wage differentials.[7] Unlike on-the-job training, however, it would also increase the cost of human investment. For in off-the-job investment, $W_0 = W_T$ so that the opportunity cost of foregone earnings is equal to $W(H_0 - H_T)$. And of course, the net wage rate is increased by a wage subsidy system. Consequently, the wage subsidy increases the cost by increasing the value of foregone earnings.

A negative income tax would also reduce benefits by $\alpha$ percent if: (1) nonpecuniary benefits did not vary with wage rates, (2) initial income would have been below the breakeven level in the absence of investment, and (3) the increased earnings as a result of human investment did not exceed the breakeven level of income in the NIT. The foregone earnings component of cost would be reduced by an identical percentage. But if D, the direct costs, were greater than zero, the total cost would be reduced by a smaller percentage than the present value of benefits. In this case, therefore, the NIT would discourage off-the-job investment, but the disincentive would be much smaller than that of the WS system.

A negative income tax, however, may actually encourage off-the-job investment. In many cases, D is already zero or near zero. Tuition for attending school is frequently zero for students of poor families, and moving allowances frequently reduce the cost of migration (a form of off-the-job human investment) to zero. (In the cases where D is currently greater than zero, it might be desirable social policy to

reduce D to zero for individuals in families eligible for an NIT.) If $D = 0$, and if nonpecuniary benefits vary positively with wage rates, or if the potential increase in earnings is large enough to increase total earnings above the breakeven level of income in the NIT, the NIT will encourage off-the-job investment. Even if $D \neq 0$, but is not too large, the latter two effects mentioned in the last sentence may outweigh this cost so that the NIT might still encourage off-the-job investment. Finally, if pre-program earnings in the absence of investment would have been above the breakeven level, but the undertaking of the investment reduced earnings below the breakeven level, the NIT will encourage off-the-job investment irrespective of the size of direct costs because there will be no reduction in net benefits vis-à-vis the no-program situation.

The most important point is that the wage subsidy entails more disincentive for off-the-job human investment. At worst, an NIT will have some disincentive effects. But unlike the WS, an NIT will decrease rather than increase the opportunity cost of foregone earnings. This differential investment disincentive could easily outweigh the static work disincentive advantages of the pure wage subsidy system in terms of productivity. A priori, of course, it is impossible to say. Theoretically, a negative income tax as compared to a wage subsidy might entail a greater, lesser, or equal output of goods and services.

## Conclusion

While a pure wage subsidy system would definitely involve less static work disincentive than a pure negative income tax system, if supply curves are forward falling, within the relevant range, a

mixed wage subsidy negative income tax system might not involve any less disincentive than the pure negative income tax system. More important, the static work incentive "advantage" of a few pure wage subsidy may be more than counterbalanced by its larger human investment disincentive. In part, therefore, the choice between a wage subsidy and a negative income tax depends on whether the smaller static decreases in the labor supply engendered by the former outweigh the larger dynamic human investment decreases.

The choice would, of course, also depend on other factors. For example, one disadvantage of a wage subsidy is that it would encourage employers and employees to engage in collusive fraud. To illustrate, consider an employee earning $60.00 a week. He could earn this amount by working forty hours a week at $1.50 an hour, or sixty hours a week at $1.00 an hour. Suppose the former is the case. Under a wage subsidy scheme which increased the market wage by 50 percent of the difference between $2.00 an hour and the market wage, the employee would fare better if he claimed to have earned the $60.00 a week by working sixty hours at $1.00 an hour. His total income in this case would be $90.00 a week vis-à-vis $70.00 a week if he told the truth. If either the employer or employee (depending upon whether the wage subsidy was paid through the employer or directly to the employee) attempted to unilaterally engage in this kind of fraud, the others' records could serve as a check, but the action need not be unilateral. Both parties can benefit from the fraud--there is enough to share. In large firms employer-employee collusion would be difficult to arrange and keep

secret. But many low-wage individuals work in very small firms where such collusion would be relatively easy to initiate and very difficult to detect.

Even if there are some advantages of a wage subsidy vis-à-vis a negative income tax that have not been discussed here, the one big advantage that has been claimed for the former--that it would lead to greater output of goods and services--no longer appears to be valid. Consequently, the case for a wage subsidy vis-à-vis a negative income tax has been weakened considerably.

## NOTES

[1]Barth and Greenberg [1, p. 14] recognize that if supply curves are backward bending a wage subsidy program might be more leisure inducing than a negative income tax. Kesselman [2, p. 281] does not.

[2]Needless to say, two necessary conditions do not make one sufficient condition.

[3]There are several reasons for making this assumption. First, the reader can trace through the implications of a backward-bending supply curve for himself. Second, since some sort of mixed system (see next section in text) would be more likely to emerge than a pure wage subsidy system if we ever enacted a wage subsidy, and since the presence of backward-bending supply curves would not alter the conclusion that a mixed system might entail greater, lesser, or equal work disincentives than a pure negative income tax experiment, modifying this assumption would not modify any policy relevant conclusions drawn from the analysis. Third, given (1) and (2), discussions of the backward-bending supply case would needlessly lengthen the analysis.

[4]Barth and Greenberg [1] fail to consider this important possibility.

[5]Just as the mixed systems blurs the static work incentive differences between a pure WS and NIT, so might a mixed system reduce the human investment differences. Again, the extent to which the differences are reduced would depend on the eligibility criteria established in the programs.

[6]If the direct costs are greater than zero, the total costs would be reduced by less than $\alpha$ or $\beta$ and there might actually be a disincentive. But this is unlikely.

[7]If either nonpecuniary benefits vary positively with wages or the potential wage increase would raise the market wage rate above the breakeven wage rate, the reduction in total benefits would be less than $\beta$ percent.

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