PART III: LABOR SUPPLY AND THE NATURAL RATE OF UNEMPLOYMENT

Income and Payroll Tax Policy and Labor Supply

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INTRODUCTION

Income and payroll taxes account for about 75 percent of federal revenues. The proportion of federal tax revenue raised by these two taxes has gone up markedly in the past decade with the amounts growing faster than the underlying inflation rate. The rise in the income tax collections occurs because of its progressive rate structure and insufficient indexing of tax brackets to account for inflation. The rise in the payroll tax has occurred because of legislative actions to fund social security payments. Both the tax rate of the payroll tax and the maximum earnings limit have increased significantly. In Table 1 we indicate the effects of the income and payroll taxes over the last two decades. Note that the combined percentage of the two taxes has risen from 56% of government revenues in 1960 to 76% of government revenues in 1978. This increasing trend is likely to continue in the future.

The current social security law calls for further tax rate increases up through 1990 and beyond, and earnings limit increases up to 1982. While the income and payroll taxes have certainly received adequate attention from economists, it is probably fair to say that most economists accepted their structure as reasonably good. Most economists liked the distributional consequences and believed that the economic cost in terms of economic efficiency was small. This latter conclusion was based on limited empirical work and survey responses that the income tax caused little reduction in labor supply. Some evidence existed which indicated that wives labor supply might be affected by taxation, but the general view was that prime age males' behavior was hardly affected at all.

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TABLE 1

Revenues from Income and Payroll Taxes (billions)

Year	Income Tax Revenues	Payroll Tax Revenues	Income Tax % of Federal Revenues	Payroll Tax % of Federal Revenues	Tax Rate for Payroll Tax	Earnings Limit for Payroll Tax
1960	$ 40.7	$ 10.6	44%	12%	3.0%	$ 4800
1965	48.8	16.7	42	15	3.625	4800
1970	90.4	38.4	47	22	4.8	7800
1975	122.4	75.7	45	29	5.85	14100
1978	198.5	106.1	46	30	6.05	17700

Two mistakes arose from this common interpretation of the income tax. First, even if we grant the hypothesis that the income tax has little overall effect on labor supply, its economic cost might still be substantial. Income taxes have two effects on labor supply. Taxes lower the net wage and reduce labor supply by the compensated substitution effect. But taxes also have an income effect, which causes individuals to work more since they have been made worse off by the tax. The two effects have opposite signs and might well approximately cancel causing only a small net effect on labor supply from income taxation. But, the economic cost of the tax arises from the first effect alone. Thus, the conclusion by many economists that the cost of raising revenue by the income tax is very small is not supported by economic theory if, in fact, the income effect and substitution effect are cancelling each other out. The second problem occurs because virtually all empirical work on labor supply disregarded taxes. The market wage rather than the after-tax wage was used in the labor supply functions. Or alternatively, the tax system was treated as a proportional tax system rather than a progressive tax system.[1] In a recent paper, Hausman (1979c), I have built on previous research and conducted a study of the effect of tax policy on the labor supply behavior of prime age males, wives of the prime age males, and females who head households. When progressive taxes are entered into a model of labor supply we see a significant effect. The findings indicate that labor supply of the husbands is reduced by about 8% because of the income and payroll taxation while labor supply of wives is reduced by about 30%. Thus, income taxes do affect labor supply in an important way.

But as I argue in the next section of the paper, economists should focus on the economic cost of income taxation more than on labor supply effects. My findings indicate that the economic cost of raising a dollar of government revenue by the income tax is about 25¢ on average in terms of lost welfare. The marginal cost of raising an additional $1 government revenue by this means is approximately 40¢. Thus, the economic cost of the income tax is substantial. At least three possible policy recommendations may follow from these conclusions. First, government expenditure might well be reduced given the cost of raising the necessary revenue. To recommend this policy we would need to study the benefits created

[1] Hall (1973), Hausman and Wise (1976), Burtless and Hausman (1978), and Wales and Woodland (1979) provide the major exceptions for analyzing U.S. tax policy.

by marginal government expenditure. Here and earlier, questions of income distribution become important. Income distribution considerations are discussed in this paper, but we have very little grasp of what constitutes marginal government expenditure or the benefits which arise from it. A further narrowing of policy options would be required to analyze the expenditure option more deeply. The second policy option is to consider raising a greater proportion of tax revenue from other federal taxes. To recommend this option, we need to know the economic cost of other taxes, such as the corporation tax, in terms of their effect on economic efficiency. We do not have adequate knowledge of the cost of other taxes to explore this option. Lastly, we could consider altering the income tax structure to raise the same amount of revenue but at lower economic cost. In the paper, we investigate progressive linear income taxes which seem to have favorable effects both with respect to economic cost and labor supply.

Policy options one and three are investigated in this paper. Policy option one is similar to Kemp-Roth type proposals for a decrease in income tax rates. Since our model is partial equilibrium, we look at the effect on tax revenue and the economic cost of taxation holding other factors constant. Our findings indicate that income tax revenues in our sample would decrease by about 6.1% for a 10% tax cut and by about 20.3% for a 30% tax cut. Labor supply effects and the effects on economic cost are discussed in this paper as well as distributional effects of the tax cut. It is certainly possible that general equilibrium effects would eliminate the estimated reduction in tax revenues, but my results lead me to doubt this possibility, especially in the short run. The third policy option appears much more favorable. The progressive tax considered there is basically as progressive as the current tax system for low incomes but decreases the high marginal rates for high incomes. When raising the same amount of revenue as the current system, the economic cost is decreased by more than one half on average with even a greater decrease at the margin. On the usual efficiency grounds this policy option looks extremely good. But as we discuss in the last section of the paper, objections might well be raised to it because it worsens the income distribution. Questions of the tradeoff between the economic cost (efficiency) and income distribution (equity) are very difficult to treat without making judgments on unobservable preferences. Yet, the investigation of this paper is useful because it indicates the size of the potential tradeoff in terms of a marked reform of our income tax system.

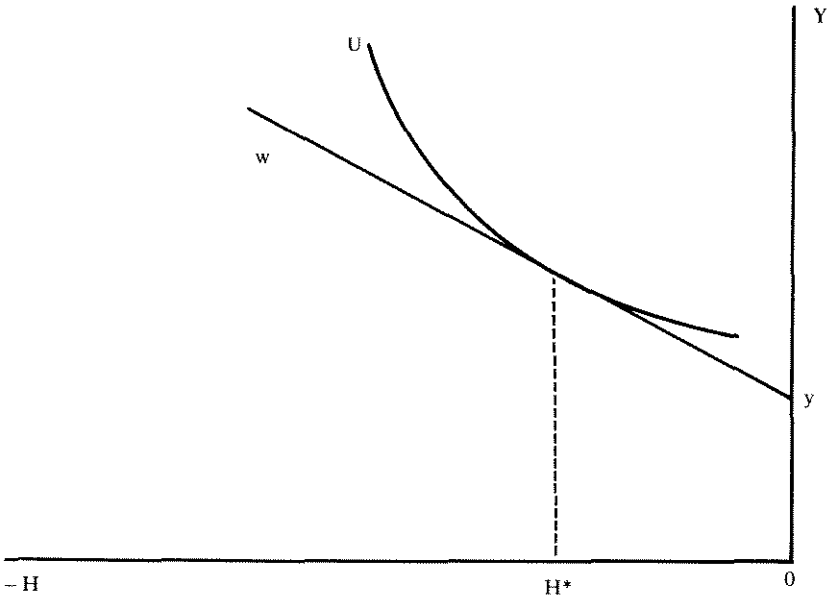
Labor Supply, Taxes, and Deadweight Loss

In this section we first consider a model of individual labor supply of the type which has been used in most empirical analysis. The model is based on individual decision makers rather than some larger unit like a family decision process. In fact, in the empirical estimates which we present we consider only husbands and wives. Thus, our model has the husband's labor supply decision independent of the wife's labor supply decision. The wife makes her decision conditional upon her husband's choice. While this model set-up has been traditionally followed in empirical research in labor supply, I expect research in the near future to be more general in its approach. A more symmetrical treatment of family labor supply decisions would be helpful. A second limitation to the model is that it is both static and partial equilibrium. Intertemporal decisions such as the amount of education that a person receives which may well be affected by taxes are omitted.[2] Also, the model does not consider demand factors for labor in terms of types of jobs offered with respect to wage and hour packages. Again, a more complete model which incorporates these factors would be desirable.

Once we outline the model of labor supply we will then consider the effect of taxes on labor supply. Labor supply has been the focus of much attention in recent discussions of supply-side economics. As a theoretical proposition, it is well known that the effect of taxes can either be to decrease or increase labor supply. However, the accepted hypothesis among supply-side economists has been that the effect of the current U.S. income tax system has been to decrease the labor supply. The labor supply model helps us to consider this question which is answered in the next section with the empirical estimates. But it needs to be emphasized that the labor supply cannot be the sole focus of discussion of the effect of taxes. Instead, measures of individual welfare need to be considered. Therefore, we introduce the appropriate measures of individual welfare, the equivalent or compensating variation. From the equivalent variation and tax revenue raised we then develop the notion of deadweight loss (often also called excess burden). From an economists viewpoint, deadweight loss is the correct measure of the effect of taxation. While deadweight loss is a somewhat difficult concept, I believe it, rather than labor supply, should be the focus of informed discussion of the effects of taxation. If we accept the

[2]Other institutional factors such as pension and social security benefits are not treated due to lack of appropriate data.

FIGURE 1



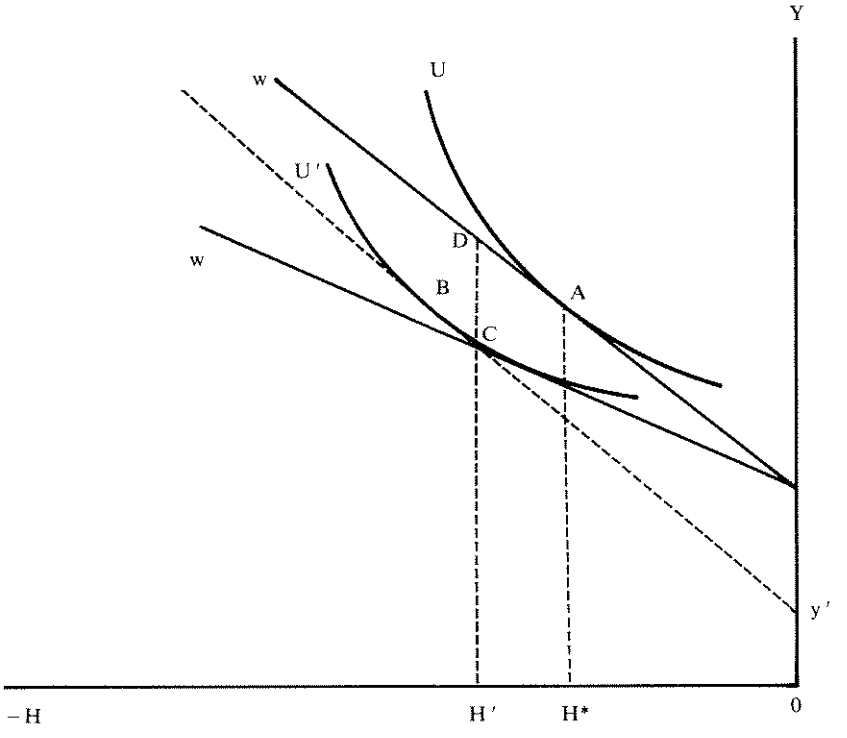
notion that the purpose of the income tax is redistributive as well as a means to raise tax revenue, then deadweight loss defines the correct way to measure the economic cost of the income tax. The error in considering labor supply only is that we can easily design feasible tax policies which raise a given amount of tax revenue while *increasing* labor supply from the no tax position even though the individual is made worse off by the tax. In this situation it would be incorrect to conclude that the tax is desirable due to its effect on labor supply when the individual's utility has decreased. Furthermore, the redistributive aspect of the income tax would be eliminated by this type of tax so that the change from the current type of system would not be acceptable.

THE MODEL OF INDIVIDUAL LABOR SUPPLY

The typical model of labor supply used in empirical work has a very simple structure. The individual is assumed to maximize a utility function over hours of work H and net of tax income Y, U(H,Y).[3] Thus, all consumption goods, except leisure, have been

[3]Some treatments replace hours of work H by leisure, T-H, where T is total time available. However, since T is an unobservable variable this approach often leads to unnecessary empirical problems.

FIGURE 2



aggregated into a composite good which is represented by the expenditure variable Y. Note that since H is a supply variable, rather than a demand variable, the derivative of the utility function has a negative sign with respect to it. The budget constraint then becomes $Y = y + wH$ where y is nonlabor income and w is the net after-tax wage rate.[4] In Figure 1 we present the two-good diagram which corresponds to this model of labor supply. The tangency of the indifference curve which arises from the utility function U(H,Y) with the budget line determined by non-labor income and the wage then leads to desired hours of work H*.

In Figure 2 we then consider the effect of a wage change from w to w'. This change could occur if the government levied a wage tax and exempted nonlabor income, e.g., income from savings. In our subsequent analysis we also allow for taxation of non-labor income, but here look at the simpler case.

[4]In this formulation the wage and income variables are given in terms of the price of the composite good.

Note in the diagram that after-tax hours of work H′ *exceed* pre-tax hours H*. Nothing pathological exists in Figure 2. We merely have the counteracting influences of the income and substitution effects which have opposite signs under normal assumptions.[5] The income effect along with the assumption that leisure is a normal good implies that labor supply *increases* when non-labor income decreases holding the wage constant. In Figure 2, the movement from point A to point B arises from the income effect. The dashed line which is tangent to the lower indifference curve at point B represents the income effect since it is drawn parallel to the original budget line and represents the same wage. The movement along the lower indifference curve from point B to point C, then represents the (compensated) substitution effect. It holds utility constant but lowers the wage from w to w′. Economic theory states that the substitution effect when the net wage falls will *decrease* labor supply. Thus, even in the most simple case of a wage tax, the income and substitution effects are of opposite sign. Econometric estimates are necessary to measure the total response and magnitudes of the two separate effects. In terms of the Slutsky equation we have the formula

$$(1) \qquad \frac{\partial H}{\partial w} = \frac{\partial H}{\partial w}\bigg|_{\overline{U}} + H\frac{\partial H}{\partial y}$$

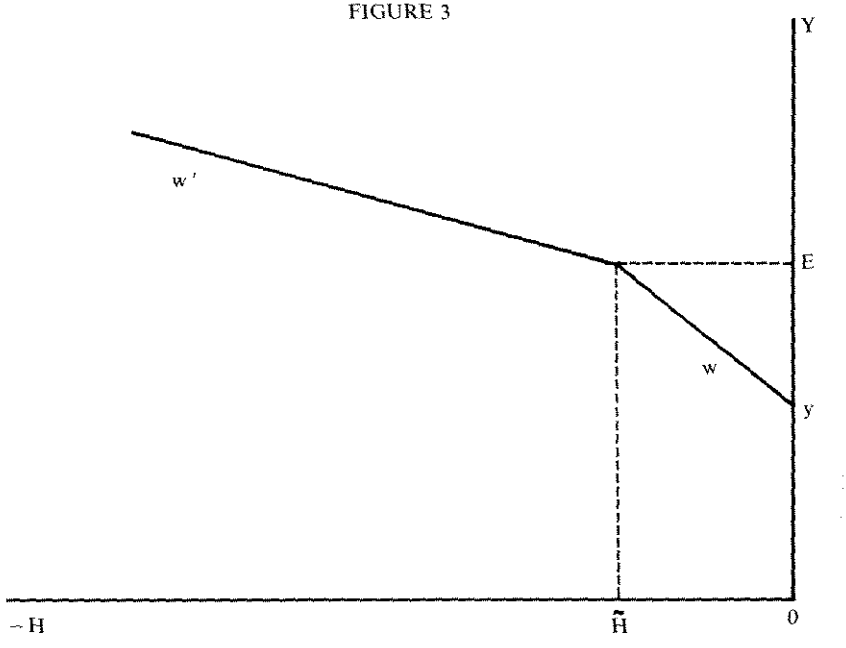
where the first term on the right-hand side is the substitution effect and the second term is the income effect. It is important to consider both the income and substitution effects when considering taxation and labor supply. As we will see shortly, it is the substitution effect alone which measures the amount of economic cost of a tax. But the income effect cannot be lost sight of because it normally serves to increase labor supply when a tax is levied and determines how much worse off an individual is made by the imposition of a tax.

THE EFFECT OF PROGRESSIVE TAXATION

We now consider the effects of two types of progressive income taxes. The first type is a linear income tax with a constant marginal tax rate while the second type of progressive tax has increasing marginal rates and is closer to the current U.S. tax system. The linear income tax has many favorable aspects. Since it has only one

[5]This example should not be confused with the textbook case of a Giffen good which may never have existed in practice. Given many empirical estimates of labor supply response, we might expect this behavior over a certain range of w and w′.

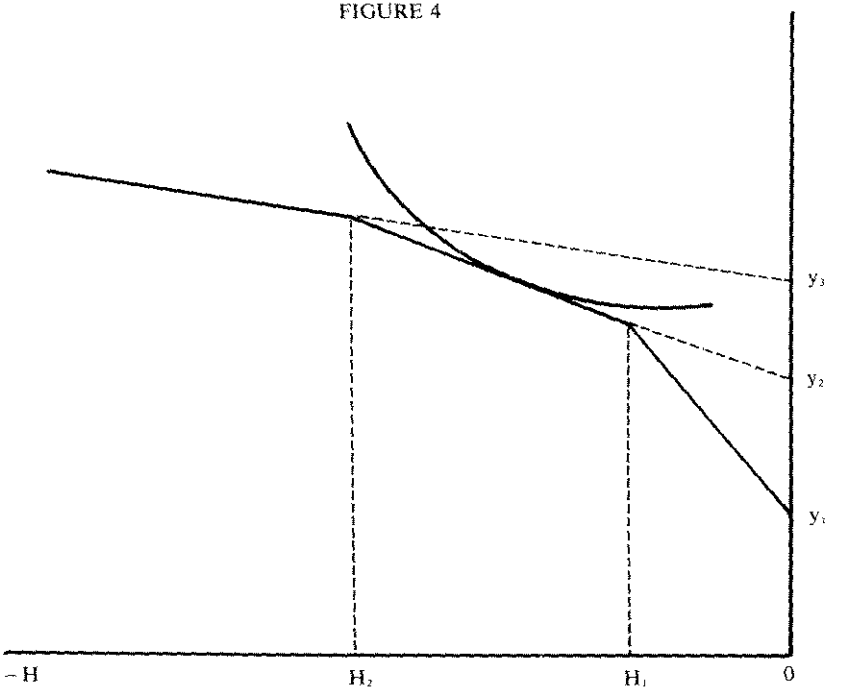
FIGURE 3



marginal rate it would decrease socially unproductive behavior which individuals currently engage in to reduce their tax liability. The linear tax would lower top marginal tax rates decreasing the incentives for certain types of tax shelters. It can also be made very progressive at the low end through the use of a lump sum grant amount G or an exemption level E.[6] In Figure 3 we consider the case of a linear tax with a given exemption level. For income up to point E the individual is not taxed so that he recovers his gross market wage w. Depending on his wage the exemption level E defines labor supply $\tilde{H}$ beyond which the individual receives a net wage rate, $w' = w(1-t)$ where t is the constant marginal tax rate. Note that while the marginal tax rate is constant beyond $\tilde{H}$ the average tax rate is increasing, hence the progressive feature of the tax. And the tax can be made extremely progressive for low Y by adjusting E. However, a disadvantage occurs at the high end because the progression declines as the average tax rate increases toward the marginal tax rate t.

[6]The lump sum grant makes the tax similar in part to the negative income tax proposals. For a model of individual behavior and empirical estimates under a negative income tax see Burtless and Hausman (1978) and Spigelman *et al.* (1978).

FIGURE 4



The general progressive tax case is similar to Figure 3 except with more linear segments.[7] However, it differs from the previous diagram in that no exemption is present so that each budget segment is determined by a net after tax wage rate of $w_i = w(1-t_i)$ and the income brackets over which t holds. After-tax non-labor income is given by y_1. In Figure 4 we indicate such a budget set with 3 tax segments although the reader should note that the actual U.S. tax code currently has about 15 brackets.

We now address the question of how to use our labor supply model when the budget set is no longer linear as in Figure 1. There we assumed that the individual chose H to maximize U(H,Y) subject to $Y = y + wH$. Here we have a multiplicity of wage rates instead of just w. The appropriate technique to use is to define the "virtual" incomes y_i which correspond to the wages w_i on a particular budget

[7]It is sometimes not recognized that the U.S. tax system is not progressive over its entire range because of the effects of the earned income tax credit, social security contributions, and the standard deduction. These tax provisions make the appropriate budget sets nonconvex instead of convex as in Figures 3 and 4. We do not treat this additional complication here but instead refer the reader to Hausman (1979c).

segment. Then along each budget segment the individual maximizes utility subject to $y_i + w_i H_i$. The resulting choice is constrained by the bracket limits which determine H_1 and H_2 in Figure 4. That is, the chosen hours of labor supply must be feasible in the sense of being on the budget line in Figure 4. However, a more straightforward approach is to use a labor supply function (which may be determined from the original utility function) of the form

$$H_i^* = g(w_i, y_i, Z, \beta) \tag{2}$$

where Z is a vector of individual socio-economic variables and β is a vector of parameters to be estimated. We enter each set of net wages w and virtual income y and at most one tangency with the feasible budget set is found. The tangency then determines labor supply. This result follows because indifference curves for which $g(\cdot)$ is derived are concave and the budget set is convex. If no feasible tangency is found then we will have bracketed one kink point, e.g., H and it will be the optimum labor supply.[8] Thus, in the case of progressive taxes the situation becomes somewhat more complex, but the usual economic theory applies. Also, the notion of virtual income plays a crucial role in the measurement of the welfare costs of taxation which we now turn to.

DEADWEIGHT LOSS FROM TAXATION

It is incorrect to measure the economic cost of a tax by its total effect on labor supply. As we see in Figure 2 the wage tax served to *increase* labor supply so on labor supply grounds the tax might be deemed favorable. Yet the individual has been made worse off by the tax since his post-tax indifference curve lies below his pre-tax indifference curve. Furthermore, even if the government returned the amount of tax revenue they raised, which is given by the line segment CD, in the form of the consumption good, the individual has still been made worse off by the tax. Thus, in our simple example the "size of the pie" has increased because the tax has brought forth more labor supply. But still the individual's utility decreases because of the tax. It seems clear that an appropriate welfare measure, rather than labor supply alone, is needed to measure the effect of taxation.

The first component of a welfare measure is the effect of the tax on individual utility. Here the measure long used by economists has

[8]This approach is put forward by Hausman (1979b). Other approaches have been used by Ashworth and Ulph (1977) and Wales and Woodland (1979). See also Burtless and Hausman (1978).

been some form of consumers' surplus. Consumers' surplus corresponds to the concept of how much money each individual would need to be given, after imposition of the tax, to be made as well off as he was in the no tax situation. Measurement of consumers' surplus often is done by the size of a trapezoid under the individual's demand curve or here it would be the labor supply curve. But Hausman (1979a) has demonstrated that in the case of labor supply this method is very inaccurate. Instead the theoretically correct notion of either the compensating variation or equivalent variation must be used.[9] These measures, set forth by Sir John Hicks, are probably best defined in terms of the expenditure function. The expenditure function determines the minimum amount of money an individual needs to attain a given level of utility at given levels of wages and prices.[10] Its form is determined by either the direct utility function U(H,Y) or the labor supply function, equation (2). In our simple example of the wage tax of Figure 3 the compensating variation equals

$$\text{(3)} \qquad \text{C.V. } (w, w', U) = e(w', U) - e(w,U)$$

Equation (3) states that the welfare loss to the individual, measured in dollars of the consumption good, equals the minimum amount of non-labor income needed to keep the individual at his original utility level U minus his non-labor income in the no tax situation, y. Since utility is kept at the pre-tax level U, the compensating variation arises solely from the substitution effect in the Slutsky equation (1). The income effect is eliminated because the individual is kept on his initial indifference curve. In the more complicated case of progressive taxes, the only difference is that we use virtual non-labor incomes in equation (3) rather than actual non-labor income.[11]

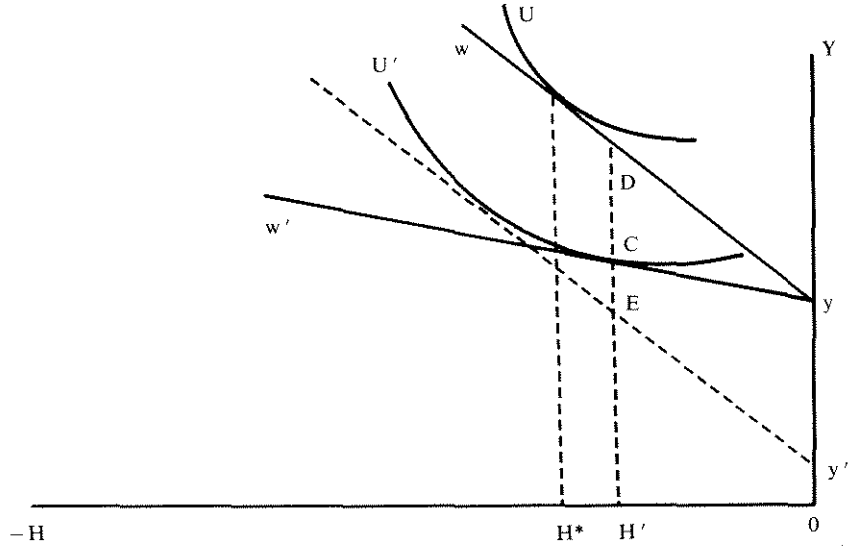
We need one more ingredient to complete the measure of the welfare loss from taxation. The government has raised tax revenue, and we need to measure the contribution to individual welfare which arises from the government spending the tax revenue. The assumption commonly used is that the government returns the tax

[9]These measures correspond to the area under the compensated demand curve which is determined by the substitution effect in the Slutsky equation (1). For further discussion see Hausman (1979a) or Varian (1978).

[10]For a more formal treatment see Varian (1978) or Diewert (1979).

[11]The alternative measure of the equivalent variation uses post-tax utility U′ as the basis for measuring welfare loss. For labor supply in the two good set-up the equivalent variation typically gives a higher measure of welfare loss than does the compensating variation.

FIGURE 5



revenue to the individual via an income transfer. Here it would correspond to increasing the individual's non-labor income by the amount of tax revenue raised. Then the total economic cost of the tax is given by the deadweight loss (or excess burden) as

$$\text{(4)} \qquad \begin{aligned} \text{DWL}(w, w', U) &= \text{C.V.}(w, w', U) - T(w, w', U) \\ &= e(w', U) - e(w, U) - T(w, w', U) \end{aligned}$$

Equation (4) states that the deadweight loss of a tax equals the amount the individual needs to be given to be as well off after the tax as he was before the tax minus the tax revenue raised $T(w, w', U)$.[12] Deadweight loss is greater than or equal to zero which makes sense given that we expect taxation always to have an economic cost. Thus, even if an individual chooses to work more after the imposition of a tax as in Figure 2, he still has not been made better off by the tax. And the economic cost of the tax to him is given by the deadweight loss formula of equation (4). Of course, if no tax revenue is returned the compensating variation gives the welfare loss to the individual. In Figure 5 the compensating variation and deadweight loss are shown in terms of our simple wage tax example of Figure 2.

[12]Here we follow Diamond and McFadden (1974) and use taxes raised at the compensated point. Kay (1980) has recently argued in favor of using the uncompensated point. As with C.V. and E.V. measures the problem is essentially one of which is the better index number basis.

Here the effect of the tax is to reduce labor supply from H* to H'. The compensating variation is measured by the line segment yy'. We then decompose the compensating variation into its two parts. The line segment CD measures tax revenue collected while the line CE measures the deadweight loss of the tax. Since the taxpayer has been made worse off but no one has benefited from the amount of the deadweight loss, it represents the economic cost of raising the tax revenue.

DEADWEIGHT LOSS AND TAX POLICY

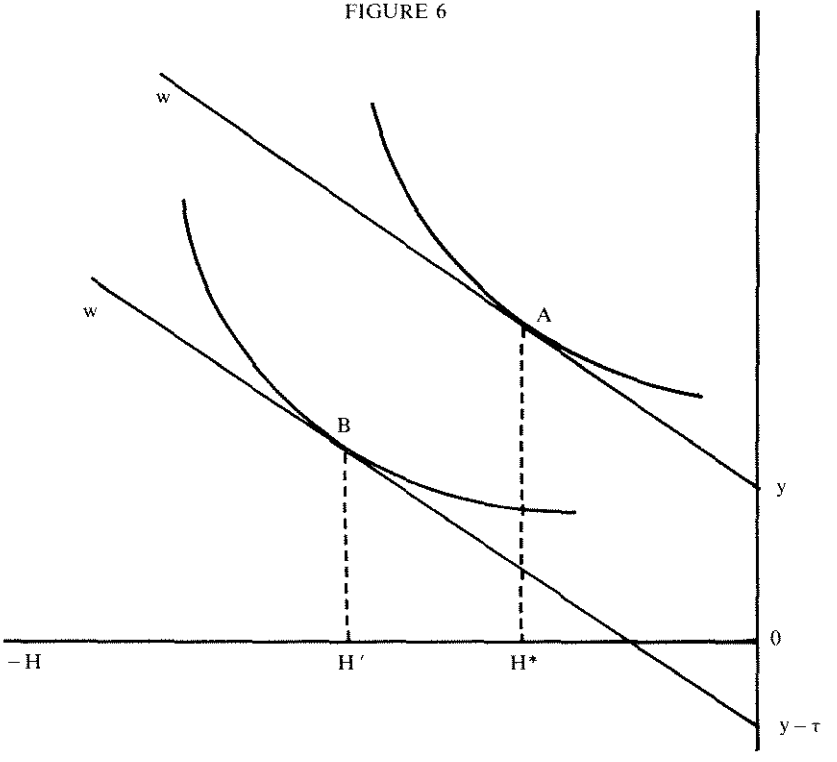
Much of public finance theory is concerned with the question of raising a given amount of tax revenue while minimizing the economic cost as measured by the deadweight loss.[13] But in considering tax policy redistribution must be accounted for or otherwise we certainly would have no need for a progressive income tax.

Suppose the government wanted to raise tax revenue equal to R dollars. The deadweight loss minimizing tax is a lump sum or poll tax of amount $\tau = R/N$ where N is the number of taxpayers. Figure 6 portrays such a tax. The deadweight loss is zero because in comparison to Figure 2 or Figure 5 note that only an income effect is present in the movement from point A to point B. No substitution effect is present since the pre-tax wage and post-tax wage are identical. The compensating variation from equation (3) equals τ, the amount of tax revenue raised. Thus, the first term of the Slutsky equation (1) is zero and the change in hours of labor supply comes totally from the income effect. No distortion in relative prices occurs and so no deadweight loss occurs. In equation (4) the compensating variation term is exactly cancelled out by the tax revenue term. Deadweight loss is zero. Furthermore, note that labor supply *increases* because of the income effect. The result of the lump sum tax is to increase labor supply while not creating any deadweight loss. On economic efficiency grounds it is an ideal tax and also would satisfy supply-side economists goals.[14] But it is doubtful such a tax would ever be acceptable on political grounds since the redistributive aspect of the current income tax has been lost. In fact, the lump sum tax is extremely *regressive* since the

[13]For an exposition and references see Chapters 12-14 of Atkinson and Stiglitz (1980). Mirrlees (1971) wrote the seminal paper on optimal income tax theory. See also Mirrlees (1979).

[14]I do not claim to know what the exact goals of supply-side economics are. However, an increase in the national product certainly seems high on the list.

FIGURE 6



average tax rate decreases with labor income. Even with its favorable supply-side effects, it is doubtful that such a tax would be politically acceptable.

The simple example of a lump sum tax raises a number of important issues. Taxes take away income from people. Taxes, therefore, make people worse off, even if they are nondistortionary. In Figure 6 the individual is on a lower indifference curve after the tax is levied. We measure the economic cost of the tax with the deadweight loss measure of equation (4). But if the tax revenue is not returned to the individual who paid it, he is still worse off. The question of individual losses from the income tax and individual gains to the recipients of tax revenue expenditures involves questions of redistribution. These questions cannot be avoided in discussions of tax policy. Taxes also effect individual behavior again even if they are nondistortionary. Along the lines of Figure 6 we can demonstrate that a lump sum tax which raises revenue τ always involves *greater* labor supply than a linear income tax like Figure 3 or a completely progressive tax like Figure 4 so long as

leisure is a normal good. Therefore, a tradeoff exists between the degree of progressivity that society wants in the income tax and the economic cost measured by the deadweight loss. Thus neither deadweight loss nor labor supply are sufficient measures alone in evaluation of the income tax. Deadweight loss gives the economic cost of the tax, but the "benefit" of the tax which arises due to its redistributive aspect must also be accounted for. Unfortunately, the correct degree of redistribution is difficult to reach agreement on, which makes consideration of income tax policy changes a difficult subject.

An Empirical Labor Supply Model and the Effect of Tax Reform Proposals

In this section we first briefly discuss an empirical labor supply model estimated by Hausman (1979c). The estimates from this model are used to evaluate the effects of income taxation. We then evaluate the effects of the current income tax via both deadweight loss and labor supply effects. Following the analysis of the current tax system, we consider two types of tax reform proposals. The first proposal is referred to as the Kemp-Roth proposal and here we consider reductions in the income tax rates of 10-30%. Besides deadweight loss and labor supply effects we are also interested in the effect on tax revenue. The change in tax revenue depends on the labor supply response when taxes are changed. If the labor supply response is not uniform across individuals, the change in tax revenue will be sensitive to whether the response is concentrated among high income or low income earners. The other type of tax reform proposal we consider is an equal yield progressive linear income tax like that in Figure 3. That is, we consider income taxes with constant marginal rates which raise the same amount of revenue as the current income tax. The overall tax will still be progressive by letting the exemption level vary across tax reform proposals. The linear tax systems that we consider are similar in progressivity at the low income levels but display much less progressivity at high income levels than the current tax system does. A linear income tax is attractive because it has the potential of sharply decreasing deadweight loss by decreasing high marginal tax rates. But how far it can do so while raising equal tax revenues depends on the labor supply response which we also consider. For each of the tax reform proposals we attempt to account for distributional effects by considering effects among population quintiles. It is important to emphasize that all our results are partial

equilibrium in nature. Potentially important general equilibrium results are not captured by the econometric model.

AN EMPIRICAL MODEL OF LABOR SUPPLY

The essential feature that distinguishes econometric models of labor supply with taxes from traditional demand models is the non-constancy of the net, after-tax wage. As we saw in the previous section, the marginal net wage and the virtual income depend on the specific budget segment that the individual's indifference curve is tangent to. Econometric techniques have been devised which can treat the nonlinearity of the budget set. An econometric model takes the exogenous nonlinear budget set and explains the individual choice of desired hours of work. Our model is based on the linear labor supply specification

$$h^*_i = \alpha w_i + \beta y_i + Z\gamma \tag{5}$$

where w is the net after-tax wage, and y is the virtual income on budget segment i. The vector Z represents socioeconomic characteristics of the individual. The unknown parameters α, β, and γ are estimated using econometric techniques. Now actual hours h may differ from desired hours h* because of stochastic reasons. Another source of stochastic variation enters the model by allowing for a distribution of preferences in the population via random β. The specific way in which these enter the model is described in Hausman (1979c). Also a zero constraint for hours as well as fixed costs to working enter the model. The model is estimated first for a sample of husbands who are between 25-55 years old for the year 1975.[15] We then estimate the model over a sample of women who are wives of the husbands' sample. The husbands' earnings are treated as non-labor income for the wives. Thus, wives labor supply is conditioned on husbands labor supply. Wives also face initial marginal tax rates given by the last tax bracket which contains their husbands earnings.

The federal income tax is represented in the model by 12 tax brackets. The first bracket is $1,000 wide with succeeding brackets falling at intervals of $4,000. Since we are interested in the taxes on labor supply, we consider only taxes on earned income. Because we do not have access to actual tax returns, a number of assumptions

[15]It is important to note that neither the model nor the simulations treat the young or old segments of the working population. We would expect a labor supply model to differ markedly for such individuals. Nor do we treat non-married individuals.

are required. We assumed that all married couples filed jointly. In forming the taxable income we took account of personal exemptions and assumed that individuals used the standard deduction up to the (1975) limit of $16,250. The standard deduction was used on approximately 2/3 of all tax returns in 1975. Beyond $20,000 we used the average of itemized deductions for joint returns for each tax bracket found in *Statistics of Income*. We also take account of the earned income credit and social security contributions which were 5.85% up to a limit of $14,000 for 1975. Lastly, we take account of state income taxes by putting the tax laws of the 41 states who taxed earned income into the budget set calculations. Thus we had a reasonably complete characterization of taxes which individuals faced on their earned income.[16]

We briefly discuss the results from the model for the average individual in the sample. A more complete discussion is contained in Hausman (1979c). For husbands we found the uncompensated wage elasticity to be very near zero. This result is similar to the findings of previous research. However, by taking account of the tax system via the virtual incomes we find an income elasticity at the mean hours of work to be approximately $-.177$ for the mean wage in the sample. Thus, the presence of a non-zero income elasticity implies that husbands' labor supply decisions are affected by the income tax. Also the deadweight loss may be significant because the substitution effect of the Slutsky equation (1) will be non-zero given our estimates. For wives we find the uncompensated wage elasticity to be .906. The income elasticity for the mean woman who works full time is approximately $-.504$.[17] Thus, both the uncompensated wage elasticity and income elasticity are non-zero which indicates that taxes have an important effect on both labor supply and deadweight loss.

Given the model specification and estimates, we can now apply it to evaluate the effect of income taxation. Suppose we want to evaluate a tax reform proposal. The estimated change in labor supply can be found from equation (6) by entering the new tax plan via the marginal tax rates w_i and virtual incomes y_i. A micro simulation is done on the sample of husbands and wives, and the

[16]City income or wage taxes could not be included due to lack of specific job location data. Minor problems may also be created because of the tax treatment by states or earnings of non-residents.

[17]It is important to note that this elasticity is calculated at a mean virtual income of approximately $8200. The reason for the high virtual income is that husbands' earnings are included in the non-labor earnings of the wife.

change in labor supply is calculated. The specific manner in which stochastic elements of the model are treated in the simulations is given in Hausman (1980). To do deadweight loss calculations we need the expenditure function for equation (3). Hausman (1979a) derives the expenditure function which corresponds to the labor supply function, equation (5), to be

$$e(w_i, U) = e^{-\beta w_i} U + \frac{\alpha}{\beta} w_i + \frac{\alpha}{\beta^2} - \frac{Z\gamma}{\beta} \tag{6}$$

We take the marginal wage w_i from the budget set and then calculated the deadweight loss from equation (4) using taxes raised at the compensated labor supply point. We then have our welfare measure of the cost of the income taxation. Two possible objections to our welfare measure are that we aggregate across individuals, giving each individual the same weight in the implicit social welfare function. Also different individuals are allowed different coefficients in their expenditure functions. The problems created for analysis of vertical equity considerations for these choices are discussed in Atkinson and Stiglitz (1976). But we attempt to indicate the importance of these considerations by looking at distribution measure across different income categories.

CURRENT TAX POLICY AND KEMP-ROTH REDUCTIONS

We begin our analysis of the current tax policy by considering the effect of the current tax system on the labor supply of husbands. First, we consider the mean individual in the sample. His before tax wage is \$6.18 per hour and his non-labor income is \$1266. Without taxes the labor supply model predicts he would work 2367 hours per year, but the effect of the current tax system is to lower his labor supply to 2181 hours per year. Thus, the effect of taxes is to decrease his desired labor supply by 8.2%. To calculate the welfare loss for these husbands we look at the deadweight loss (DWL) based on the compensating variation measure of deadweight loss from equation (3). For the mean individual we calculate the deadweight loss to be \$235 which is 21.8% of the total tax revenue collected from him. It is 2.4% of his net, after-tax income. Thus, we see that taxes on earned income have an important effect on both labor supply and on deadweight loss. These results differ markedly from the received knowledge in the field, e.g., Pechman (1976), which is that taxation has almost no effect on the labor supply of prime age males. Also, the deadweight loss calculation indicates that the

TABLE 2
Mean Tax Results for Husbands

Market Wage	DWL	DWL/Tax Revenue	DWL/Net Income	Change in Labor Supply
$ 3.15	$ 66	9.4%	0.8%	− 4.5%
4.72	204	14.4	2.0	− 6.5
5.87	387	19.0	3.1	− 8.5
7.06	633	23.7	4.5	−10.1
10.01	1749	39.5	9.9	−12.8

income tax is a relatively high cost means of raising tax revenues.[18] If less expensive means to raise federal tax revenue do not exist, the large amount of redistributive expenditure by the federal government is being done at relatively high economic cost.

Now the mean individual calculation leaves out two potentially important factors. First, because of the nonlinearity of the tax system, it may provide a poor guide to population averages. It can be shown that deadweight loss is proportional to the square of the marginal tax rate so that deadweight loss will grow quickly as marginal rates rise. Second, distributional considerations are neglected. We have emphasized that an important objective of the income tax system, in addition to raising tax revenue, is to redistribute income. We attempt to investigate distributional considerations by looking at quintiles based on the market wage. The market wage seems a better measure than income to base distributional categories on, because it is closer to the notion of the opportunity set of the individual. In an optimal tax calculation, the tax is based on the opportunities facing the individual instead of post-tax behavior.

In Table 2 we look at the effect of the current tax system for five categories defined by the market wage. Overall, we find that the tax system decreases labor supply by 8.5% and the mean deadweight loss as a proportion of tax revenue raised is 28.7%. Thus, the results are not too different from the results for the mean individual. However we note important differences among the five categories.

[18]Of course, the economic cost of raising revenue from other federal taxes would need to be investigated before an informal choice could be made. Federal taxes on labor income currently raise about 75% of federal revenues.

First, we see that deadweight loss rises rapidly with the market wage as we expected. In terms of the welfare cost of the tax we see that the ratio of deadweight loss to tax revenue raised starts at 9.4% and rises to 39.5% by the time we reach the highest wage category. Again we see that the cost of raising revenue via the income and payroll taxes is not negligible. In terms of a distributional measure we see that the ratio of deadweight loss to net income also rises rapidly. In fact, this measure indicates that individuals in the highest wage category bear a cost about 10 times the lowest category while individuals in the second highest category bear a cost 5 times as high. Without specific social welfare measure, we cannot decide whether the current tax system has too much, too little, or about the right amount of progressiveness. But the measures of Table 2 seem an important step in thinking about the problem. Lastly, note that the change in labor supply from the no tax situation again rise with the wage category. The high marginal tax brackets have a significantly greater effect on labor supply than do the low tax brackets.

We now do a similar set of calculations for our sample of wives. While we found both significant deadweight loss and an important effect on labor supply for husbands compared to the no tax situation, the situation is more complicated for wives. First, about half of all wives do not work. In the absence of an income tax, the net wage would rise causing some of them to decide to work and others to increase their labor supply. But, at the same time their husbands' after-tax earnings would also rise which has the opposite effect on labor force participation. Thus, both effects must be accounted for in considering the effects of the income tax.

TABLE 3
Mean Tax Results for Wives

Market Wage	DWL	DWL/Tax Revenue	DWL/Net Income	Change in Labor Supply
$2.11	$ 23	4.6%	.3%	+31.2%
2.50	119	15.3	1.3	−14.2
3.03	142	15.9	1.5	−20.3
3.63	184	16.5	1.7	−23.8
5.79	1283	35.7	8.6	−22.9

Overall for wives, we find the ratio of deadweight loss to tax revenue to be 18.4%. But it should be remembered that this ratio understates the effect on labor force participants alone. For labor supply, we find that taxes serve to increase labor supply in the lowest wage category, but decrease labor supply as the wage rises. Overall, they decrease labor supply by 18.2%. Thus, again for wives we see that the current income tax system has both an important labor supply effect and imposes a significant cost in welfare terms for raising tax revenue.

We now turn to a consideration of Kemp-Roth type tax proposals. We will consider two levels of tax cuts, 10% and 30%. The question which has been focussed on most is what effect these tax cuts would have on tax revenues. Our results are partial equilibrium so that general equilibrium effects are not accounted for. The main effect here arises from the change in labor supply. But increased labor also moves some individuals into higher tax brackets. Both effects need to be accounted for. In Table 4 we present the two Kemp-Roth simulation results. For the 10% tax deduction mean hours of labor supply for husbands rise 22.5 hours or 1.1%. Tax revenues fall by 7.4%. Even given the fact that our model is partial equilibrium, rudimentary calculations demonstrate that general equilibrium effects are very unlikely to be large enough to cause tax revenues from decreasing significantly in the short run as our results show. In terms of the welfare cost of the tax we see that the DWL falls significantly. The ratio of mean deadweight loss to tax revenue falls from 22.1% under the current system to 19.0% under the 10% tax cut plan.[19] For the 30% tax cut labor supply increases by 2.7% while tax revenue falls by 22.6%. Again we see that deadweight loss decreases significantly with the ratio of deadweight loss to tax revenues raised decreasing to 15.4%. Thus Kemp-Roth type tax cuts have large effects both in terms of decreasing deadweight loss and in decreasing government revenue. Without knowledge of marginal government expenditure, it is difficult to evaluate the tradeoff. But we cannot recommend Kemp-Roth on welfare grounds alone given the substantial fall in government revenue.

[19]A problem arises here because we are doing welfare calculations with different indifference curves because of the tax changes. But we are using a common basis of comparison, the no tax situation.

TABLE 4
Kemp-Roth Tax Cut Proposals for Husbands

	10% Tax Cut			30% Tax Cut		
Market Wage	DWL/Tax Revenue	DWL/Net Income	Change in Labor Supply	DWL/Tax Revenue	DWL/Net Income	Change in Labor Supply
$ 3.15	8.5%	.7%	+.4%	6.8%	.4%	+1.3%
4.72	13.3	1.7	+.5	10.9	1.1	+1.6
5.87	17.4	2.6	+.9	14.5	1.8	+2.7
7.06	21.8	3.8	+1.1	17.9	2.5	+3.1
10.01	36.1	8.2	+1.4	29.5	5.3	+4.6

For wives we do not present detailed quintile results because the overall pattern is similar to husbands. The mean results are given in Table 5.

TABLE 5
Overall Kemp-Roth Tax Cut for Wives

Tax Cut	Change in Tax Revenue	Change in DWL	Change in Supply (Hours)
10%	− 3.8%	−10.6%	+ 50.2
30	−16.2	−17.4	+117.0

Overall, we see that the labor supply response to a tax cut is greater for wives than for husbands. We expect this since the wage elasticity is about twice the income elasticity so we should have a net increase in labor supply. Furthermore the difference in the elasticities is about four times that of husbands, and we do observe a significantly larger response. For the 10% tax cut case labor supply increases by 4.1% and tax revenues fall by 3.8%. For the 30% tax cut case labor supply increases by 9.4% and tax revenues fall by 16.2%.

Our overall evaluation of the Kemp-Roth tax proposals is that while tax revenues will decrease by significantly less than the tax cut, overall government revenue from the income and payroll tax will decline. An argument might be made that general equilibrium results may be large enough to reverse this conclusion, but I doubt that it is a valid argument, especially in the short run. Thus, unless a strong argument can be made for reducing government expenditures with little welfare loss from the recipients, the Kemp-Roth tax cut proposals cannot be supported on the basis of our results. They certainly do not have the "free lunch" properties claimed by some of their supporters.

A LINEAR INCOME TAX

We now consider an equal yield change from the current tax system to investigate whether the welfare cost in terms of deadweight loss can be significantly decreased. The type of tax system which we consider are linear income taxes with initial

exemptions like the tax system drawn in Figure 3. Thus, we specify an initial exemption E and then search our marginal tax rates until we find the minimum tax rate which raises the same amount of tax revenue as the current tax system. We might expect such a linear income tax to do well in two respects.[20]

First, in Table 2 we saw that deadweight loss increases rapidly as marginal tax rates increase. Since the linear income tax will not have such high marginal rates, deadweight loss should be decreased. Second, we would expect a significant labor supply response given a decrease in the marginal tax rates. Thus, the tax rate should not have to be too high to raise equal revenues to the current tax system. Yet a potential problem still exists. Even if total deadweight loss decrease, some individuals may still be made worse off by a change from the current tax system to a linear income tax. Although overall deadweight loss will decrease, we have the problem of potential versus actual compensation which was the basis of the Kaldor-Hicks-Scitovsky-Samuelson debate of the 1940s. However, we will see that the linear income tax does so well that the problem may be overcome in some cases.

In Table 6 we consider the equal yield linear income tax for husbands. Note first that the tax rate begins at 14.6% with an exemption level of zero and rises to 20.7% with an exemption of $4000. Each tax measure gives a substantial welfare gain. Since tax revenues remain the same the change in deadweight loss gives the welfare improvement. Note that even with the highest exemption level of $4000 the deadweight loss falls by 49% from the current system. The labor supply also increases substantially from the current system. My conjecture is that except for a lump sum tax, we have done about as well as possible because labor supply is now only approximately 1.5% below the no tax case. Lastly, we look at the question of distribution. By considering the average tax rate for various exemption levels, we see that either the $2000 or $4000 exemption is superior to the current tax system since the average (as well as the marginal) tax rate is lower at every tax bracket. The results are sensitive to various deductions and credits an individual taxpayer declares but yield the conclusion that approximately all taxpayers are made better off by this type of linear income tax system.[21]

[20]Mirrlees (1971), when he considered the optimal nonlinear income tax, found that the optimal tax was nearly linear for the particular labor supply function he considered.

[21]The earned income tax credit is taken into account in these calculations.

TABLE 6

Equal Yield Linear Income Tax
With Initial Exemption for Husbands

Exemption Level	Tax Rate	Change in Deadweight Loss	Deadweight Loss/ Tax Revenue	Change in Hours	Average Tax Rate at: 4000	8000	16000	24000
0	14.6%	−825.75	.071	+170.0	.146	.146	.146	.146
$1000	15.4	−798.82	.083	+169.3	.116	.135	.144	.148
2000	16.9	−765.31	.098	+167.6	.085	.127	.148	.155
4000	20.7	−659.18	.145	+163.0	0	.104	.155	.172
Current Tax Code	IRS Code	—	.287	—	.119	.147	.173	.188

TABLE 7
Linear Income Tax for Wives

Exemption Level	Tax Rate	Change In Taxes	Deadweight Loss/ Tax Revenue	Change In Hours
0	14.6%	− 5.1%	.104	+372.6
$1000	15.4	− .3	.110	+345.1
2000	16.9	+ 4.6	.114	+302.2
4000	20.7	+11.2	.143	+232.8

We briefly consider what effect this type of tax system would have on wives. We assume here that each family gets only one exemption and faces the same marginal tax rates as her husband. We use the tax rates from Table 6 so that tax revenue for wives is not held constant. The results are presented in Table 7. As we expect, labor supply increases for women with the linear income tax because the marginal tax rate has decreased. Because of the increase in labor supply, the revenue changes are not that large. Tax revenues fall by 5.1% for a 14.6% tax rate but rise by 11.2% for the case of a 20.7% tax rate. The ratio of deadweight loss to tax revenues falls markedly from the current tax system. Thus, for wives as well as husbands, the linear income tax has favorable implications from an economic cost viewpoint.

Our example bears out to some extent the lessons from the optimal tax literature. The crucial parameters there are the weighted (compensated) substitution response and the net revenue raised from each individual. We use the same weights for each individual in our deadweight loss calculations. Our results indicate the importance of the net revenue consideration. Because of the labor supply response, Tables 6 and 7 demonstrate that lower income groups can *gain* from lowering the top marginal income tax rates. Can anyone then object to the case for a linear income tax? The answer is unfortunately yes, if it is relative rather than absolute income or utility that matters for society's choices on distribution matters.[22] Economists used to the Pareto principle typically think of each individual's or family's welfare apart from the rest of the

[22]Such cases are analyzed by Fair (1971) and Boskin and Sheshinski (1978).

population. Since the linear income tax has the possibility of making everyone better off, most economists would favor it on these grounds. But by sharply decreasing the top marginal rates from say 50% to 20.7%, the highest paid individuals have a greater increase in welfare than do the lowest paid. Therefore, on a relative basis or by some income distribution measures, the linear income tax might not be an improvement from the current tax system. These arguments would need to be considered in tax reform discussions. I favor such a change in our tax system because I do not give great weight to the relative welfare argument. Favorable economic effects could occur with less progression in the tax system at higher income levels. This type of proposal emphasizes the economic efficiency aspects of the tax system. Thus, it seems that a more linear type of tax system is to be favored over the current system. The Kemp-Roth tax cuts do not do nearly as well by comparison.

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Transfers, Taxes and the NAIRU

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Just as war is too important to be left to the generals, the impact of taxes and transfers on the aggregate unemployment rate is too important to be left to the macroeconomists. I therefore subject the issue of how tax and transfer policy affects unemployment and aggregate supply to a detailed, microeconomic examination of the effects of individual tax and transfer program structures. This inductive approach is, I believe, likely to provide a far better guide to discovering how changes in these policies have worked through the economy than would a macroeconomic approach that ignored the programs' complexities.

Throughout the discussion we need to distinguish the programs' effects on two different aspects of economic performance. First, they may affect the measured nonaccelerating-inflation rate of unemployment (NAIRU). Such effects would be important for planning macroeconomic policy, though it is not clear how informative knowledge of any effects on the NAIRU is for learning about aggregate supply. Second, each tax and transfer policy may change the amount of employment observed at the NAIRU; assuming productive efficiency, this means that these policies will affect the amount of output, and thus per-capita incomes observed in the economy. It is this second set of effects that is more in the spirit of the supply-side discussions of recent years. Unlike the first effect, it is more than just an issue of measurement.

Before proceeding to present first a macro approach to the issue, then a detailed micro approach, it is worth considering some well-known (to labor economists) aspects of labor force change over the past twenty years. For selected years of roughly comparable aggregate demand pressures (though 1969 was probably somewhat tighter than the other two years), we present the aggregate unemployment and participation rates, and unemployment rates,

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participation rates and labor force shares of five demographic groups. Several features, in decreasing order of my estimate of their importance in the history of the U.S. labor market over the past 20 years, stand out: 1) The adult female participation rate has skyrocketed, causing that group's representation in the civilian labor force to jump from 30 to 38 percent; 2) As a result of the post-war baby boom, the teen-age share of the labor force has also increased, a rise that has been accentuated by the simultaneous rise in (mostly part-time) labor-market participation in this group; 3) The participation rates of older males have decreased drastically, substantially lowering their representation in the labor force. (This change is a major focus of my discussion in the fourth section below.); and 4) Partly as a result of the first two changes and their interaction (see Grant and Hamermesh, 1981), the unemployment rate of teenagers has increased sharply. Teenagers are indeed one of only two groups among the five whose pattern of unemployment rates across the three years departs obviously from the aggregate rate. (The other is older men, whose unemployment rate is lower in 1979 than in 1957.)

A Macro Approach to the Effects of Transfers and Taxes

If you are an unreformed macroeconomist, and you believe that taxes and transfers have affected the NAIRU, your initial inclination should be to specify a time-series equation to estimate the direction and magnitude of their effects. In the case of unemployment insurance benefits, such a time-series model has been estimated by Grubel and Maki (1976). Postulating that the net effect will be positive, they find, in a regression of the logarithm of the aggregate unemployment rate on the gross replacement rate of UI benefits and other variables, that this effect is observed in the data. Unfortunately for believers in such models, the size of the effect is so large as to imply that unemployment would be reduced nearly to zero if the UI program were abolished.[1]

Taking this simplistic approach to its logical conclusion, we estimate in this section an equation explaining variations in aggregate unemployment. The dependent variable is log (U*/100-U*), a transform of the adjusted unemployment rate. Rather than using the published aggregate unemployment rate, we use a constant-weight average of unemployment rates of teenagers, women 20+,

[1]The implied effect of a .1 increase in gross replacement by UI in the Grubel-Maki study is an extra 6.31 percentage points of unemployment!

TABLE 1
Selected Labor Force Data, 1957, 1969, 1979

	1957	1969	1979
Aggregate			
Unemployment Rate	4.3	3.5	5.8
Participation Rate	59.6	60.1	63.7
Teens			
Unemployment Rate	8.8	8.8	16.1
Participation Rate	49.7	49.4	58.1
Fraction of Labor Force	.064	.086	.092
Women 20+			
Unemployment Rate	4.1	3.7	5.7
Participation Rate	36.5	42.7	50.6
Fraction of Labor Force	.297	.340	.378
Men 20-24			
Unemployment Rate	7.8	5.1	8.6
Participation Rate	87.0	82.8	86.6
Fraction of Labor Force	.054	.065	.080
Men 25-54			
Unemployment Rate	3.1	1.6	3.4
Participation Rate	97.1	96.1	94.4
Fraction of Labor Force	.455	.395	.362
Men 55+			
Unemployment Rate	3.5	1.9	2.9
Participation Rate	63.4	56.1	46.7
Fraction of Labor Force	.130	.114	.088

men 25-54, and other men, where the weights are their shares in the civilian labor force in 1957:I. This refinement circumvents the problem that growing replacement rates of transfer programs are observed to be positively correlated with an aggregate unemployment rate that is rising because of the very substantial changes in the demographic mix of the labor force that have occurred since 1957.

To represent transfer and tax policy, two variables are used, in each case with lags to avoid part of any problem that may be caused by simultaneity. These are: 1) NRR, the net replacement rate of transfer payments in aggregate. This is computed as personal transfer payments, divided by wages and salaries minus personal contributions for social insurance minus a prorated (by wages' share in personal income) share of personal income taxes; and 2) TAX, the sum of personal income taxes on wages and salaries, and individual and employer contributions for social insurance, all divided by the sum of wages and salaries and employer social insurance contributions.[2] This is designed to measure any disincentive effects that taxes on wages and salaries may have beyond their effects through the financing of transfer payments.

Also included in the model are a time trend variable and the change in the rate of growth of per-capita real GNP.[3] This acceleration term seems more appropriate than the growth rate itself, as it is hard to argue that the NAIRU will vary with the steady-state growth rate of an economy. The model is estimated over U.S. data from 1954:II through 1978:IV. Both simple lag terms in NRR and TAX are included, and variants that include polynomial distributed lags in these variables are also estimated.[4] All of the equations are estimated using the Cochrane-Orcutt technique to account for first-order autocorrelation in the residuals.

The results of estimating four versions of the equation relating a logarithmic transformation of the adjusted unemployment rate to the variables defined above are presented in Table 2. The change in the rate of per-capita real GNP growth has the expected negative sign. Interestingly, the trend coefficient is negative. (Remember, we have removed any trend effects produced by demographic changes in the labor force.) Including all lagged terms (in both NRR and TAX) significantly increases the explanatory power of the

[2]A TAX variable that excluded employer contributions from both numerator and denominator was also used in place of the variable discussed in the text. While the results were qualitatively similar, the coefficient of determination was in every case slightly lower.

[3]The model was also estimated with the theoretically improper variable, percent change in GNP. Though the R^2 exceeded those reported for comparable equations in Table 2, and though the implications of NRR and TAX were the same as in the table, the lack of a good justification for this variable suggests the discussion should be based on the model including its rate of change.

[4]The polynomial lags were estimated with the far end-point coefficients constrained to equal zero. A test of the validity of these constraints in the equation in column (4) yielded $F(3,87) = .49$. (The 95 percent significance level with these degrees of freedom is 2.71.)

TABLE 2

Effects on log (U*/100-U*)
1954:II-1978:IV

	(1)	(2)	(3)	(4)
Constant	−3.39	−3.34	−3.45	−4.26
	(−17.93)	(−12.79)	(−19.01)	(−9.91)
$\dot{GNP}-\dot{GNP}_{-1}$ (sum of four lagged terms)	−.036	−.037	−.047	−.045
	(−1.64)	(−1.66)	(−2.11)	(−2.04)
Time	−.011	−.011	−.014	−.022
	(−3.01)	(−2.71)	(−3.04)	(−3.74)
NRR_{-1}	6.71	6.22	6.15	5.91
	(4.80)	(4.79)	(5.00)	(4.87)
NRR_{-2}	—	—	2.21	2.42
	—	—	(3.98)	(4.44)
NRR_{-3}	—	—	−.13	.27
	—	—	(−.17)	(.36)
NRR_{-4}	—	—	−.86	−.54
	—	—	(−1.38)	(−.85)
TAX_{-1}	—	−.361	—	.15
	—	(−.29)	—	(.13)
TAX_{-2}	—	—	—	1.56
	—	—	—	(2.04)
TAX_{-3}	—	—	—	2.01
	—	—	—	(2.27)
TAX_{-4}	—	—	—	1.49
	—	—	—	(2.16)
R^2	.9320	.9320	.9348	.9384
D-W	1.31	1.31	1.31	1.29
ϱ	.912	.911	.902	.900

equation.[5] We thus base our discussion of these variables' effects on the results in column (4) of Table 2. Both the terms in the net replacement rate and those in the tax rate are significant, and the sum of each set of four coefficients is positive.

Since NRR grew from .095 in 1954:II to .265 in 1978:IV (reaching a high of .290 during the 1973-75 recession), we may infer that the growth of transfer payments relative to net wages and salaries has induced an increase in the unemployment rate. A similar inference may be drawn from the positive coefficients on TAX and the increase in TAX from .167 to .301 (its highest value) during this period. However, lest this be reported in tomorrow's *Wall Street Journal* as proof positive of the deleterious effects of transfers and taxes on labor income, two considerations are in order. First, the coefficients imply incredibly large effects of taxes and transfers on the adjusted unemployment rate. For example, a one standard deviation increase in NRR from its mean is seen to induce an increase in U* from its mean, 5.00, to 7.85. Similarly, an increase in TAX of one standard deviation from its mean of .231 induces an increase of U* from its mean to 6.08.[6] Both of these are ridiculously large, suggesting other things are going on that we have not accounted for. Second, it may be the skepticism of one who has seen too much simple-minded macroeconometric "evidence," but I tend to disbelieve studies whose bold conclusions are based solely on time-series results. Accordingly, I would give little weight to the results in this section, and would instead base my conclusions on careful thought about the programs' effects and on cross-section evidence about their impact.

Some Theoretical Considerations

Given my skepticism about using macro estimates of the effects of taxes and transfers on unemployment to deduce their effects on the NAIRU, it is incumbent upon me to propose some alternative method of answering this question. Help is provided by the approach of Perloff and Wachter (1979) and others who use aggregate production and pricing models to deduce what aggregate unemployment rate, adjusted for demographic change, is consistent with nonaccelerating inflation. This method is clearly the correct

[5] In an equation like that in column (4) from which TIME was excluded, the sum of the coefficients on NRR was 5.35, and that on TAX was 3.00.

[6] NRR has a mean of .171 and a standard deviation of .060; TAX has a mean of .231 and a standard deviation of .040. Their correlation is .933.

one for macro policy planning; it does not, though, as its users would readily admit, indicate whether changes in tax and transfer policy are responsible for changes in the NAIRU. (This approach really says little about the causes of changes in the NAIRU.) Thus, while it may be helpful for other purposes, it provides no evidence on the positive issues under consideration here.

A second approach is simply to make grandiose statements about how the NAIRU has increased tremendously, or, depending upon one's political views, how unemployment much above four percent is evidence of a recession. In the former camp we have statements from at least one ex-Chairman of the Council of Economic Advisors; sympathetic to the latter, a recent annual report of the Council of Economic Advisors made the bold admission that, "A number of forces have been at work . . . to raise the overall unemployment rate at which inflationary pressures begin to appear above the neighborhood of 4 percent. . . ?[7] Neither statement has the least bit of scientific basis, and neither should therefore receive any serious attention. Nonetheless, because of the political importance of the issue, and because of the attention those making such statements command, they have infected the public debate. They do not, though, tell us anything about how or to what extent transfers and taxes have affected the labor market.

A third approach is inductive; it tries to construct, from available estimates of the effects of *individual* tax and transfer programs, the likely impact on the NAIRU of the sum of such programs. The problem with this approach is that, unless one examines the underlying estimates carefully before basing one's conclusions upon them, one quickly comes to outlandish results. For example, taking Feldstein's (1973) estimate that unemployment insurance (UI) benefits and taxes induce a 1.25 percentage point increase in the NAIRU, and combining it with Clarkson and Meiners' (1977) estimate that AFDC and Food Stamps work registration requirements have raised measured unemployment by two percentage points, the absurdity of the exercise becomes apparent. It is impossible to believe that without these two fairly small programs, the unemployment rate in 1979 would have been reduced to below 3 percent. Either these effects are not additive, or the

[7]Herbert Stein noted, "I am not in a position to insist that it [full employment] is 7 percent unemployment. But it is a possibility that must be given weight. Suppose we accepted the idea that there is a 50-50 chance that we are now at full employment." (*Wall Street Journal*, September 14, 1977, p. 22) The CEA statement is from the *Report*, 1978, p. 171.

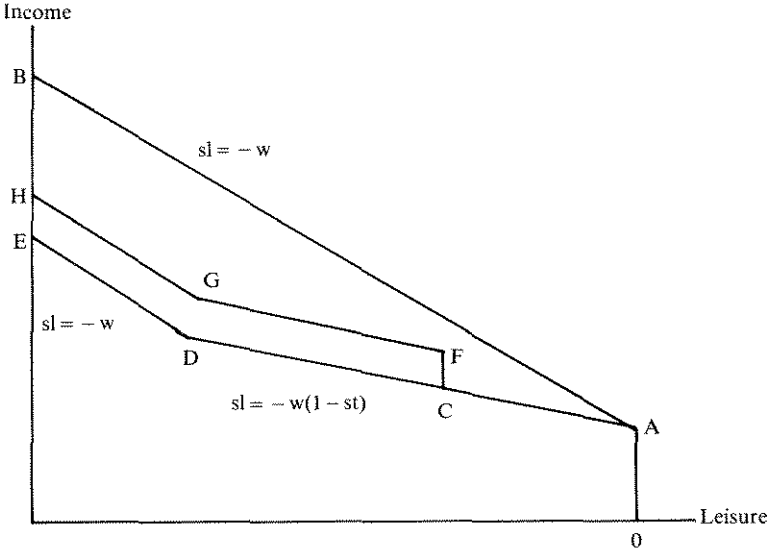
underlying estimates are grossly overstated. (The former criticism may be correct, though I present no evidence on it; the latter does, as I show below, have substantial support.) Given these difficulties, this third approach is also not one that is likely to produce precise estimates unless great care is given to the interpretation of the underlying studies.

What I do here is recognize that the NAIRU has increased since the 1950s, probably by the slightly more than 2 percent implied for 1977 by the Perloff and Wachter study. Of this increase a bit more than one percentage point has been attributed by Wachter (1976) to changes in the demographic mix of the labor force. Using the four groups underlying the calculation of U* in the estimates in the previous section, I find that the unemployment rate would have been .85 percentage points lower in 1978:IV had the labor-force weights of 1957:I prevailed. (I am somewhat uncomfortable with the assumption implicit in this approach that the relative unemployment rates of the various demographic groups must remain unchanged from 1957. In any case, those who loved the implications of this approach for the 1970s' labor market may be less enthralled with its implications for the late 1980s!) The task, then, is to consider on a program-by-program basis whether the remaining one percentage point increase could have been produced by changes in transfer policy. In conjunction with this we consider whether the slowdown in the growth of real output per capita may also have been in part induced by these policy changes.

Although it is impossible to summarize in a succinct way the massive amount of theoretical work on the incentive effects of various transfer programs, I believe that there are sufficient general similarities among the programs' effects to make a general discussion of their likely economic impact worthwhile. The purpose of doing so is to point out some aspects of these effects that have been ignored by research that has been concentrated narrowly; to demonstrate the similarities among various strands of research; and to provide a focus for the discussion of specific programs' effects in the next section. Throughout this analysis we assume that leisure and unemployment are synonymous—both are voluntary. We also recognize that any attempt to synthesize a general model will surely ignore some important programmatic details within individual transfer schemes.

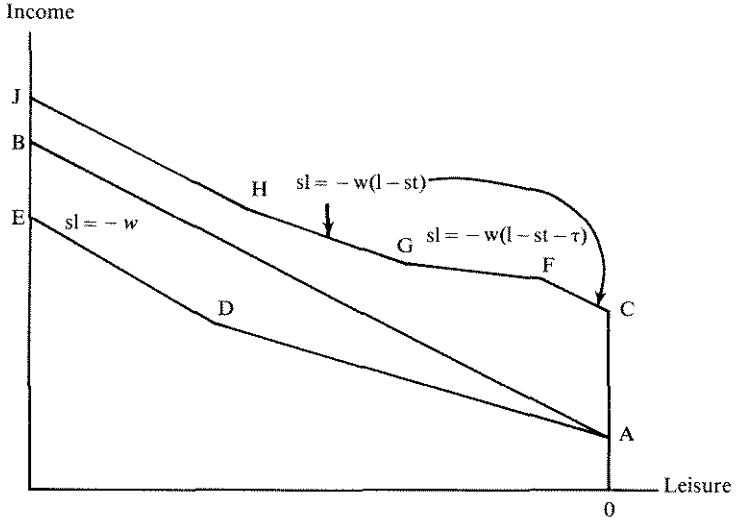
We examine the likely effects of transfers under the assumption that each member of the adult population faces two separate situations vis-à-vis these programs. In the first the individual is

FIGURE 1
Budget Constraints Before Eligibility for Benefits



ineligible for benefits under the program. Nonetheless, the program affects his behavior because of the incentives it provides to establish eligibility for benefits later on. This represents the entitlement effect discussed for UI in Hamermesh (1979b), part of the effect of OASI on hours of work before age 62 implicit in Burkhauser and Turner (1978), and the work incentive effect of OASI through automatic benefit recomputation noted in Blinder *et al.* (1980). As Figure 1 shows, the budget line in the absence of the transfer scheme (and the taxes that finance it) is OAB. With the transfer program and its concomitant tax structure the line shifts to OACFGH. As compared to the budget line OADE, describing the choice set available to the worker who sees only the wage net of taxes, the constraint OACFGH induces substantial changes in behavior. (See Moffitt and Kehrer, 1980; Burtless and Hausman, 1978; and Hamermesh, 1980.) Some persons who would have been at the corner solution at A, or who would have found an internal maximum along AC, are induced by the entitlement aspect of the transfer program to increase their supply of labor and move to point F. (In addition to its effects in UI and OASDI, it may also be operative in affecting military enlistments, as the post-service educational and other benefits are an added bonus to enlistees.) Though this entitlement effect has no immediate impact upon unemployment rates, it may

FIGURE 2
Budget Constraints When Eligible for Benefits



change the aggregate rate insofar as it increases labor force participation among persons whose probability of being unemployed differs from the average. So too, it will clearly increase market employment and thus measured real GNP.

Once eligibility for the transfer is established, the individual faces a different set of constraints. Under UI and OASDI these can *mutatis mutandis* be described as resulting from a lump sum benefit paid if no work, or only a small amount of work, is undertaken; as reflecting the sum of the wage rate and a steadily reduced benefit as hours increase, until the point at which no more benefits are paid. The budget line OACFGHJ in Figure 2 describes this choice set. As compared to the case in which the only perceived effect is through the tax (along OADE), the impact of the program is to induce those who otherwise would have supplied labor along FC to reduce their supply (assuming leisure is a normal good). This effect likely occurs beneath the ceiling on OASI benefits (currently $5000 per year), though this does not appear to have been analyzed empirically; and the same effect is expected beneath the $280/month at which an individual no longer is eligible for Disability Insurance.

In addition to the possible effect in shifting persons rightward from F in Figure 2, transfer programs also shift them from points to the left of F toward point F. These are the disincentive effects that have received so much attention in the literature (see Feldstein,

1973, and Hamermesh, 1977, on regular UI; Munts, 1970, on partial UI benefits; Quinn, 1977, and Boskin, 1977, on OASI; and Parsons, 1980, Leonard, 1979, and Haveman and Burkhauser, 1980, on DI.) In each program there is some, occasionally nearly infinite, tax rate on additional earnings beyond point F such that labor supply is reduced. It is this effect that has been viewed as the culprit in reducing market employment and, in the case of leisure that is measured as unemployment, in increasing the unemployment rate.

Throughout the discussion we have glided over the effect of taxes that finance the transfer payments. Since the concentration of this paper (and most of the literature) has been on the effects of transfers, that seemed appropriate. Nonetheless, some attention to this difficult issue is in order at this point. The following considerations seem relevant. 1) At least for transfer programs, the issue of what the financing method does to labor supply is unusually murky because of the extreme difficulty of extricating the effects of taxes that are, for some programs, experience rated (see Hamermesh, 1977, and Ehrenberg *et al*, 1978). 2) Assuming that the financing is through a payroll tax, a very complicated simultaneity problem seems to be operating. Without knowing the incidence of the combined employer-employee tax that finances OASI and DI, we cannot know the true shape of the budget constraint facing the worker-consumer. But, without knowing the shape of the constraint, we cannot deduce the labor supply elasticity that partly determines the incidence of the tax. This means that any consumer-theoretic analysis of the effect of a combined tax-transfer program rests on shaky ground. 3) Despite these problems, we do know that the payroll taxes are at least partly borne by workers, so that it makes sense to represent the slope of the budget lines OADE in Figures 1 and 2 as $-w(1-st)$, where w is the wage rate, t is the (total) tax rate, and s is the fraction of the tax borne by workers. 4) Because of the ceiling on payroll taxes, there is a convexity in the budget constraint facing the worker-consumer over some range. This will affect labor supply and thus market output in that range. (Clearly, though, if one modelled the entire structure of taxes on earnings, one would find that the appropriate constraint is concave to the left of some point.)

The net effect of taxes and transfers on aggregate supply combines all of these separate impacts implied by this general model. Entitlement effects, induced unemployment, bunching at notches in benefit structures, and behavior induced by taxes, either

general income taxes or earmarked taxes that finance a particular program, must be considered as we discuss how each specific transfer program affects the labor market.

While our discussion abstracts from changes in the demographic mix that have affected the NAIRU, we should recognize that there are other changes in the composition of the labor force that are induced by transfer schemes and that will have an impact on the NAIRU. Within each demographic group, for example, those persons with the lowest market productivity (relative to their productivity at home) will be induced to leave by any given increase in transfer payments. So long as relative market-household productivity is positively (negatively) correlated with the individual's probability of being employed when in the labor force, this will induce a decrease (increase) in the measured unemployment rate *within* the particular demographic group. Though this is a change induced by transfers, it is also a measurement problem of a sort similar in quality to that which we have circumvented by assuming constant labor-force weights.

Effects of Specific Transfer and Tax Programs

That transfer payments have formed an increasing fraction of disposable income was made clear in our discussion in the second section, and it is underscored by the totals in the bottom two lines of Table 3. The growth of transfer payments has been very uneven, however; it is interesting to note that the phrase "welfare mess" is hardly apropos, as "welfare"—usually thought of as AFDC—has grown more slowly than disposable income. Disability Insurance payments have been the most rapidly growing among programs that were ongoing in 1966, and we have seen the birth and explosive growth of payments under SSI and Food Stamps. The data clearly suggest that transfers could, by virtue of their increased generosity and coverage, have induced substantial changes in the labor market since the mid-1960s. Whether this is in fact the case can be seen by a program-by-program consideration of the transfers' effects.

Prompted by Feldstein's (1973) seminal work, there was a resurgence of research on the effects of UI on the labor market. Unfortunately the bulk of this work is on only one of the potential impacts of UI, namely on the duration of spells of unemployment. The twelve studies summarized in Hamermesh (1977, Chapter 3) show a substantial consensus that higher UI benefits do induce people to remain unemployed longer (as our discussion in the previous section suggested). Further work (e.g., Kiefer and

TABLE 3
Income Maintenance Programs
1966 and 1978
(billions of dollars)

Program	1966	1978	Growth Rate (% per year)
Old Age and Survivors' Insurance	$ 18.071[a]	$ 78.524[a]	12.2
Unemployment Insurance (state and railroad)	1.891	9.233	13.2
Workers' Compensation (state laws and federal programs)	1.320	6.760	13.6
General Assistance (AFDC)	4.306	10.700	7.6
Food Stamps (value of federal contributions)	.065[a]	4.595[a]	—
Disability Insurance (under OASDHI)	1.721[a]	12.214[a]	16.3
Supplemental Security Income	—	6.551	—
All Transfer Programs	44.7	224.1	13.4
Disposable Income	510.4	1458.4	8.7

[a]Fiscal year basis

Neumann, 1979, and Katz and Ochs, 1980) has done nothing to dispel this consensus, and even my synthesis "best-guess" impact—.5 extra weeks of unemployment for each .1 increase in the net replacement rate—seems supported by more recent studies.[8] There should be no doubt whatsoever that UI benefits in the U.S. do induce longer spells of unemployment.

Feldstein (1976) and Baily (1977) have shown how the partly experience-rated tax that finances UI can induce increases in

[8]The weak evidence available suggests that this effect is smaller in looser labor markets (Hamermesh, 1977, Chapter 3).

employment fluctuations and thus increases in the number of spells of unemployment. This is postulated to occur because the marginal tax cost to employers of another layoff is zero. Many employers' UI taxes already exceed the benefits paid to prior employees because of nonzero minima on state UI taxes, and some others' taxes are limited by maxima on state tax rates. (Elsewhere, Hamermesh, 1977, I have shown that roughly only 2/3 of UI taxes are experience rated.) Recently, there has been some effort to quantify the impact of the tax structure on the labor market. Brechling (1981) has carefully parameterized state UI tax laws and shown that they appear to have a substantial effect in raising manufacturing layoff rates across states and over time. Halpin (1979) has presented similar evidence for seasonal fluctuations in employment in several industries. I find this evidence, and the theoretical structure underlying it, to be nearly as convincing as that on unemployment duration.

The provision of UI benefits represents a safety net under workers' participation in the labor market. As such, it induces the potential worker to choose to participate where she otherwise might not. This entitlement effect (Hamermesh, 1979b) is especially likely to be important among demographic groups whose attachment to the labor market is fairly loose. It will affect the composition of the labor force by increasing the weight accorded to such groups, and will raise (lower) the aggregate unemployment rate if these groups' unemployment is greater (less) than average. I have shown for adult women that this effect does appear important in increasing participation, and one might assume that it affects the behavior of teenagers and older workers too. Since these groups generally have higher-than-average unemployment, we may infer that it adds to the positive effect of UI on aggregate unemployment. However, by inducing persons marginally attached to the labor market to spend more time in the work force, it also increases market employment in these groups.

The net effects of an expanded UI program—higher benefit amounts, longer potential duration and wider coverage—have been clearly demonstrated empirically: Unemployment duration is raised; employment variability is increased, and the composition of the labor force is tilted toward groups having higher-than-average unemployment. There is no question that UI raises the NAIRU, by an amount that I elsewhere (Hamermesh, 1977) have "guesstimated" to be .7 percentage points. Part of this effect has been added since the mid-1960s, due to expansion of coverage of

this program and to recession-triggered extensions of the potential duration of benefits. The program also induces declines in employment (as unemployment duration is increased, and additional layoffs occur when product demand decreases), but may also increase market employment among secondary workers. The net effect on aggregate employment, and thus per-capita GNP, is an empirical question; however, as I have shown elsewhere (Hamermesh, 1979b) that even among adult women the net effect is negative, we may conclude it is negative in aggregate as well.

As Table 3 shows, retirement benefits under Social Security represent the largest component of the transfer panoply. While our discussion in the previous section hinted at the program's major effects, there is one other effect that deserves mention first. Not only does OASI raise the cost of working for those eligible; the structure of benefits is also such that the cost is especially raised for younger eligibles. This occurs because: 1) at age 72 the earnings ceiling is removed, whereas it applies before then; 2) the increase in monthly benefits if a man (woman) postpones filing beyond age 65 (age 62) is far less than would be actuarially fair;[9] and 3) the ceiling on earnings is a more important constraint among younger eligibles, because their market wage rates are greater. These last two considerations coalesce to induce those eligible for benefits to file as soon as eligibility for full benefits is achieved. The removal of the ceiling at age 72 likely comes too late to have much impact on persons who have been out of the labor force, and whose skills have deteriorated.

Far more important than the induced switches among eligibles, the system has provided increasing incentives for early retirement through expanded support levels. (In terms of an ultra-rational life-cycle model, though, the opposite is true: The ratio of expected benefits to OASI contributions has been falling since the 1940s. In such a model the income effect works toward greater lifetime labor supply. I doubt people are that rational, and the participation data for older males in Table 1 suggest they are not.) As Munnell (1977) showed, these rose sharply between the late 1960s and 1976, both because of *ad hoc* statutory increases and the now-repealed double indexing of benefits. Even though the 1977 Amendments will prevent further increases in gross replacement, the projected rises in

[9]Each month beyond age 65 in which benefits are not claimed raises the monthly benefit eventually claimed by 1/4 of one percent; each month before age 65 in which benefits are claimed reduces the monthly benefit by 5/9 of one percent. (Department of Health, Education and Welfare, *Social Security Handbook*, 1978)

payroll tax rates, and a continuation of current trends in taxes on earnings, indicate that net replacement may continue rising. This suggests that the incentive that benefits give for early retirement will continue to increase unless further amendments to the Social Security Act are passed.

The magnitude of the increases in net replacement is large enough to have had substantial impacts on the labor market. Quinn (1977) and Boskin (1977) provide some weak evidence for the empirical importance of these effects in cross-section data, and Pellechio (1979) has provided a very convincing demonstration that it is higher Social Security benefits particularly that are responsible for the earlier findings. However, Blinder and Gordon's (1980) estimates show only slight effects. One might infer that the data on labor-force participation rates for older men in Table 1 reflect the time-series analog of this cross-section evidence. This effect has served to decrease employment; it says nothing *per se* about effects on the NAIRU. Indeed, our arguments on composition in the previous section; the observation that the unemployment rate among older males decreased between 1957 and 1979; and the evidence that early retirement is more likely among less educated, lower skilled workers, precisely those for whom incidence of unemployment is greater, all imply that the increased generosity of OASI benefits may have reduced measured unemployment by inducing nonparticipation by older workers with the poorest labor-market prospects.

We showed in the previous section that an entitlement effect can also exist in OASI payments, as workers seek to establish greater monthly retirement benefits later on through work before age 62. This effect is compounded by the incentive the system provides to shift hours of work away from periods of eligibility for OASI, when the implicit marginal tax rate on effort is 50 percent. Burkhauser and Turner (1978) use aggregate time series to "show" that inclusion of Social Security wealth explains much of the sudden halt in the decline in the workweek after World War II. I am skeptical about attributing so much of this important phenomenon to what appears to be so far-removed an incentive, and I refuse to be convinced by time-series evidence alone. Some cross-section evidence seems to be required. Even without this, though, we should note that this effect implies an increase in labor input and market output, and probably no effect on the NAIRU, as *hours* are increased among prime-age workers whose participation rates are already high.

Because the shared payroll tax finances OASI benefits, one cannot assess the program's effects without knowing the burden of the tax. While some aggregate evidence implies the burden is entirely on workers (Brittain, 1971), other macro evidence (Vroman, 1974) and micro studies (Hamermesh, 1979a) imply that it is shared by workers and capitalists through higher product prices. It is likely that the tax reduces effort. (I believe that substitution effects outweigh income effects for some groups, and that they are roughly equal for others.) However, though this does imply a reduction in total labor inputs into production, it may also imply a reduced NAIRU, since the greatest labor supply elasticities are among groups with a high incidence of unemployment (compare Borjas and Heckman, 1978, and Cain and Watts, 1973).

All these considerations suggest that OASI retirement benefits change labor-force participation in such a way as to reduce the NAIRU: The composition of the labor force is induced to shift toward groups with a low incidence of unemployment. With the exception of the (to me) secondary effect on the distribution of hours of work over the lifetime, the theoretical arguments and empirical evidence suggest the major impact of OASI retirement benefits is to decrease employment. Because of increased net replacement and earlier eligibility, this effect has moreover likely increased since the 1950s, and has increased since the late 1960s for the first of these reasons.

Federal Disability Insurance has since 1960 provided benefits to disabled workers of all ages. As Table 3 showed, the program has received increasing attention from potential eligibles, drawn by increased replacement rates and a not overly harsh interpretation of eligibility rules. While there is a five-month waiting period during which the person is not to be involved in substantial gainful activity, an initial denial of benefits still leaves the applicant four appeals levels; and the evidence (Haveman and Burkhauser, 1980) suggests that claimants are increasingly aware of this and increasingly successful in their appeals.

Like OASI under Social Security, Disability Insurance provides incentives that affect the NAIRU and aggregate employment. Workers with low market productivity, *either* because of severe impairments or because of minor impairments coupled with a lack of marketable skills, have a substantial incentive to apply for and continue to seek DI benefits. (This is not, though, a decision to be made lightly: Once eligibility is established, the individual cannot earn more than $280 per month and then reapply successfully for

benefits.) We should thus expect low-wage workers, minority workers, older persons, etc., to be represented disproportionately among DI recipients. Indeed, one might view DI partly as a retirement program for those in their fifties.

These predicted effects are exactly what we observe: Leonard (1979) shows that among males 45-54 nonwhites have twice the representation among DI recipients as they do in the labor force. He also shows that the probability of filing for DI is negatively related to one's past wage rate.[10] Haveman and Burkhauser (1980) show that the "overwhelming majority of DI benefits are initially made [sic] to workers age 50-64."

The most clearly demonstrated impact of the program's increased legal and administrative attractiveness to potential eligibles is on the labor-force participation of older men. Among nonwhites, for example, Siskind (1975) has shown using time-series data that much of the decline in participation can be attributed to the changes in the DI program. In a more complex model Leonard (1979) confirms Siskind's results. Parsons (1980) finds similar results for the participation of males ages 48-62 using cross-section data for 1969. He also finds that the effect of higher DI benefits in 1969 is greater among persons who died within the next few years and who presumably were in poor health when they filed for benefits. The results suggest strongly that the growth of DI has induced a decline in the NAIRU. All the groups which the program data and empirical work demonstrate are induced to leave the labor force are composed disproportionately of persons with an above average incidence of unemployment. This means that the composition of the labor force is shifted by DI benefits away from persons with higher unemployment rates, and thus that measured unemployment is lower at a given level of labor market tightness.

The effects of DI on the labor-market issues of interest—the NAIRU and the size of the work force—are the same as those of OASI: Market employment is reduced, as is the NAIRU. This rapidly growing program may well have contributed to reducing the rate of GNP growth, but it has also disguised some of the unemployment that would otherwise have been observed.

While the Food Stamp program is relatively new and has grown rapidly, AFDC payments were established under the Social Security Act and have grown relatively slowly in the last decade.

[10]Because of the problem of specifying full-capacity earnings to hold constant for the effects of health on the probability of filing, Leonard's results should be viewed as quite tentative.

Analytically, though, they can be lumped together for our purposes. The first consideration for each program is the work registration requirement each entails: Recipients of benefits must register with the state Employment Service and accept suitable work if such is found for them. Clarkson and Meiners (1977) have argued that this has induced a 2 percentage point increase in measured unemployment. The calculation is based on the assumption that no registrants would have been in the CPS labor force before the work registration requirement was imposed, and that all report themselves as unemployed in the CPS. Both assumptions seem highly questionable, and Cagan (1977) and Devens (1978) have argued that the Clarkson-Meiners number is greatly overstated. Without econometric evidence based on observation of the effect of Food Stamp or AFDC on labor force status, little credence appears owed to this finding. One would need longitudinal data to test the issue properly; though such are available, the test has not been undertaken. Perhaps the best conclusion on the issue, based upon consideration of the enforcement of the work-seeking requirements, is that there may have been some one-shot effect on the NAIRU in the early 1970s, but it was likely tiny.

If one believes the registration effect on the NAIRU was important, one must also believe that the requirement has induced an increase in employment and thus in aggregate supply: Some of these induced to register presumably did find work when they otherwise would not have. Since I do not believe the effect on the NAIRU is large, I do not believe this positive effect on employment is large either. Far more important is likely to be the effect of the benefit structure under both programs. Saks (1975), for example, has shown that the implicit tax rate on AFDC mothers in New York in 1967 was .6, and that there was a substantial guarantee. (Casual evidence suggests the implicit tax rate is somewhat lower today.) Similarly, Food Stamps have increasingly substituted for the negative income tax that was never enacted: There is no longer a purchase requirement; a certain amount of Food Stamps is guaranteed, and the allotment is reduced by less than 100 percent as other income increases. This implies that both programs will induce the usual negative effects on labor supply that we know are associated with negative income taxes, assuming, as seems likely, that recipients' supply elasticities are positive (see Saks, 1975, for strong evidence on this).

How much have the induced changes in labor supply resulting from AFDC and Food Stamps changed the NAIRU and aggregate employment in the past 15 years? Since AFDC has not expanded

relatively, it is hard to argue its effect has changed, so that one must conclude it has not contributed to *higher* unemployment or a changed employment rate. (Though, clearly, reducing the guarantee or the tax rate would increase supply.) Food Stamps are new since the mid-1960s, though; it is thus likely that they have affected unemployment and employment. However, as with the other programs that have reduced labor supply, one can reasonably argue that the reduction has been disproportionately among persons with the highest incidence of unemployment. Thus, if anything, the benefit structure of Food Stamps has reduced the NAIRU slightly. Without careful econometric evidence (and there is currently none), this conclusion is based only on a little logic and on an analogy to the demonstrated effect of other programs whose benefits can be modelled similarly to those of Food Stamps.

There are numerous other transfer programs that one could examine, and some, such as Workers' Compensation or Supplemental Security Income, are fairly important. However, there has been little or no work studying the effects of these other programs on the NAIRU or on employment; since the discussion above has given the flavor of the likely directions of the impacts of most programs, there is little point repeating the analysis absent specific empirical results. Suffice it to say that these other programs most likely accentuate the effects we have already discussed.

I have avoided analyzing the effect of income taxes on the NAIRU and on aggregate supply. While the latter issue has received tremendous popular attention (and far too little scientific analysis), the former has received none. There is no obvious direct effect of the progressive income tax on the NAIRU, though there may be some compositional effect of the sort we have stressed throughout this section. Whatever the impact of the income tax on the labor supply of high-wage earners, it is unlikely to have induced them to withdraw from the labor force. A reduction in weekly hours seems far more likely. Thus if anyone is induced to reduce market work to zero, it is probably those whose market opportunities are least attractive. To the extent that the income tax does affect supply—and, I stress, this has not been demonstrated directly—it has likely done so among persons with the greatest probability of being unemployed. Thus, if anything, the progressive income tax reduces the NAIRU by changing the composition of the labor force.

The effect of the progressive income tax on hours of employment cannot be answered here. (Hausman's paper covers this in more detail.) Nonetheless, we should note that the induced reduction in

output (assuming wage rates reflect marginal productivity) is $\sum_i t_i \eta_i w_i N_i$, where t is the marginal tax rate on the i'th group of potential workers; η is their labor supply elasticity; w is their market wage, and N is the number of persons in the group. Across different groups of workers both a higher marginal tax rate and a higher supply elasticity will induce a greater reduction in effort (and thus presumably in market output and real GNP). Among high-wage groups the marginal income tax rate on effort is fairly high; however, all the available evidence suggests η is quite low (Borjas and Heckman, 1978). Thus it is unlikely that income taxes are inducing much shortfall of output from this group and, conversely, laughable to think that tax reductions will induce a sharp rise in workhours and total earnings.

For low-wage groups the evidence is much less clear. While it is true that most studies find fairly high values of η for these groups (see Cain and Watts, 1973), some recent evidence suggests that, at least for women with children, these findings are due to fixed costs of entering the labor market (see Cogan, 1980). This suggests that the effect of increases in the marginal tax rate on hours of effort will be small. Also, the marginal tax rates on low-wage workers are not very high.

Taken together, the evidence says that it is unlikely that the progressive income tax has reduced employment much. Moreover, it has, if anything, reduced the NAIRU. There may be difficulties with the current income tax structure in this country; taxes may be "too high"; but these statements should not be based on fears about any huge detrimental effects on the labor market.

CONCLUSIONS

I would like to give one grand number indicating the effect of income transfer programs on the NAIRU. I cannot. All I can do is note that UI does raise unemployment, but that the other, often larger-scale programs have the opposite impact through their effects on the composition of the labor force. Since I have not been able to quantify these, I cannot weigh them against the effect of UI that I have previously "guesstimated." Nonetheless, if forced to pick one number to summarize the entire impact of transfers and taxes on the NAIRU, zero would appear to be a good choice. At the very least, it is a far better choice than that implied in the regressions in the second section or in much of the popular discussion.

Zero would be a very *bad* estimate of the effect of taxes on aggregate employment. Every program we have discussed likely reduces labor supply on net. While we have not quantified this reduction for all the programs and taxes discussed, the studies that have done so for particular programs suggest the decline is substantial. That transfers induce such a reduction should be especially disturbing, as the tax structure in the U.S. economy already contains a (probably increasing) bias against market work. (Though, as we saw above, its effects may not be very large.) While guessing the size of the induced drop in employment is not possible, it is worth noting that, if even one-half of the decline in participation of men 55+ has been caused by changes in OASI and DI benefits and regulations, that alone would have induced a .8 percent reduction in aggregate employment since the mid-1950s. The effect for the entire labor force is likely somewhat larger than this. This guess, though, creates a conundrum: Why has aggregate labor force participation risen by 3.6 percentage points since 1969, at the same time we estimate that taxes and transfers have induced a decline? Have nonmarket substitutes for women's time in the home experienced such huge relative price reductions? Has the structure of tastes changed (a thought that is repugnant to me as an economist)? Perhaps the real issue we should be addressing is: Why has the aggregate participation rate grown so much, departing from its long-term near constancy just below 60 percent?

While this is not a policy paper, a few conclusions for policy seem clear. The evidence is abundant that we cannot ease program eligibility and pay higher benefits without inducing changes in behavior. This raises program costs, and thus the taxes that finance the programs, and it targets benefits toward persons who were not (at least apparently) meant to be targeted. At a time when the older population is becoming healthier, DI has induced substantial decreases in participation of men 55-62. OASI benefits have done the same for persons 62+ and caught them in what Maggie Kuhn of the Gray Panthers has called the "retirement trap": They are induced to leave the labor force early, find they cannot maintain their financial status during an unexpectedly long retirement, and discover it is difficult to reenter the labor force at the same rate of earnings.[11] Clearly, unless we wish to see the growth rate of real per-capita income decline further, steps such as raising the

[11]Case histories and a discussion of this problem are presented in *Wall Street Journal*, November 5, 1979, p. 1 *et. seq.*

minimum age of eligibility back to 65 for men, and 62 for women, seem perfectly reasonable and consistent with a healthier and longer-lived population. Similarly, DI cannot be allowed to grow further into a retirement program, as that will reduce the benefits that the politics of the program will allow to be paid to the seriously disabled who do need them. In short, we risk hurting those persons for whom all these programs were designed by letting them expand far beyond their original purposes with no thought to the tax burdens they impose or their induced effects on production.

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Discussion of the Hausman Paper

JEFFREY M. PERLOFF

Jerry Hausman's paper makes major contributions to both the labor supply and taxation literatures. His paper provides the most reliable labor supply estimates to date since he takes account of the nonlinear budget constraint created by federal and state income taxes. His work also helps rectify the misleading approach taken by politicians, the popular press, and many economists which stresses the revenue effects of tax cuts: the relevant question is the welfare effect of tax cuts. Hausman is able (amazingly enough!) to rigorously calculate the deadweight loss imposed by a tax.

Of great policy importance is his conclusion that an across-the-board tax cut of the Kemp-Roth variety would lower welfare (and tax revenues), while a reduction in the progressivity of the tax could raise welfare. As Head argued in 1966, a progressive tax will have greater disincentive effects than a proportional tax so long as the economy is not in the prohibitive range where a reduction in the proportional tax rate would raise revenues.[1]

If (as Hausman defines it) the progressive tax differs from the proportional tax in that some level of income is exempted from the tax, then revenues collected under the progressive tax system will be less than under the proportional system for any marginal tax rate, as shown in Figure 1. Holding revenues fixed at $\bar{R}$, so long as the economy is not in the prohibitive range (as Hausman's estimates show), the marginal tax rate which corresponds to the proportional tax, t^*, will be less than that under the progressive tax, t^{**}. As a result, the proportional tax will have less of a disincentive effect, as shown in Hausman's estimates.

While Hausman's research is destined to become one of the classics of applied econometrics, I have a few minor quibbles. First,

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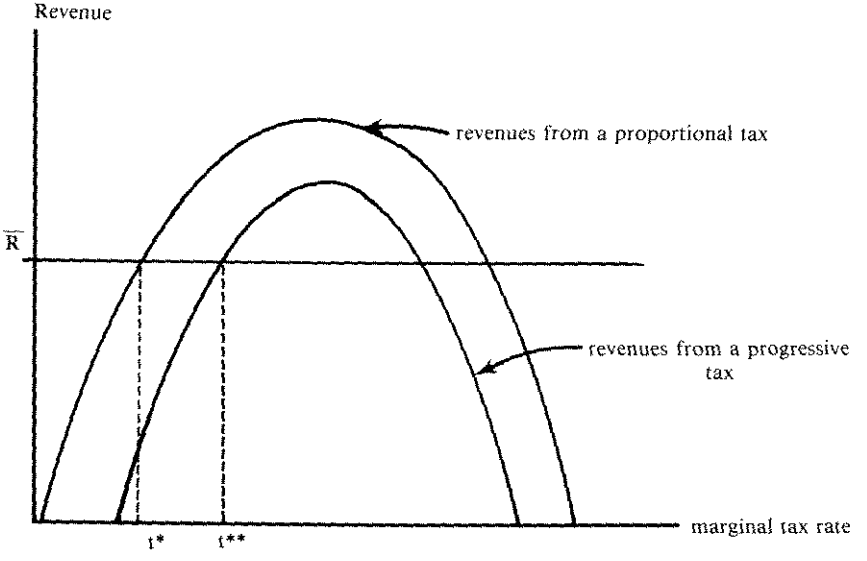
[1]Head, J. G., "A Note on Progression and Leisure: Comment," *American Economic Review*, V. 56, 1966, pp. 172-179.

FIGURE I



the effects of taxation on the amount of education people undertake may be pronounced. This effect, however, is likely to reinforce the distortions Hausman estimates.[2] Second, the estimation process used assumes that the income effect is always normal, which seems unreasonable in general.

Third, these estimates presume individuals know their marginal tax rates. There is some justification for this approach, however, according to Harvey Rosen and some of Hausman's other papers, so this potential problem is probably not serious.[3] Fourth, Hausman assumes that women are the secondary workers in a family, while it would have been more reasonable to assume that the lower wage family member was the secondary worker. Hausman is currently working on a model where the family makes a joint decision so that this problem will be eliminated in the future. In any case, in his sample, few if any households had women earning more than their spouses.

[2]Perhaps some handle on this effect can be obtained by examining people who made their education decisions before WWII when income taxation was relatively unimportant.

[3]Rosen, Harvey S., "Taxes in a Labor Supply Model with Joint Wage-Hours Determination," *Econometrica*, V. 44, N. 3, May, 1976, pp. 485-508.

One should show care in interpreting some of Hausman's results (though he is fairly careful about pointing out these limitations). Because utility levels are different across experiments, one cannot compare deadweight losses directly. Moreover, his implicit social welfare function, which is not very egalitarian, favors the policy prescription which he favors. Finally, his experiments where he compares progressive and proportional taxes are (necessarily) relatively arbitrary. A more reasonable experiment might be to reduce the number of kinks in the progressive tax constraint rather than eliminating all but one kink. That is, an intermediate policy might be even more favorable to Hausman's argument.

Hausman also argues that his results, while partial equilibrium in nature, are likely to be close to the general equilibrium effects. Since this proposition was not immediately obvious to me, I tried a few "back of the envelope" calculations to confirm this conjecture.

A tax on labor income will have complicated general equilibrium effects. While the taxes are likely to influence capital, energy, output prices, and wages, Hausman's partial equilibrium analysis implicitly treats these variables as constants. The calculations reported here are actually less partial equilibrium than Hausman's rather than fully general equilibrium results, since capital and other variables are still treated as constants: only wages are allowed to adjust. In some sense, these results may be viewed as "short-run" general equilibrium ones, where the labor market has time to adjust, but the other markets have not yet adjusted.

Suppose, for simplicity, the labor supply equation is written as

$$i = ((1 - t_i)w_i)^{d_i} I^{b_i}, \tag{1}$$

where i represents the hours worked by the i^{th} group, t_i is their marginal tax rate, w_i is their wage, d_i their after-tax wage elasticity, and I is the nonearned income. The tax-supply elasticity is

$$\eta_i = \frac{\partial i/i}{\partial t_i/t_i} = \frac{-t_i}{1-t_i} d_i. \tag{2}$$

The demand for each demographic group is derived from an aggregate translog production function (assuming competition):

$$w_i = \frac{Q}{i}(\alpha_i + \sum_j \gamma_{ij} \ln j) \equiv \frac{Q}{i} M_i, \tag{3}$$

where Q is aggregate output and M_i is the factor share of the i^{th} group ($M_i = w_i i$/total cost).

Combining (2) and (3) and differentiating, we obtain

$$(4)\quad \varepsilon_{ii} = \frac{\partial i/i}{\partial t_i/t_i} = \frac{t_j}{1-t_i}\, d_i \,\frac{1}{\left((M_i+\gamma_{ii}/M_i)d_i - (d_i+1)\right)}$$

$$\equiv \eta_i\theta_{ij},$$

$$(5)\quad \varepsilon_{ij} = \frac{\partial i/i}{\partial t_j/t_j} = \frac{t_j}{1-t_j}\, d_i \times$$

$$\frac{\gamma_{ij}/M_i + M_j}{\left((M_i+\gamma_{ii}/M_i)d_i-(d_i+1)\right)\left((M_j+\gamma_{jj}/M_j)d_j - (d_j+1)/d_j\right)}$$

$$\equiv \eta_i\theta_{ij},$$

and, if $t_i = t_j = t$,

$$(6)\quad \varepsilon_i = \frac{\partial i/i}{\partial t/t} = \frac{t}{1-t}\, d_i \times$$

$$\frac{1-(\gamma_{ij}/M_i+M_j)/M_j+\gamma_{jj}/M_j-(d_j+1)/d_j)}{\left((M_i+\gamma_{ii}/M_i)d_i-(d_i+1)\right)}$$

$$\equiv \eta_i\theta_i.$$

If the production function uses a single labor index, then only equation (6) is relevant. Using an aggregate production function with aggregate labor, capital, and energy factors, then in 1977 fourth quarter:[4]

d_i	θ_i
0.1	0.9748
0.2	0.9508
0.3	0.9279
0.5	0.8854
1.0	0.7944
2.0	0.6589

[4]This production function, the estimated coefficients, and a description of the data is contained in Jeffrey M. Perloff and Michael L. Wachter, "A Production Function-Nonaccelerating Inflation Approach to Potential Output: Is Measured Potential Output Too High?" Carnegie-Rochester Conference Series Vol. 10, 1979, *Journal of Monetary Economics*, pp. 113-163.

That is, the supply elasticity η_i is only likely to deviate substantially from the equilibrium elasticity, ε_i, if d_i is relatively large. For example, if

$d_i = .1$, then $\varepsilon_i = 0.9748\eta_i$; while if $d_i = 1.0$, $\varepsilon_i = 0.7944\eta_i$.

There is substantial evidence, however, that it is inappropriate to aggregate labor into a single index. Grant and Hamermesh, using 1969 cross-sectional manufacturing data in a translog production function, have shown that it is reasonable to aggregate youths and white females, but that it is not reasonable to aggregate all of labor. Using time series data, Michael L. Wachter and I have estimated a comparable production function for the private economy using inputs of capital, energy, prime age males (M), and all other labor (0).[5] Using our estimated coefficients, the following adjustment factors can be calculated using equation (6):

d_O	d_M	θ_O	θ_M
0.1	0.1	0.982	1.000
0.1	0.5	0.991	0.907
0.1	1.0	0.999	0.813
1.0	0.1	0.832	1.192
1.0	0.5	0.839	1.082
1.0	1.0	0.846	0.969

Thus, if d_M is approximately 0.1 and d_O is approximately 1.0, then $\varepsilon_M \cong 1.192\eta_M$ and $\varepsilon_O \cong 0.832\eta_O$. That is, the equilibrium elasticity for prime age males would be almost 20 percent higher than the supply elasticity, while the supply elasticity would be almost 20 percent higher than the equilibrium elasticity. Of course, even if Hausman's estimates were off by as much as 20 percent, it would make no difference to most of his conclusions.

Hausman's analysis is very useful in determining the costs of our income tax system. This cost must be balanced against the benefits of government goods and services and transfer programs. It should be noted, however, that a substantial part of funds collected at

[5] A similar model is described in "Productivity Slowdown: A Labor Problem?" in *The Decline in Productivity Growth*, Federal Reserve Bank of Boston Conference Series No. 22, June, 1980, pp. 115-142. The only difference in that model is that one labor series consists of young people (under 25 years) and the other of older workers. The coefficients are: $M_O = .23465$, $M_M = .49218$, $\gamma_{OO} = .13152$, $\gamma_{MM} = .12096$, $\gamma_{OM} = -.10972$

some levels of government go to collecting taxes. Small U. S. counties (populations under 100,000) spent 7.4% of their tax revenues, on average, on financial administration; while the federal government spent only about 0.7%. These figures are low, since they include only central fiscal operations (which reached $1,798 million for the federal government in 1976). The U. S. government spent 6.22% of tax revenues on general administration (which includes the cost of tax collection and all administration costs not directly attributable to specific programs).[6]

[6]These statistics are discussed in Dick Netzer, "State-Local Finance and Intergovernmental Fiscal Relations," in *Economics of Public Finance*, (Washington, D. C.: The Brookings Institution, 1974) and Jeffrey M. Perloff "Economies of Scale in Tax Collecting: Evidence for the U. S. and Abroad," Working Paper.

Discussion of the Hamermesh Paper

FREDRIC RAINES

Daniel Hamermesh has undertaken an extensive survey of what we know about the impact of income maintenance programs on employment, unemployment and labor force participation. Reflected in this paper is an awesome amount of research, both that of others and his own. And, on balance, he has done an excellent job of synthesizing this literature. He is, certainly, the resident expert in this area among us. If this conference is a supply-side harvest, we may note that Hamermesh has been busy tilling the fields, and gathering the crops.

However, there are problems. The first problem Hamermesh has is where to look for evidence of supply-side effects. He starts by looking at macro time series data, regressing $\log \frac{U^*}{100-U^*}$ (where U^* is the unemployment rate adjusted for shifts in demographic composition) on lagged values of two policy variables:

(1) NRR—net replacement rate of aggregate transfers payments;

(2) TAX—the overall tax rate on earnings.

Unfortunately the results seem not to be to his liking, though they would warm the heart of a Lafferite. A one standard deviation increase in NRR from its mean raises U^* from 5% to 7.85%, and a similar increase in tax raises U^* from 5% to 6.19%.

Hamermesh then decides that truth may only be revealed by an examination of the effect of individual programs. But not everybody's examination. For instance, the 1973 study of benefits by Feldstein, which finds that Unemployment Insurance benefits and taxes have raised NAIRU by 1.25 percentage points, and a 1977 study by Clarkson and Meiners, which finds that AFDC (Aid to Families with Dependent Children) plus Food Stamps have raised the measured unemployment rate by 2 percentage points, are rejected as patently too large.

Finally Hamermesh hits upon a solution. He takes the Perloff and Wachter (1979) finding that NAIRU has increased since the

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mid-1950s by about 2 percentage points (of which slightly less than 1 percentage point is due to demographic shifts), and sees if, by an examination of individual programs, he can work up to that modest total. He also investigates what appear to be the more important effects of income maintenance programs—those on employment.

A point about what it is we are trying to measure the effect on is in order here. Hamermesh makes it quite clear that a given program may have distinctly different effects on employment and unemployment. But the unemployment concept that he chooses, and the one commonly used in these studies—NAIRU—is, I would argue, incorrect.

NAIRU refers to that rate of unemployment associated with balance in the *product market.* But the relevant concept for labor market studies is that unemployment rate which is consistent with a balanced—the number of job vacancies equal to the number of unemployed workers, say—*labor market.* Unless you are sufficiently neo-classical to deny or ignore differing adjustment speeds, these two concepts need not yield the same number. Indeed, if I define the latter concept as a "full employment" benchmark adjusted over time for demographic shifts—call it the natural rate of unemployment (NRU)—then I can cite the above Perloff and Wachter study as giving evidence that NRU and NAIRU have been diverging over time. But the point is that NAIRU might be consistent with a 5 percent unemployment rate at one point in time, and an 8 percent rate at another, without there being any implication or deducible inference for the impact of supply-side programs on unemployment.

Putting this consideration aside, what does Hamermesh find? Examining research on four different programs: Unemployment Insurance (UI), Social Security, Disability Insurance (DI), and Aid to Families with Dependent Children plus Food Stamps (AFDC/FS), the consensus he finds is that the employment effects (and labor force participation effects) are negative in each case. However, the unemployment effects are mixed, implying reductions in NAIRU for Social Security and DI, and increases in NAIRU for UI and AFDC/FS. For the overall net effect on NAIRU of these programs, Hamermesh likes the number "zero."

It should be pointed out that Hamermesh gets his reductions in NAIRU entirely through changes in the composition of the labor force. Those induced to leave the labor force due to the benefit structure of Social Security and DI, for instance, are assumed to be those with below average marketable skills and above average

unemployment rates. This is a testable proposition, and while Hamermesh does present some evidence, the full implications do not appear to have been explored. One implication is that average worker productivity should have been increasing as a result of these programs. If so, it was much more than wiped out by other factors. Another implication, which does seem borne out by overall participation data, is that the composition of the labor force is tilted toward younger workers.

One may ask, is the Hamermesh approach of counting the trees to measure the forest a reasonable one? I strongly agree with him that the foundations of imputing a supply-side effect must come from observing micro behavior. There are just too many complexities that get washed out in aggregate data—and our policy proposals must deal with these complexities. At the same time, the effect of these individual programs may not be additive as Hamermesh is inclined to assume. For example, Hamermesh concludes that the net effect of AFDC/FS on labor force participation, employment, and NAIRU is slight. This conclusion is based in part on the gradual reduction in the AFDC implicit tax rate over time. But the AFDC implicit tax rate compounds with the food stamp implicit tax rate, and these compound with the implicit tax rate for Medicaid, Housing Assistance, Child Nutrition, and a few other programs. This is known as the "stacking" problem, and it implies overall effective tax rates in many cases in excess of 100 percent with numerous notches and kinks. If a 100 percent tax rate doesn't have any effect on labor supply then Laffer is really barking up the wrong tree.

I have a final comment to make on "where to look" for supply-side effects. I think that, methodologically, we may want to examine the trees, but conceptually we should be thinking about the forest. The subsidies and implicit taxes of welfare programs, the tax system, and the pattern of government spending are imbedded in our institutions and our culture. I don't know what it means to say that if you abolish UI, the unemployment rate will decline by 3 percentage points. What is being held constant and what is changed? There are important trends to be explained—slow economic growth, virtually stagnant productivity, chronic inflation, dramatic shifts in labor force composition—and the causes may be bigger (or at least more subtle) than our independent variables.

But the tax/transfer system, in toto, does make a difference: consider the following data on income distribution prepared by Watts & Skidmore (1977):

INCOME SHARES OF HOUSEHOLDS

	Before Taxes and All Transfers	[a]After Taxes and Transfers
lowest 40 percent	7.5%	17.8%
highest 40 percent	76.2%	64.7%

[a]Programs include insured cash transfers, cash assistance, in-kind transfers, and income and payroll taxes.

One way of looking at these numbers is to say that government programs currently move one third of the way toward instituting a completely egalitarian income distribution. I have no idea what a redistribution of this order of magnitude—and the policies that brought it about—entails for the economic behavior of individuals. But I would venture the guess that those seriously concerned about supply-side economics have bought themselves a rather large and complex research agenda.

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