NBER WORKING PAPER SERIES

THE EFFICIENCY COST OF INCREASED PROGRESSIVITY

Robert K. Triest

Working Paper No. 4535

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
November, 1993

This is a revised version of a paper prepared for the Office of Tax Policy Research Conference on Tax Progressivity, University of Michigan, September 11-12, 1992. I would like to thank Charles Ballard, Gary Burtless, Joel Slemrod, Steven Sheffrin, conference participants, participants at the November 1992 National Tax Association - Tax Institute of America annual conference, and several referees for very helpful comments. This paper is part of NBER's research program in Public Economics. Any opinions expressed are those of the author and not those of the National Bureau of Economic Research.

NBER Working Paper #4535
November 1993

THE EFFICIENCY COST OF INCREASED PROGRESSIVITY

ABSTRACT

Increases in income tax progressivity generally entail some efficiency cost due to increased distortion of individuals' labor supply decisions. This paper quantifies the magnitude of the efficiency cost of several policies which would increase the progressivity of the U.S. individual income tax. The analysis differs from previous work on this topic in allowing for complex nonlinear tax schedules similar to those which actually exist. The efficiency cost of increased progressivity is found to vary considerably with the type of tax reform considered. Expanding the earned income tax credit (EITC) is found to be a particularly efficient means of increasing progressivity. Using the labor supply parameters I consider most reasonable, I find that the efficiency cost of expanding the EITC financed by increased tax rates in the intermediated brackets is less than 20 cents per dollar transferred from the upper income groups to the lower income groups.

Robert K. Triest
Department of Economics
University of California - Davis
Davis, CA 95616-8578
and NBER

I. Introduction

In considering the optimal degree of income tax progressivity, economists and policy makers have long been concerned with the effect of taxation on labor supply. The disincentive effect of taxation on labor supply played a central role in discussions regarding the desirability of introducing a negative income tax system in the 1970's, and was part of the motivation for the "supply side" tax cuts in the early 1980's. Most models of optimal income taxation depend critically on the response of labor supply to taxation. Increased income tax progressivity comes at the cost of increased distortion in individuals' choice of hours of work. Policy makers must decide on what trade-off between equality and efficiency they are willing to accept in determining the progressivity of the tax system. In general, the more responsive labor supply is to economic incentives, the greater will be the efficiency cost of increased progressivity.

Due to the pivotal role of labor supply in tax and transfer policy discussions, a voluminous literature attempting to estimate how labor supply responds to economic incentives grew during the 1970's and 1980's. A much smaller literature has developed which uses the labor supply estimates to attempt to quantify the trade-off between equality and efficiency which exists in the United States. In an influential study, Browning and Johnson (1984) estimate that it costs those in the top three quintiles of the income distribution \$3.49 in reduced economic well being when the U.S. tax and transfer system is used to increase the welfare of those in the bottom two income quintiles by one dollar. In other words, there is an efficiency cost equal to \$2.49 per dollar transferred to the lower income groups.

Their estimate is based on a simulation in which the marginal tax rate on labor income is increased by one percentage point for all households (each household faces a linear budget constraint), and the resulting increase in revenue is then distributed in the form of equal per-capita cash grants ("demogrants").

Ballard (1988) estimates a much lower efficiency cost of increasing progressivity through the use of a similar tax increase/demogrant scheme. In the simulations he puts the most emphasis on, the efficiency cost of transferring one dollar from the upper income groups to the lower income groups is between 50¢ and $1.30. Ballard also investigates the cost of increasing progressivity through use of a "notch grant" program, in which a cash grant is increased for low income groups financed by increasing the marginal tax rate faced by higher income groups (assignment to an income group is exogenous and all individuals face linear budget constraints), and through use of a wage subsidy for low income workers (again, assignment to the low income category is exogenous and all individuals face linear budget constraints). Ballard estimates that the efficiency cost of both of these programs is much smaller than is the case for the demogrant policy, and is close to zero for the wage subsidy program.

In this paper, I reexamine the issue of the efficiency cost of increased progressivity. My analysis differs from earlier work on this question in allowing for complex nonlinear tax schedules similar to those which actually exist. I also incorporate the results of recent research on the effect of taxation on labor supply, which suggests that labor supply may be less responsive to taxation than had previously been thought. I find that the efficiency cost of increased progressivity varies considerably with the type of tax reform considered. Using the labor supply parameters I consider most reasonable, I find that the efficiency cost of increasing progressivity by expanding the earned income tax credit (EITC) is less than 20¢ per dollar transferred from the upper income groups to lower income groups when it is financed by increasing tax rates in the intermediate brackets. Increasing tax rates applying only to upper income taxpayers results in a higher efficiency cost of increased progressivity. Two alternative means of increasing tax progressivity, a general refundable tax credit program and increasing the value of the personal exemption, also have higher efficiency costs.

The next section reviews recent work analyzing the effect of taxation on labor supply. Section three outlines the simulation methodology which I use to investigate the economic cost of increased progressivity. The simulation results are presented and analyzed in section four. Section five concludes the paper with a brief summary of the findings.

II. Recent Work Estimating the Effect of Taxation on Labor Supply

Research analyzing the effect of taxation on labor supply has increasingly adopted a methodology, originated by Burtless and Hausman (1978), which takes full account of the way in which tax and transfer programs affect individuals' budget constraints. A recent exposition of this methodology is provided by Moffitt (1990). An important insight gained from the development of this method is that an income tax system with marginal tax rates which vary with taxable income combines a reduction in the net wage with an implicit lump sum subsidy equal to the difference between the tax an individual would pay if she faced her current marginal tax rate over the full range of taxable income and the tax she actually does have to pay. Burtless and Hausman (1978) called the sum of nonearned income and the implicit lump sum subsidy "virtual income", since an individual locating in a given tax bracket is acting as though she has unearned income equal to her actual non-labor income plus the lump sum subsidy implicit in the tax system. This is illustrated in figure 1, which is an indifference curve diagram depicting the labor supply decision of an individual who has no unearned income and is subject to a simple two bracket earnings tax (with the marginal tax rate in the second bracket greater than the marginal tax rate in the first bracket). The individual is in the first tax bracket when she works less than H^* hours. When the individual works H^* hours, her taxable income puts her on the border between the two tax brackets. When she works more than H^* hours, she is in the second tax bracket. Her net wage is then lower than it was in the first bracket, and she acts as though she were receiving an implicit lump sum subsidy equal to that labeled "virtual income" in the diagram.

In a very influential study, Hausman (1981) estimated a fairly large (and negative) income effect for married men. Although Hausman estimated an uncompensated wage effect which was very close to zero, he found that the 1975 U.S. tax system resulted in a large decrease in male labor supply through the virtual income effect. However, more recent work estimating the impact of income taxation on male labor supply has generally tended to find fairly small effects. In a recent paper (Triest, 1990), where I estimated a specification very similar to that of Hausman (1981), I estimated that the uncompensated wage elasticity of married American men is 0.06 when evaluated at sample mean values; this compares to an elasticity of less than 0.01 estimated by Hausman.[1] I estimated an income elasticity of zero, much smaller than Hausman's (1981) estimate of -0.17.[2] MaCurdy, Green and Paarsch (1990) also found that male labor supply is largely unresponsive to economic incentives. When they imposed parameter restrictions insuring that the nonnegativity of the compensated wage elasticity, both the wage and income elasticities were driven to zero. One interpretation of their results is that male labor supply is completely insensitive to economic incentives.

It is not particularly surprising to find that parameter restrictions need to be imposed to prevent the estimated compensated wage elasticity from being negative. In a recent survey of the male labor supply literature, Pencavel (1986) provides a table summarizing the results of fourteen male labor supply studies using nonexperimental U.S. data. Six of the fourteen studies estimate compensated labor supply elasticities which are either zero or negative. However, to some degree this is probably due to the failure of some of these studies to properly account for the effect of taxation. As Hausman (1985) notes, ignoring taxation will induce a downward bias in the estimate of the uncompensated wage elasticity.

Burtless (1987) reviews the results from labor supply studies using data from the income maintenance experiments of the late 1960's through early 1980's. He reports that male uncompensated wage elasticities estimated using experimental data are clustered tightly around zero. Compensated wage elasticities average about .08. Overall, data from the income maintenance experiments indicate that male labor supply is not very responsive to economic incentives.

Bosworth and Burtless (1992) construct time series based on micro data from the Current Population Survey in an effort to determine the effect of the Reagan era tax changes on labor supply. They find that male labor supply is six percent higher in 1989 than it would have been had the trend from 1967-80 continued through 1989. While this provides some support for the view that the decreases in marginal tax rates during the 1980's stimulated labor supply, the distribution of the hours increase by income quintile does not. Men in the bottom quintile increased their labor supply (relative to trend) more than did those in other quintiles in both absolute and percentage terms. Bosworth and Burtless note that low-income men faced constant or rising marginal tax rates during most of the 1980's. Thus, it is hard to draw any conclusion from this evidence regarding the effect of the 1981 and 1986 tax changes.

Overall, the bulk of the evidence on male labor supply suggests that there are only minor incentive effects. While it is important to take any incentive effects into account in analyzing possible tax or transfer program changes, one needs to view efficiency cost calculations based on large male labor supply elasticities with some skepticism.

Female labor supply was long thought to be much more elastic than that of men, but this view has changed somewhat in recent years. Mroz (1987) finds that the large wage and income elasticities produced in many previous studies are the result of assumptions which can be statistically rejected. The use of a standard tobit specification to control for self-selection into the labor force, treating the wage rate as exogenous, and treating prior labor force experience as exogenous can all be rejected. He concludes (p. 795) that "...economic factors such as wage rates, taxes, and nonlabor incomes have a small impact on the labor supply behavior of *working* married women." However, Mroz's results are consistent with economic factors having a large impact on the labor force participation decision.

In estimating a model of married women's labor supply similar to that of Hausman (1981), I (Triest, 1990) found that the estimation method used made a great deal of difference. Including data on nonparticipants in the estimation resulted in uncompensated wage elasticities (evaluated at the sample means of women with positive hours of work) of approximately .9, and virtual income elasticities of about $-.3$. Hausman (1981) estimated an uncompensated wage effect of similar magnitude, but a virtual income effect over twice as large. When I estimated the same specification, but used only data on women with positive hours of work (with an appropriate statistical adjustment), the uncompensated wage elasticity fell to approximately .27 and the virtual income elasticity fell to about $-.16$.

The decrease in the magnitude of the wage and income elasticities when one goes from a censored (including observations with zero hours of work) to a truncated (excluding observations with zero hours of work) specification is consistent with Mroz's (1987) work. Mroz similarly finds that wage and income elasticities drop in magnitude when switching from a censored to a truncated tobit specification (in a model without taxes). Moreover, he finds that the elasticities drop by an even larger amount when one switches from a truncated tobit specification to a more general self-selection correction. Mroz is able to reject both the censored and truncated tobit specifications in favor of the more general specification. This implies that even the relatively small elasticities I estimated using the truncated specification may be too high. However, it is important to recall that Mroz's results apply only to working women.

Burtless (1987), in summarizing the literature examining the effect of the income maintenance experiments on female labor supply, notes that studies based on the experimental data tend to produce much smaller wage elasticity estimates than do studies based on non-experimental data. For wives, the average uncompensated wage elasticity is approximately $-.04$ in the experimental studies (.07 when the studies are weighted to account for differences in sample size). In contrast, the average uncompensated wage elasticity in the nonexperimental studies considered by Burtless was nearly 2.

Bosworth and Burtless (1992) attempted to measure the effect of 1980's tax changes on female labor supply in the same manner that they did for men. As with men, labor supply appears to have increased in the 1980's (relative to trend), with the largest increase in the lowest income quintile. However, unlike the case for men there was also a sizable increase in hours of work for women in the top quintile. Although Bosworth and Burtless claim that "It is likely that part of the estimated change among high-income women is attributable to marginal tax rate reductions" (p.13), the increase in hours among low income women casts some doubt on using this type of analysis to make inferences regarding the effect of tax policy. Nonetheless, it would be very surprising if the marginal tax rate decreases had no effect on the labor supply of women in the top quintile.

Overall, recent work on female labor supply has called into question the assumption that women's hours of work is highly responsive to economic incentives. In simulating the efficiency cost of progressivity, using low to moderate wage and income elasticities seems most reasonable.

All of the labor supply research reviewed in this section has taken the overall structure of the tax system as given. Changes in the range of deductible expenditures and other opportunities for tax avoidance have not been considered. However, the Tax Reform Act of 1986 changed much more than just the rate structure of the income tax. The response of labor supply to taxation may vary considerably depending on the opportunities for tax avoidance.[3] For this reason, one must be cautious in using labor supply estimates to analyze the effect of a tax reform which changes the tax base or opportunities for avoidance.

III. Simulation Methodology

The main purpose of this paper is to explore the implications of the labor supply research described in the previous section for the economic cost of increased progressivity. In order to do this, I first constructed a database using the Panel Study of Income Dynamics (PSID) data. A budget constraint relating consumption and leisure was imputed to every PSID sample member. I then assumed a specific functional form for labor supply (which implies a functional form for the underlying preferences), calibrated the labor supply functions given four sets of possible behavioral parameters, and simulated the effects of various possible tax reforms which would tend to increase progressivity. The remainder of this section describes the simulation methodology in greater detail.

The data for the simulations comes from wave XXI of the Panel Study of Income Dynamics (Survey Research Center, 1991). This wave was collected in 1988, but pertains to calendar year 1987. Family observations were selected if both the family head and spouse (if present) were between 20 and 60 years old. Only the income and labor supply of the family head and spouse is considered in the simulations. While this is restrictive, relatively little is known about the effect of taxation on other family members. The reason for imposing the age restriction is to avoid complications involved in modeling retirement behavior. To the extent that the labor supply of those over sixty is relatively inelastic, or influenced primarily by social security, private pensions, or health status, the omission of the old may result in an upward bias in the efficiency cost estimates.

For non-workers, a wage was imputed based on a simple regression.[4] Non-earned taxable income was calculated based on federal tax imputations made by the PSID staff.[5] The PSID tax payment imputations are fairly sophisticated, and allow for itemized deductions to increase with income. In constructing the budget constraints facing potential workers, I treated eligibility for participation in the AFDC and food stamps programs as exogenous. Families receiving any benefits from these programs in 1987 were considered eligible, and others considered ineligible. Given the complex eligibility rules, and the fact that not all eligible families participate in these programs, I did not want to attempt to simulate the program participation decision. The tax reforms I consider do not increase the desirability of program participation, so treating eligibility as fixed should not be a serious problem. I assumed that AFDC benefits would be reduced 70 cents for every dollar earned, and that food stamps would be reduced by 30 cents for every additional dollar of income (including AFDC payments) received.[6] Food stamps were assumed to be valued by recipients at their face value. The eligibility rules and benefit reduction rates for food stamps and AFDC are not based on an annual accounting period. In reality, families may spend only part of any given year participating in the program. In this case, their effective marginal tax rates would vary considerably over the year. Thus, my procedure, which assumes families are either participating or not participating for the entire year, should be viewed as a rough approximation.

One explanation of why the participation decision is more sensitive to economic incentives than is hours of work given participation is the existence of fixed costs associated with working. I assume that women face fixed monetary costs of working which vary with family size and the number of young children according to a function estimated by Hausman (1981).[7] Women are assumed to incur this cost with the first hour of work. Hopefully, incorporation of fixed costs into the simulations results in a realistic model of the participation decision even in the scenarios with low assumed wage and income elasticities.

It is difficult to know how to treat the Social Security payroll tax. To some extent, workers may view the tax as contributions toward the purchase of an annuity which they will receive after retiring. The degree to which it is rational for a worker to do this depends on the worker's age, sex, earnings stream, and whether he or she expects to have a dependent spouse after retiring

(Feldstein and Samwick, 1992). As a crude approximation, I assume that workers treat the employee paid part of the tax as a true tax, and ignore the employer paid portion. In 1987, the employee paid combined Social Security and Medicare tax rate was .0715 on earnings up to $43,800, and zero on earnings above $43,800.

The earned income tax credit plays an important role in many of the simulations. In 1987, workers could receive a tax credit equal to 14 percent of the first $6080 of their earnings. The credit was reduced by 10 cents for every dollar that adjusted gross income (AGI) or earnings (whichever was greater) exceeded $6920. The credit was reduced to zero at an earnings or AGI level of $15,432.

The 1987 U.S. federal individual income tax had six brackets, with marginal tax rates ranging from 0 to 38.5%. Table 1 shows the rate schedule (as a function of gross income) applicable for a married couple filing jointly who are eligible for three exemptions, who do not itemize deductions, and who do not have other adjustments to income. The third column in this table displays the implicit lump sum subsidy (virtual income adjustment) for each tax bracket. Figure 2 shows how tax liability varies with gross income (for a couple with the same characteristics assumed in table 1, and making the additional assumptions of their having no unearned income and only a single wage earner), taking into account the combined effects of the federal individual income tax, the earned income tax credit, and the employee paid part of the Social Security and Medicare tax.

Household heads and spouses are assumed to have preferences (each spouse with a separate utility function) which result in desired hours of work (h) being a linear function of the net wage

(w) and virtual income (y):[8]

$$h = \gamma + \alpha w + \beta y$$

This functional form was chosen since it has often been estimated. Thus, it is easy to pick α and β values (which are allowed to vary by sex) that are consistent with previous empirical work. The intercept term, γ, is allowed to vary over individuals. For each individual (and for each set of assumed α and β values), it is set by finding the value of γ such that the observed value of hours of work is locally optimal.[9] After the γ values are determined, the observed values of h are checked to see if they are consistent with global utility maximization. When a value of h yields higher utility than the observed value, it is substituted for the observed value.[10]

In the case of married couples, each husband was assumed to make his labor supply decision ignoring the hours of work decision of his wife. Each wife was assumed to make her labor supply decision taking the hours of work of her husband as fixed.[11] While these assumptions are often made in the labor supply literature, and simplify the simulations, they are unlikely to be accurate. Future work should incorporate a more realistic model of household decision making.

The simulations consist of specifying a particular tax policy parameter change (such as increasing the 15% federal rate to 16%) and then allowing another policy parameter (such as the range over which the 14% bracket of the earned income tax credit is applicable) to change to the extent necessary to keep the total amount of revenue raised the same as in the original situation.[12] Decreases in transfer payments due to increases in hours worked are counted as tax revenue increases.

IV. Tax Progressivity Simulations

Table 2 displays the four sets of labor supply parameters which were used in the simulations; the last lines of tables 4a (for men) and 4b (for women) display the net wage and virtual income elasticities (evaluated at the sample means) for the four parameter sets. Parameter set 1 consists of parameters estimated in my 1990 paper, adjusted for the change in the consumer price index. The coefficients for women are from a specification using data only on those with positive hours of work.[13] I take this set of parameters as the base case. The male labor supply parameters in parameter set 2 are those estimated by MaCurdy, Green and Paarsch (1990) in their "Slutsky constrained differentiable budget constraint" specification. The female labor supply parameters are equal to one half the values in parameter set 1. Parameter set 2 is meant to represent lower bound estimates of the responsiveness of labor supply to taxation. The male labor supply parameters in parameter set 3 are the same as those in parameter set 1, while the parameters for women are those I estimated using a censored tobit-like specification (using data on both participants and non-participants). Parameter set 4 is based on estimates by Hausman (1981), adjusted for changes in the price level. This set of parameters represents an upper bound to plausible estimates of the responsiveness of labor supply to income taxation.

In order to allow for differences by family size in the cost of reaching a given level of economic well being, I adjust the after-tax and transfer income of the family head and spouse using a crude equivalence scale. Based on the federal poverty scales, Cutler and Katz (1992) estimate that the number of equivalent persons per family is equal to $(A + .76\,K)^{.61}$, where A is number of adults and K is number of children. I use after tax and transfer income per equivalent person (calculated using the Cutler and Katz estimates) as the basis for sorting families into deciles of the income distribution. Table 3 presents descriptive statistics by decile of after tax and transfer income per equivalent person. "Selected transfers" in this table is equal to the sum of AFDC, Supplemental Security Income (SSI), food stamps, and Social Security benefits. Note that the mean marginal tax rate decreases over the first four deciles, and then increases with income thereafter. Families in the bottom two income deciles often face very high benefit reduction rates (implicit marginal tax rates) in the AFDC and food stamp programs. The earned income tax credit reduces the overall marginal tax rate at very low levels of income, but increases the marginal tax rate by ten percentage points at slightly higher levels of income as the credit is phased out. Since not all families are eligible for AFDC, foodstamps, or the EITC, there is a high degree of heterogeneity in the marginal tax rates faced by lower income families.

One feature of the linear labor supply specification adopted in this study which merits attention is that the magnitude of the net wage and virtual income elasticities increase with, respectively, the net wage and virtual income. Since the mean net wage and virtual income values increase with adjusted (using the equivalence scale) family income, the labor supply elasticities also tend to increase with adjusted family income. In tables 4a and 4b the labor supply elasticities implies by the four parameter sets are displayed by deciles of adjusted family income. The pattern of elasticities increasing with family income implies that the linear labor supply specification is "biased" against tax reforms which increase marginal tax rates on very high income groups. A constant elasticity specification (with elasticities equal to the mean values of the elasticities from the linear specification) would show a smaller deadweight loss due to increasing the marginal tax rate on upper income groups.

The first progressivity increasing reform which I consider is using a one percentage point increase in the 1987 15% and 28% federal marginal tax rates to increase the range of earnings over which the earned income tax credit increases (at a rate of 14%); the range of income where the EITC is phased out (at a rate of 10%) is also increased in this reform. The effect of this reform on an individual's budget constraint is shown in figure 3. The individual (who is assumed to have no unearned income, to be eligible for the EITC, to be ineligible for food stamps and AFDC, and to face no fixed costs associated with working) enjoys the 14% EITC subsidy rate over a longer range of hours of work, but is also subject to the 10% EITC phase out rate over a wider range of hours. The decreased slope of the budget constraint at higher values of hours of work reflects the increase in the 15% marginal tax rate to 16%, and the increase in the 28% rate to 29%. The last segment of the budget constraint shown, which reflects the 35% marginal tax rate, has an unchanged slope. While an individual who is in this bracket (or the 38.5% bracket) both before and after the reform faces an unchanged marginal tax rate, his average tax rate has increased.

Tables 5a and 5b present results from simulating this reform. For each parameter set, the first two columns show the mean (weighted using sample weights) changes in taxes paid and annual hours worked resulting from the policy change. The third column shows the mean equivalent gain (using King's (1983) terminology) associated with the reform. The equivalent gain is the lump sum transfer which would result in the same change in well being as the reform being simulated. The fourth column displays the equivalent gain as a percentage of after tax and transfer income. The "efficiency cost of increased progressivity" is equal to the sum of mean equivalent gains over deciles where the equivalent gain is negative divided by the mean equivalent gains summed over the deciles where they are positive minus one. One plus this measure is the same as that which Browning and Johnson (1984) use to quantify the "trade-off between equality and efficiency." My measure is the same as what Ballard (1988) calls the "marginal efficiency cost of redistribution." It indicates the degree to which the welfare losses of those who are made worse off by the policy change of redistributing one dollar exceed the welfare gains of those who are made better off by the reform.

For all four sets of parameters considered, sizable percentage increases in economic well being are realized by the bottom two deciles, with relatively small percentage decreases in economic well being realized by those in the upper deciles. When comparing simultions based on different parameters, one should note that the size of the increase in the EITC varies with the parameter set used. This is because the behavioral response to the reform depends on the labor supply parameters. More elastic labor supply result in less revenue being raised by the tax rate increaes, and therefore a smaller expansion of the EITC being possible.

The efficiency cost of increased progressivity is very small in the base case (parameter set 1). This is well below any of the marginal efficiency cost estimates of Browning and Johnson (who only consider reforms which increase the value of a demogrant financed by increasing marginal tax rates by one percentage point). My estimate of the marginal efficiency cost of expanding the EITC is similar in magnitude to Ballard's (1988) estimates of the marginal efficiency cost associated with what he calls "notch grant" programs, in which a cash grant is increased for low income groups financed by increasing the marginal tax rate faced by higher income groups (assignment to an income group is exogenous and all individuals face linear budget constraints).

In comparing my estimates to those of Ballard (1988) and Browning and Johnson (1984), one must remember that the policy I am simulating is quite different than those which they considered. In addition, I use a different specification of preferences and labor supply elasticities which are lower than those which they put the most emphasis on.

Predictably, the efficiency cost is lower using parameter set 2 than when basing the simulation on parameter set 1. The simulated efficiency cost rises when the simulations are based on parameter sets 3 and 4. However, the efficiency cost is still relatively low even using parameter set 4 (which Browning and Johnson (1984, p. 191) refer to as "implausibly high" for men). Increasing the generosity of the earned income tax credit appears to be an efficient means of increasing progressivity. One reason for the efficiency of this scheme is that it tends to encourage labor force participation. Although it decreases the marginal net wage for some low income workers (see figure 3), it increases the average net wage for those same workers.

The second progressivity increasing reform which I simulate is using one percentage point increases in the 15% and 28% marginal tax rates to finance an increase in the value of the personal exemption. Figure 4a shows the effect on an individual's budget constraint of increasing the personal exemption without any tax rate increases (the individual is assumed to have no unearned income, to be ineligible for the EITC and transfer programs, and to have no fixed costs of working). Hours of work on the first segment of the budget constraint yields earnings which are less than the sum of allowed exemptions and deductions. Hours of work on the second segment of the budget constraint results in the individual being in the 15% tax bracket; the third segment of the budget constraint corresponds to the 28% bracket; the fourth segment of the budget constraint corresponds to the 35% bracket. The kink points in the budget constraint all move to the right as a result of the increase in the exemption. Those who are initially on the first segment of the budget constraint (and therefore have taxable income below the value of their deductions and exemptions) do not realize any decrease in tax payments. Note that the size of the tax decrease (increase in consumption) increases as one moves to successively higher tax brackets. Figure 4b shows the effect on an individual's budget constraint of simultaneously increasing the value of the personal exemption and increasing the 15% and 28% marginal tax rates. Overall, this produces only minor changes in the budget constraint. Consumption (after-tax income) is increased slightly for someone whose hours of work locates him in the low end of the 15% tax bracket (the second segment of the budget constraint), and decreases slightly for most hours of work values beyond the middle of the 15% bracket.

Tables 6a and 6b display results from simulating the effect of using one percentage point increases in the federal 15% and 28% marginal tax rates to finance an increase in the value of the personal exemption. Perhaps the most striking aspect of these tables is how much less redistribution of the tax burden results from using the increased tax rates to fund increases in the exemption rather than increased generosity of the EITC. This is just another manifestation of what was illustrated in figure 4b: simultaneously increasing the personal exemption and marginal tax rates results in only fairly minor effects on tax liabilities. The efficiency cost of increased progressivity is fairly low using parameter set 1, but climbs rapidly as parameter sets 3 and 4 are considered. Increasing the personal exemption is a very risky means of increasing tax progressivity if a reasonably high probability is attached to parameter set 4 being "true."

Figure 5 illustrates the effect on an individual's budget constraint of the third type of policy reform which I simulate: using one percentage point increases in the federal 15% and 28% marginal tax rates to finance the introduction of a "demogrant" style refundable tax credit.[14] The total credit received by a tax filing unit is equal to the base amount of the credit times the number of personal exemptions. The credit is taxable (taxable income is increased by the amount of the credit), and it enters as income in the AFDC and foodstamps benefit reduction formulas.[15] As a result of the demogrant, the first segment of the budget constraint makes a parallel shift up; the second and third segments of the budget constraint become flatter due to the increase in the 15% and 28% tax rates. Note that unlike increasing the value of the personal exemption, introducing a demogrant increases the after tax income of an individual locating on the first segment of the budget constraint.

Table 7a and 7b show results from simulating this policy reform. As expected (based on a comparison of figures 5 and 4b), the one percentage point increase in the 15% and 28% marginal tax rates result in larger increases in economic welfare for those in the lower income deciles (and larger decreases in economic welfare in the upper income deciles) when the revenue increase is used to finance the introduction of a demogrant rather than an increase in the personal exemption. The demogrant policy has an efficiency cost roughly the same as that of the increased personal exemption policy when the simulations are based parameter sets 1 and 2, but a lower efficiency cost when the simulations are based on parameter sets 3 and 4. In interpreting this one must keep in mind that the increased personal exemption policy would have to be financed by larger tax rate increases than those simulated here to achieve the same redistribution of the tax burden as the demogrant policy. Overall, the demogrant policy seems preferable to increasing the personal exemption as a means of increasing progressivity.

So far, the policy simulations have all been based on increasing only the 15% and 28% federal marginal rates. Table 8 displays results for alternative means of financing an increase in the range of earnings over which the earned income tax credit increases. Both of the simulations reported in this table are based on parameter set 1. Comparing the effect of increasing the 28% and 35% rates (leaving the 15% and 38.5% rates unchanged) rather than the 15% and 28% rates (as in table 5a) is instructive. Increasing the higher tax rates results in a sharply higher efficiency cost, and raises less revenue which can be used to increase the generosity of the EITC. However, a potential advantage of increasing the higher marginal tax rates is that proportionately more of the cost of making those in the three lowest deciles better off is borne by those in the top two deciles.

In some ways, it is "fairer" to compare the effect of using a one percentage point increase in the 15% and 28% marginal tax rates to finance the introduction of a demogrant with using a one percentage point increase in the 28% and 35% marginal tax rates to finance an expansion of the EITC than it is to compare the demogrant policy with using a one percentage point increase in the 15% and 28% marginal tax rates to finance an expansion of the EITC. Comparison of tables 5a and 8 with table 6a suggests that the pattern of the redistribution of economic welfare resulting from using increases in the 15% and 28% rates to finance a demogrant is more similar to the pattern of redistribution resulting from using increases in the 28% and 35% tax rates to expand the EITC than it is to the pattern of redistribution resulting from using increases in the 15% and 28% tax rates to finance an expansion of the EITC. Although expanding the EITC has a lower efficiency cost than introducing a demogrant when both are financed by increasing the 15% and 28% marginal tax rates, the demogrant policy has a lower efficiency cost when it is compared with an expansion of the EITC financed by increasing the 28% and 35% marginal tax rates.

One conclusion which can be drawn from this is that a measure such as the efficiency cost of increased progressivity cannot be used to rank the desirability of policy reforms which differ in how they affect the distribution of economic welfare. When a group of progressivity increasing tax reforms all have the same effect on the distribution of economic welfare, the one with the lowest efficiency cost of increased progressivity is the most efficient means of achieving that change in the distribution of welfare. However, comparison of the efficiency cost of increased progressivity for reforms which have varying effects on the distribution of economic welfare merely indicates which reforms have the greatest degree of "leakage" in the redistribution bucket (using Okun's (1975) analogy). One would not necessarily most prefer the policy with the smallest degree of leakage if the policies differ in their patterns of the redistribution of the tax burden.

Increasing only the 35% marginal rate (table 8) results in a much higher simulated efficiency cost than when the 28% and 35% rates are both increased. There are two primary reasons for this. One is that the excess burden of a tax increases approximately with the square of the tax rate. The increase in excess burden resulting from increasing the marginal tax rate of someone in the 35% bracket by one percentage point is greater than the increase in excess burden resulting from increasing the marginal tax rate of someone in the 28% bracket by one percentage point. Secondly, an increase in the marginal tax rate in the current 28% bracket (but not in other brackets) has the effect of creating an implicit lump sum tax increase for those in higher brackets. Individuals in the 35% and 38.5% tax brackets would pay higher taxes as a result of the increase in the 28% rate, but would face unchanged marginal tax rates themselves.

The results in table 8 suggest that the efficiency cost of redistributing income from the middle class to the poor is much less than that of redistributing income from the very well off to the poor. However, this conclusion must be treated with some caution. As discussed earlier, the labor supply specification adopted in this study results in wage and income elasticities which increase in magnitude with adjusted family income. This will increase the tendency for marginal excess burden to increase as one moves from increasing a tax rates in a given tax brackets to instead increasing the tax rate in a higher income tax bracket.

Perhaps a more important reason for caution is that the rich are neither adequately represented in the dataset I use, nor adequately treated in the labor supply specification which I employ. High income filing units are extremely important sources of federal individual income tax revenue. For example, in 1987 over ten percent of federal individual income tax revenue came from the approximately one percent of returns which had adjusted gross income over $500,000 (IRS, 1992). Since the dataset I draw my sample from, the Panel Study of Income Dynamics, does not oversample high income households and does not collect information regarding capital gains realizations, I have very little information about the high income filing units.

As Slemrod (1992, this volume) notes, behavioral parameters estimated from a sample of the overall population may not accurately predict the behavior of the very rich. The labor supply parameters I use in this study may be more appropriate for predicting the behavior of low and moderate income workers (which predominate in the samples used for labor supply estimation) than for predicting the behavior of high income workers. Slemrod (1992, this volume) also notes that capital income makes up a much larger proportion of the total income for very high income households than it does for the general population, and that those with high earnings may have more flexibility in the form in which they receive their employment compensation than do those with lower earnings. Since the only distortion I model in this paper is that in individuals' hours of work decisions, I may be missing the most important distortionary effects of taxation affecting very high income households.

Despite these caveats, the simulations do suggest that the efficiency cost of increasing progressivity by raising the marginal tax rates faced only by very high income households is likely to be considerably higher than if the progressivity increasing reform was instead financed by increasing the marginal tax rates faced by moderate income groups. A well known result appearing in the optimal nonlinear income tax literature is that, under certain conditions, the optimal marginal tax rate at the highest level of income is zero even if the government is maximizing a very egalitarian social welfare function (Slemrod (1990) provides an intuitive exposition and discussion of this result). While this result applies only when there is no limit to the number of brackets the income tax may have, Slemrod, Yitzhaki, and Mayshar (1991) find (in all cases which they simulate) that when the the income tax is limited to two brackets plus a demogrant, the optimal tax policy is to set the marginal tax rate in the second bracket at a level lower than that of the marginal tax rate in the first bracket. The lesson of the optimal income tax literature is that even if one has a very egalitarian objective, an income tax with marginal tax rates which increase sharply with income may not be desirable.

V. Conclusion

In this paper, I have investigated the efficiency cost of several possible progressivity increasing tax reforms. Based on the labor supply parameters I consider to be most reasonable, it appears possible to devise progressivity increasing tax reforms which have a quite small degree of "leakage" in redistributing after-tax economic welfare from upper income to lower income families. The efficiency cost of using an expansion of the earned income tax credit financed by one percentage point increases in the 15% and 28% federal marginal tax rates to transfer one dollar of economic welfare from upper income families to lower income families is only 16 cents. When other labor supply parameters are assumed, the efficiency cost of this transfer ranges from 4 cents to $1.18.

When the same simulated changes in tax rates are used to finance a demogrant, the efficency cost of the transfer is higher, but the pattern of redistribution differs from that produced by the earned income tax credit expansion, and may be preferrable. While a measure such as the efficiency cost of increased progressivity provides a useful indicator of the degree of "leakage" involved in redistributing the tax burden, it cannot be used to rank the desirability of tax reforms which differ in their patterns of redistribution.

Further research into the properties of various reforms which increase the progressivity of the tax system is desirable. There may be policies which dominate, in the sense of achieving the same redistribution of the tax burden with a smaller efficiency cost, those considered in this paper. Horizontal equity considerations also need to be considered. The earned income tax credit is available only to those with earned income and dependent children. This property may help to make expansion of the EITC a particularly efficient way of increasing progressivity, since it encourages work effort on the part of those who are likely to be eligible for transfer programs which have high benefit reduction rates, but some would view an earnings credit available to a broader group of recipients to be desirable.

NOTES

1. Elasticity estimates for Hausman (1981) are from Hausman (1985).

2. The income coefficient was constrained to be non-positive in this estimation. However, based on a Lagrange multiplier test, I was unable to reject the hypothesis that the true coefficient was zero.

3. Triest (1992) finds that increasing the marginal tax rate faced by married male itemizers tends to increase their labor supply through the price of deductible consumption effect. Heckman (1983) outlines an alternative model of labor supply with endogenous tax avoidance.

4. The natural log of the wage (of labor force participants) was regressed on a five part spline based on years of education, a five part spline based on years of potential labor market experience, and marital status. Separate regressions were run for men and women. The imputed wage was set equal to the exponential of the sum of the predicted log wage plus one half the variance of the regression error. This is a consistent predictor under the assumption that the error in the log wage regression is homoskedastic and has a normal distribution. No correction was made for possible problems of selection bias. Further details are available on request.

5. Starting from the PSID variable for federal taxes paid, I calculated taxable income by using the inverse of the statutory federal tax function.

6. The effective benefit reduction rate in the AFDC program has been estimated to average .7 even though the statutory rate is 1 (Burtless, 1990).

7. Hausman (1981) estimated that married women incur fixed cost associated with working equal to \$1213 plus \$172 times the number of children less than 6 minus \$212 times family size. For female heads of households, fixed costs are estimated to be \$1350 plus \$660 times the number of children less than 6 minus \$654 times family size. Since Hausman's estimates are in terms of 1975 dollars, they were inflated to 1987 levels using the consumer price index.

8. As noted by Hausman (1981), the indirect utility function implied by this specification is $v(w,y) = e^{\beta w}(y + \frac{\alpha}{\beta}w - \frac{\alpha}{\beta^2} + \frac{\gamma}{\beta})$.

9. In the case of non-workers, the maximum value of γ which is consistent with nonparticipation being optimal is first found. A draw from an assumed distribution for γ (truncated from above at the maximum value consistent with nonparticipation) is then generated. This draw is then used as the non-participant's γ value. The assumed distribution for γ is based on parameter estimates in Triest (1990), and varies by sex.

10. The procedure for picking γ results in the observed value of hours of work being consistent with local (given the segment of the budget constraint) utility maximization, but does not ensure that the observed value of hours is consistent with global (given the entire budget set) utility maximization due to the existence of non-convex regions of the budget set (which result from the fixed cost of working, AFDC, foodstamps, the earned income tax credit, and the social security tax). See Moffitt (1986) for an exposition of the complications caused by non-convex budget sets. Whenever the observed hours of work value was inconsistent with global utility maximization (given the values of γ, α, and β), I solved for the utility maximizing value of hours and then substituted that for the observed value. For parameter set one, this was done for 8 (unweighted) men (out of 3863 total), and for 147 (out of 3441) women. For parameter set 2, this was done for 73 women but no men; for parameter set 3, this was done for 8 men and 396 women; for parameter set 4, this was done for 126 men and 427 women. The number of observations where the observed value of hours must be replaced varies with the parameter set chosen since the size of the interval around a non-convex kink point which is inconsistent with utility maximization increases with the magnitude of the compensated wage elasticity.

11. Although wives' are assumed to take their husbands' labor supply as fixed, husbands' earnings are not included in wives' virtual income in order to avoid double counting of husbands' earnings in the welfare change calculations.

12. The PSID family level sample weights were used in all tax revenue calculations.

13. The econometric procedure used to estimate these parameters took account of the truncation of the subsample used for estimation.

14. As in figures 4a and 4b, the individual is assumed to have no unearned income, to be ineligible for the EITC and transfer programs, and to have no fixed costs of working.

15. The policy reform was designed in order to not make it more attractive for AFDC and foodstamps non-participants to become participants in response to the reform. This allows me to avoid modeling the AFDC and foodstamps participation decision (which depends on very complex eligibility rules).

REFERENCES

Ballard, Charles L., "The Marginal Efficiency Cost of Redistribution," *American Economic Review*, vol. 78 (December 1988), pp. 1019-1033

Bosworth, Barry and Gary Burtless, "Effects of Tax Reform on Labor Supply, Investment, and Saving," *Journal of Economic Perspectives*, vol. 6 (Winter 1992), pp. 3-26

Browning, Edgar K. and William R. Johnson, "The Trade-Off Between Equality and Efficiency," *Journal of Political Economy*, vol. 92 (April 1984), pp. 175-203

Burtless, Gary, "The Work Response to a Guaranteed Income: A Survey of Experimental Evidence," in Alicia H. Munnell, ed., *Lessons from the Income Maintenance Experiments*, Federal Reserve Bank of Boston, 1987

_____, "The Economist's Lament: Public Assistance in America," *Journal of Economic Perspectives*, vol. 4 (Winter 1990), pp. 57-78

_____ and Barry Bosworth, "Effects of Tax Reform on Labor Supply, Investment, and Savings," *Journal of Economic Perspectives*, vol. 6 (Winter 1992), pp. 3-26

_____ and Jerry A. Hausman, "The Effect of Taxation on Labor Supply: Evaluating the Gary NIT Experiment," *Journal of Political Economy*, vol. 86 (December 1978), pp. 1103-1130

Cutler, David M. and Lawrence F. Katz, "Rising Inequality? Changes in the Distribution of Income and Consumption in the 1980's," *American Economic Review*, vol. 82 (May 1992), pp. 546-551

Feldstein, Martin and Andrew Samwick, "Social Security Rules and Marginal Tax Rates," N.B.E.R. working paper no. 3962, 1992

Hausman, Jerry A., "Labor Supply," in Henry J. Aaron and Joseph A. Pechman, *How Taxes Affect Economic Behavior*, Washington: Brookings Institution, 1981

_____, "Taxes and Labor Supply," in Alan J. Auerbach and Martin Feldstein, editors, *Handbook of Public Economics*, vol. 1, Amsterdam: North-Holland, 1985

_____ and James M. Poterba, "Household Behavior and the Tax Reform Act of 1986," *Journal of Economic Perspectives*, vol. 1 (Summer 1987), pp. 101-120

Heckman, James J., "Coment" on paper by Jerry A. Hausman, in Martin Feldstein, editor, *Behavioral Simulation Methods in Tax Policy Analysis*, Chicago: University of Chicago Press, 1983

Hoffman, Saul D. and Laurence S. Seidman, *The Earned Income Tax Credit - Antipoverty Effectiveness and Labor Market Effects*, Kalamazoo, Michigan: W. E. Upjohn Institute for Employment Research, 1990

Internal Revenue Service, *Statistics of Income Bulletin*, vol. 12 (Winter 1992)

Killingsworth, Mark R. and James J. Heckman, "Female Labor Supply: A Survey," in Orley Ashenfelter and Richard Layard, editors, *Handbook of Labor Economics*, vol. 1, Amsterdam: North-Holland, 1986

King, Mervyn A., "Welfare Analysis of Tax Reforms Using Household Data," *Journal of Public Economics*, vol. 21 (1983), pp. 183-214

MaCurdy, Thomas, David Green, and Harry Paarsch, "Assessing Empirical Approaches for Analyzing Taxes and Labor Supply," *Journal of Human Resources*, vol. 25 (Summer 1990), pp. 415-490

Moffitt, Robert, "The Econometrics of Piecewise-Linear Budget Constraints: A Survey and Exposition of the Maximum Likelihood Method," *Journal of Business and Economic Statistics,* vol. 4 (July 1986), pp. 317-327

_____, "The Econometrics of Kinked Budget Constraints," *Journal of Economic Perspectives*, vol. 4 (Spring 1990), pp. 119-139

_____, "Incentive Effects of the U.S. Welfare System: A Review," *Journal of Economic Literature*, vol. 30 (March 1992), pp. 1-61

Mroz, Thomas, "The Sensitivity of an Empirical Model of Married Women's Hours of Work to Economic and Statistical Assumptions," *Econometrica*, vol. 55 (July 1987),pp. 765-800

Okun, Arthur M., *Equality and Efficiency: The Big Tradeoff*, Washington: Brookings Institution, 1975

Pencavel, John, "Labor Supply of Men: A Survey," in Orley Ashenfelter and Richard Layard, editors, *Handbook of Labor Economics*, vol. 1, Amsterdam: North-Holland, 1986

Slemrod, Joel, "Optimal Taxation and Optimal Tax Systems," *Journal of Economic Perspectives*, vol. 4 (Winter 1990), pp. 157-178

_____, "On the High-Income Laffer Curve," Office of Tax Policy Research working paper, University of Michigan, 1992

_____, Shlomo Yitzhaki, and Joram Mayshar, "The Optimal Two-Bracket Linear Income Tax," National Bureau of Economic Research working paper no. 3847, September 1991

Steuerle, C. Eugene, "Policy Watch: Tax Credits for Low-Income Workers with Children," *Journal of Economic Perspectives*, vol. 4 (Summer 1990), pp. 201-212

Survey Research Center, *A Panel Study of Income Dynamics: Procedures and Tape Codes, 1988 Interviewing Year*, Ann Arbor: Institute for Social Research, 1991

Triest, Robert K., "The Effect of Income Taxation on Labor Supply in the United States," *Journal of Human Resources*, vol. 25 (Summer 1990), pp. 491-516

_____, "The Effect of Income Taxation on Labor Supply when Deductions are Endogenous," *Review of Economics and Statistics*, vol. 74 (February 1992), pp. 91-99

Table 1
1987 U.S. Federal Individual Income Tax

Gross Income Range (dollars)	Marginal Tax Rate	Implicit Lump Sum Transfer
0-10850	0	0
10850-13850	0.11	1193
13850-38850	0.15	1747
38850-55850	0.28	6798
55850-100850	0.35	10707
over 100850	0.385	14237

Note: This table is accurate only for married couples filing jointly who are eligible for three exemptions and who do not itemize deductions or have other adjustments to income.

Table 2
Parameter Sets

Parameter Set 1		Parameter Set 3	
male net wage coefficient	12.4	male net wage coefficient	12.4
male virtual income coefficient	0	male virtual income coefficient	0
female net wage coefficient	64.1	female net wage coefficient	206.2
female virtual income coefficient	-0.0097	female virtual income coefficient	-0.019

Parameter Set 2		Parameter Set 4	
male net wage coefficient	0	male net wage coefficient	5.35
male virtual income coefficient	0	male virtual income coefficient	-0.054
female net wage coefficient	32	female net wage coefficient	218.2
female virtual income coefficient	-0.0049	female virtual income coefficient	-0.042

Table 3
Mean Values by Decile

decile	income range		income per equivalent person	family income	percent married	number of children	total earnings	asset income	selected transfers	tax payments	marginal tax rate
1	0	6868	4483	7554	0.43	1.2	5775	185	1413	-522	0.29
2	6869	9324	8099	14001	0.61	1.3	13896	466	550	1696	0.26
3	9324	11630	10515	18322	0.68	1.2	19684	957	143	3186	0.24
4	11631	14183	12955	22965	0.74	1.2	24804	1188	232	4181	0.23
5	14185	16412	15349	25897	0.73	1	28200	1374	282	4949	0.25
6	16415	19005	17647	30780	0.77	1.1	33744	2216	189	6362	0.29
7	19005	22319	20662	34314	0.77	0.8	38647	2250	156	7693	0.31
8	22323	26517	24335	39152	0.73	0.7	44545	3312	12	9627	0.36
9	26544	34192	29897	46946	0.76	0.5	54533	3576	41	12612	0.38
10	34244	285771	50118	77135	0.77	0.4	83558	16842	40	24367	0.41
overall			19417	31723	0.7	0.9	34756	3242	306	7421	0.3

Table 4a
Male Labor Supply Elasticities

decile	hours of work	net wage	virtual income	parameter set 1		parameter set 2		parameter set 3		parameter set 4	
				wage	income	wage	income	wage	income	wage	income
1	1556	3.52	2741	0.03	0.00	0.00	0.00	0.03	0.00	0.01	-0.10
2	1969	5.27	2997	0.03	0.00	0.00	0.00	0.03	0.00	0.01	-0.08
3	2212	6.12	3105	0.03	0.00	0.00	0.00	0.03	0.00	0.01	-0.08
4	2215	7.75	3739	0.04	0.00	0.00	0.00	0.04	0.00	0.02	-0.09
5	2222	8.01	4235	0.04	0.00	0.00	0.00	0.04	0.00	0.02	-0.10
6	2265	9.20	5404	0.05	0.00	0.00	0.00	0.05	0.00	0.02	-0.13
7	2277	10.13	5719	0.06	0.00	0.00	0.00	0.06	0.00	0.02	-0.14
8	2300	10.98	7385	0.06	0.00	0.00	0.00	0.06	0.00	0.03	-0.17
9	2344	12.81	9160	0.07	0.00	0.00	0.00	0.07	0.00	0.03	-0.21
10	2448	18.96	22758	0.10	0.00	0.00	0.00	0.10	0.00	0.04	-0.50
overall	2210	9.66	7075	0.05	0.00	0.00	0.00	0.05	0.00	0.02	-0.17

Table 4b
Female Labor Supply Elasticities

	hours of	net	virtual	parameter set 1		parameter set 2		parameter set 3		parameter set 4	
decile	work	wage	income	wage	income	wage	income	wage	income	wage	income
1	1103	3.43	2140	0.20	-0.02	0.10	-0.01	0.64	-0.04	0.68	-0.08
2	1489	3.67	2015	0.16	-0.01	0.08	-0.01	0.51	-0.03	0.54	-0.06
3	1578	4.37	1301	0.18	-0.01	0.09	-0.00	0.57	-0.02	0.60	-0.03
4	1564	4.95	1674	0.20	-0.01	0.10	-0.01	0.65	-0.02	0.69	-0.04
5	1710	5.56	1820	0.21	-0.01	0.10	-0.01	0.67	-0.02	0.71	-0.04
6	1660	5.92	2915	0.23	-0.02	0.11	-0.01	0.74	-0.03	0.78	-0.07
7	1704	6.36	2545	0.24	-0.01	0.12	-0.01	0.77	-0.03	0.81	-0.06
8	1775	6.62	5023	0.24	-0.03	0.12	-0.01	0.77	-0.05	0.81	-0.12
9	1819	7.36	5944	0.26	-0.03	0.13	-0.02	0.83	-0.06	0.88	-0.14
10	1784	9.05	13333	0.33	-0.07	0.16	-0.04	1.05	-0.14	1.11	-0.31
overall	1647	5.9	4017	0.23	-0.02	0.11	-0.01	0.74	-0.05	0.78	-0.10

Table 5a

Increase in the 14% Range of the Earned Income Tax Credit Funded by 1 Percentage Point Increases in the 15% and 28% Federal Tax Rates

	Parameter Set 1				Parameter Set 2			
	Change in		Equivalent	Percentage	Change in		Equivalent	Percentage
Decile	Taxes	Hours	Gain	Gain	Taxes	Hours	Gain	Gain
1	-340	1.8	351	4.6	-338	3.7	341	4.6
2	-693	-0.6	673	4.8	-740	-2.1	735	5.2
3	-405	-4.3	354	1.9	-434	-6.8	420	2.3
4	-104	-6.0	50	0.2	-106	-6.8	92	0.4
5	114	-4.4	-140	-0.5	115	-4	-126	-0.5
6	188	-4.8	-212	-0.7	204	-1.6	-209	-0.7
7	241	-4.0	-264	-0.8	261	-1.6	-266	-0.8
8	282	-2.8	-307	-0.8	304	-1.7	-311	-0.8
9	338	-1.7	-355	-0.8	354	-0.9	-358	-0.8
10	377	-0.7	-377	-0.5	379	0.0	-379	-0.5
overall	0	-2.8	-23	-0.1	0	-2.2	-6	0.0
efficiency cost of increased progressivity			0.16				0.04	
increase in 14% bracket			7321				7875	

Table 5b

Increase in the 14% Range of the Earned Income Tax Credit Funded by 1 Percentage Point Increases in the 15% and 28% Federal Tax Rates

	Parameter Set 3				Parameter Set 4			
	Change in		Equivalent	Percentage	Change in		Equivalent	Percentage
Decile	Taxes	Hours	Gain	Gain	Taxes	Hours	Gain	Gain
1	-301	18	320	4.3	-273	5	259	3.5
2	-630	-22.1	589	4.2	-597	-71.2	416	2.9
3	-378	-53.5	261	1.4	-373	-101.5	118	0.7
4	-83	-39.6	-17	-0.1	-102	-67.4	-87	-0.4
5	89	-17.2	-143	-0.6	19	-44.7	-153	-0.6
6	153	-14.4	-213	-0.7	84	-41.4	-210	-0.7
7	197	-15.8	-260	-0.8	170	-25.8	-252	-0.7
8	271	-10.2	-309	-0.8	229	-19.3	-305	-0.8
9	329	-5.9	-356	-0.8	343	-6.5	-349	-0.7
10	351	-0.9	-388	-0.5	498	11	-376	-0.5
overall	0	-16.2	-52	-0.2	0	-36.2	-94	-0.3
efficiency cost of increased progressivity			0.44				1.18	
increase in 14% bracket			6357				4866	

Table 6a

Increase in the Personal Exemption Funded by 1 Percentage Point Increases in the 15% and 28% Federal Tax Rates

	Parameter Set 1				Parameter Set 2			
	Change in		Equivalent	Percentage	Change in		Equivalent	Percentage
Decile	Taxes	Hours	Gain	Gain	Taxes	Hours	Gain	Gain
1	-36	0.8	38	0.5	-37	0.2	37	0.5
2	-95	-2.0	82	0.6	-87	-0.5	86	0.6
3	-60	-2.8	55	0.3	-62	-1.1	61	0.3
4	-29	-2.0	25	0.1	-33	-0.8	32	0.1
5	-2	-3.0	-4	0.0	-3	-1.1	1	0.0
6	-2	-2.1	-4	0.0	-1	-0.4	1	0.0
7	28	-1.2	-42	-0.1	29	0.1	-29	-0.1
8	39	-2.9	-52	-0.1	43	-0.5	-46	-0.1
9	75	-2.3	-85	-0.2	77	-0.4	-78	-0.2
10	83	-0.1	-81	-0.1	73	0.1	-72	-0.1
overall	0	-1.8	-7	0.0	0	-0.4	-1	0.0
efficiency cost of increased progressivity			0.30				0.04	
increase in personal exemption			333				344	

Table 6b

Increase in the Personal Exemption Funded by 1 Percentage Point Increases in the 15% and 28% Federal Tax Rates

	Parameter Set 3				Parameter Set 4			
	Change in		Equivalent	Percentage	Change in		Equivalent	Percentage
Decile	Taxes	Hours	Gain	Gain	Taxes	Hours	Gain	Gain
1	-29	1.1	32	0.4	-23	0.0	16	0.2
2	-86	-5.0	65	0.5	-72	-9.9	45	0.3
3	-48	-7.8	36	0.2	-46	-18.7	9	0.1
4	-19	-6.9	6	0.0	-27	-18.2	-20	-0.1
5	8	-7.8	-30	-0.1	-2	-20.7	-54	-0.2
6	8	-7.8	-33	-0.1	-5	-24.0	-58	-0.2
7	23	-8.7	-63	-0.2	13	-18.8	-92	-0.3
8	45	-8.7	-88	-0.2	15	-22.9	-116	-0.3
9	97	-4.8	-120	-0.3	58	-19.9	-149	-0.3
10	1	-8.0	-124	-0.2	88	-4.6	-159	-0.2
overall	0	-6.4	-32	-0.1	0	-15.8	-58	-0.2
efficiency cost of increased progressivity			2.32				8.12	
increase in personal exemption			288				236	

Table 7a

Demogrant Funded by 1 Percentage Point Increases in the 15% and 28% Federal Tax Rates

	Parameter Set 1				Parameter Set 2			
	Change in		Equivalent	Percentage	Change in		Equivalent	Percentage
Decile	Taxes	Hours	Gain	Gain	Taxes	Hours	Gain	Gain
1	-166	-1.5	162	2.1	-172	-0.1	169	2.3
2	-165	-3.6	157	1.1	-172	-0.7	171	1.2
3	-124	-4.1	115	0.6	-132	-1.0	131	0.7
4	-91	-4.0	81	0.4	-100	-1.3	97	0.4
5	-43	-5.4	30	0.1	-45	-1.4	42	0.2
6	-1	-6.5	-20	-0.1	3	-2.1	-9	0.0
7	63	-6.7	-88	-0.3	70	-1.8	-77	-0.2
8	117	-6.2	-143	-0.4	128	-2.0	-136	-0.3
9	183	-4.2	-204	-0.4	192	-1.0	-197	-0.4
10	225	-1.4	-235	-0.3	227	0.0	-227	-0.3
overall	0	-4.3	-15	0.0	0	-1.2	-4	0.0
efficiency cost of increased progressivity			0.27				0.06	
size of demogrant			88				93	

Table 7b

Demogrant Funded by 1 Percentage Point Increases in the 15% and 28% Federal Tax Rates

	Parameter Set 3				Parameter Set 4			
	Change in		Equivalent	Percentage	Change in		Equivalent	Percentage
Decile	Taxes	Hours	Gain	Gain	Taxes	Hours	Gain	Gain
1	-145	1.9	149	2.0	-126	-8.0	107	1.4
2	-156	-8.0	145	1.0	-151	-21.4	109	0.8
3	-116	-10.7	100	0.6	-107	-26.1	63	0.3
4	-86	-10.8	67	0.3	-86	-27.7	31	0.1
5	-40	-12.0	16	0.1	-50	-29.7	-17	-0.1
6	-7	-14.6	-35	-0.1	-50	-38.1	-59	-0.2
7	30	-18.1	-100	-0.3	16	-29.7	-118	-0.3
8	103	-13.6	-157	-0.4	60	-28.2	-170	-0.4
9	180	-8.2	-215	-0.5	151	-19.1	-209	-0.4
10	236	-1.7	-248	-0.3	343	3.5	-251	-0.3
overall	0	-9.6	-28	-0.1	0	-22.5	-51	-0.2
efficiency cost of increased progressivity			0.58				1.66	
size of demogrant			80				65	

Table 8
Increase in the 14% Range of the Earned Income Tax Credit

Decile	Financed by 1 Percentage Point Increases in the 28% and 35% Federal Tax Rates				Financed by a 1 Percentage Point Increase in the 35% Federal Tax Rate			
	Change in Taxes	Change in Hours	Equivalent Gain	Percentage Gain	Change in Taxes	Change in Hours	Equivalent Gain	Percentage Gain
1	-181	1.6	183	2.4	-77	-0.1	76	1.0
2	-248	-8.4	228	1.6	-65	-2.5	58	0.4
3	-76	-5.9	58	0.3	-16	-1.2	12	0.1
4	-24	-1.4	18	0.1	-4	-0.2	3	0.0
5	-10	-1.4	5	0.0	-5	-0.1	4	0.0
6	8	-2.9	-20	-0.1	-2	-0.1	1	0.0
7	31	-3.9	-50	-0.1	-3	-0.4	-1	0.0
8	72	-5.5	-101	-0.3	2	-1.6	-12	0.0
9	122	-7.5	-181	-0.4	14	-4.7	-48	-0.1
10	305	-7.6	-397	-0.5	154	-7.5	-245	-0.3
overall	0	-4.3	-26	-0.1	0	-1.8	-15	0.0
efficiency cost of increased progressivity			0.52				0.96	
increase in 14% bracket			3135				1257	

Figure 1

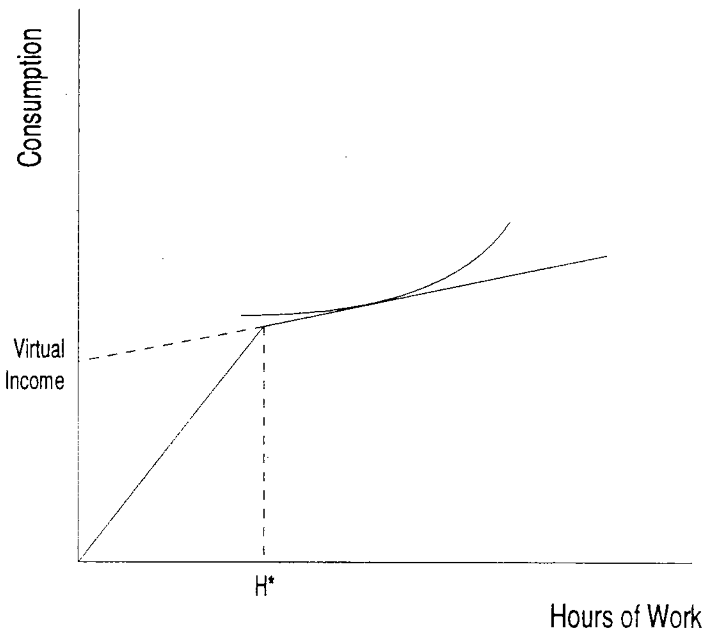
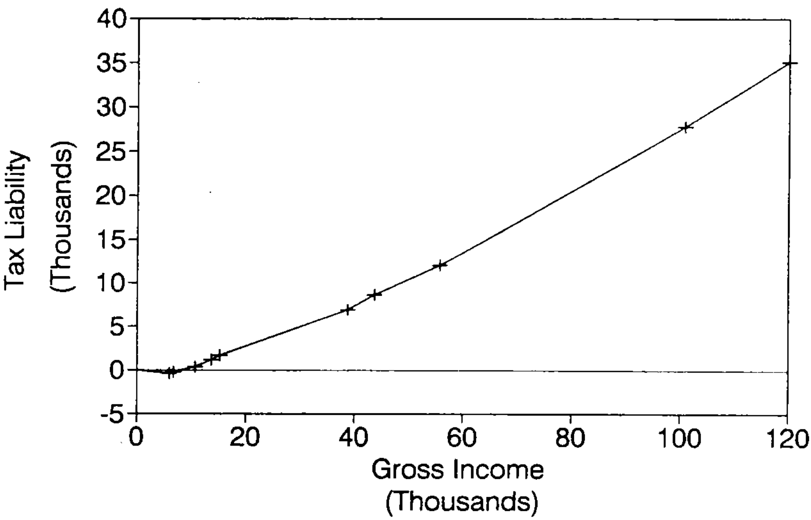


Figure 2
1987 U.S. Federal Taxation



Note: This figure shows the federal individual income tax liability plus the empoyee paid portion of the Social Security and Medicare tax for married couples filing jointly who are eligible for three exemptions and for the earned income tax credit, who do not itemize deductions or have other adjustments to income, who have no unearned income, and who have only a single wage earner.

Figure 3
Change in the Earned Income Tax Credit Financed by
Increasing the 15% and 28% Tax Rates

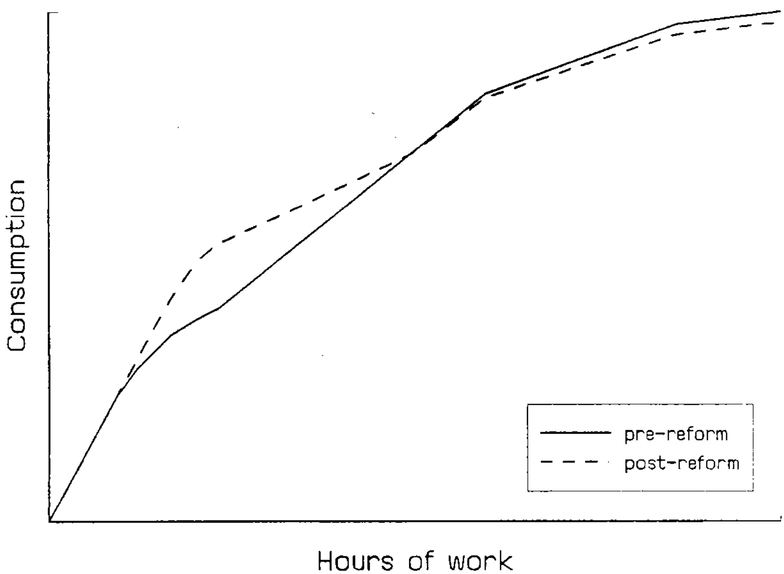


Figure 4a
Increase in the Personal Exemption
(with no tax rate increases)

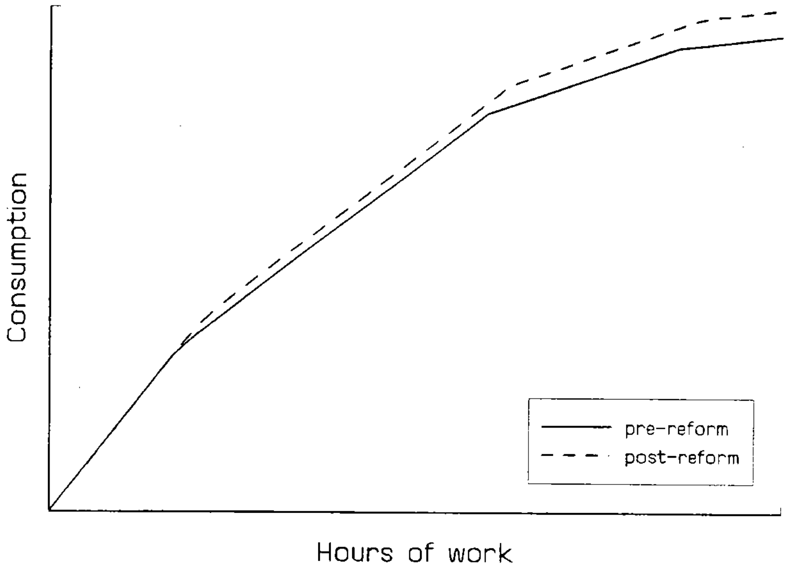


Figure 4b
Increase in the Personal Exemption Financed by Increasing the 15% and 28% Tax Rates

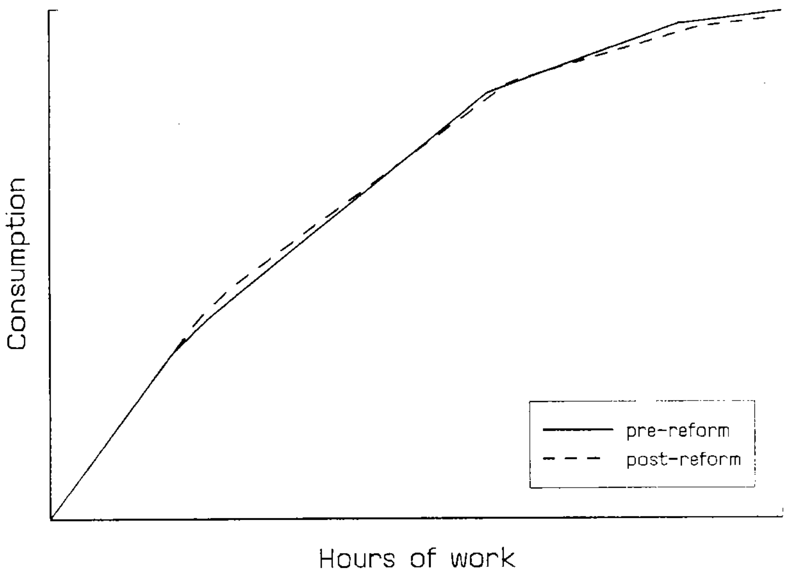


Figure 5
Introduction of a Demogrant Financed by Increasing the 15% and 28% Tax Rates