The Trade-Off between Equality and Efficiency

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This paper uses a 1976 microdata base to estimate the marginal cost of reducing income inequality with a policy that has distributional effects similar to the present tax-transfer system. The analysis uses a simulation methodology in which only the labor supply effects are evaluated; other behavioral effects are ignored. The most striking finding is that marginal cost is quite high even for modest labor supply elasticities. For example, in the benchmark case with a weighted-average economy-wide uncompensated wage elasticity of 0.2 (and compensated elasticity of 0.31), the disposable money income of upper-income quintiles of households is depressed by $9.51 for each dollar increase in the disposable money income of lower-income quintiles. When income equivalent values that take account of the value of leisure are compared, the marginal cost for this case is estimated to be $3.49.

Income redistribution is not a socially costless endeavor because the policies required to accomplish it generally produce misallocations of resources. This basic proposition is well known and usually interpreted as implying a trade-off between equality and efficiency. Identifying the magnitude of this trade-off is probably the most important contribution economics can make to the evaluation of distributional policies. However, to be useful, the measure of the trade-off should be a marginal one: What is the cost of slightly more or less inequality than we now have?

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Given the importance of this issue, it is surprising how little attention it has received. Of course, there are many studies that investigate the effects of various transfer and tax policies, and these are certainly related in some way to the marginal trade-off between equality and efficiency.\(^1\) The exact relationship, however, is not obvious since most tax and transfer studies only estimate the total welfare cost of a program, and total welfare costs are not a good indicator of the size of marginal welfare costs, especially in the case of redistributive policies. The optimal income tax literature also deals with this trade-off, but it tends to concentrate on the calculation of optimal marginal tax rates using an assumed social welfare function and hypothetical data, and consequently does not directly estimate the actual trade-off society faces.\(^2\)

In this study, we seek to clarify the trade-off between equality and efficiency by focusing on marginal changes in the current U.S. tax-transfer system. The analysis utilizes a rich microdata base that allows us to develop estimates of the marginal and average tax rates imposed on households by the current mixture of taxes and transfer programs. Using these data, we simulate the effects of a (small) change in the distribution of income produced by a demogrant form of redistributive policy, while taking into account the labor supply effects of the changes in marginal and average tax rates. Our most striking conclusion is that the marginal trade-off between equality and efficiency is quite severe even when labor supply elasticities are low and despite a modest total welfare cost of the current tax-transfer system. For example, in our benchmark case with an uncompensated labor supply elasticity of 0.2 (and a compensated elasticity of 0.3), each dollar increase in the disposable incomes of the lowest two quintiles requires a reduction in the disposable incomes of the highest three quintiles of more than $9.00.

I. Preliminary Remarks

The nature of the trade-offs between equality and efficiency to be considered can be clarified by using an income distribution frontier. Assume that there are only two individuals, \(H\) with high market earnings and \(L\) with low market earnings. In figure 1, their market earnings in the absence of any taxes or transfers are \(OH_1\) and \(OL_1\), and this distribution is identified by point \(A\) on the income distribution fron-

\(^1\) Danziger, Haveman, and Plotnick (1981) survey the literature on transfer programs, while Aaron and Boskin (1980) and Aaron and Pechman (1981) contain several studies on tax policy and numerous references to that literature.

\(^2\) Mirrlees (1971) is the seminal paper. Sheshinski (1972), Sadka (1976), and Stern (1976) are good introductions to the optimal tax literature.
To generate other points on the frontier, we must specify a mechanism for altering the distribution of income. Suppose the mechanism is a flat-rate tax on income that finances equal lump-sum grants to \( H \) and \( L \). By raising the tax rate from zero to 100 percent and then plotting the resulting combinations of disposable incomes for \( H \) and \( L \), we can generate the entire frontier, \( ABCO \).

If the market earnings of both individuals are unaffected by the tax and transfer policy, the frontier would have a slope of \(-1\) throughout; \( L \)'s disposable income could be increased by $1.00 at a constant marginal cost of $1.00 in disposable income to \( H \). Of course, it is possible that if income effects on \( H \) are strong enough and labor supply rises enough with the tax, more than $1.00 can be transferred to \( L \) for each $1.00 loss to \( H \). In the more important case, however, where the level of market earnings is adversely affected by the redistributive policy, the frontier will take on the general shape shown in figure 1. That is, raising \( L \)'s disposable income results in an increasing marginal cost to \( H \), until we reach point \( C \); for further redistribution, the adverse effect on market earnings is so large that the disposable incomes of both individuals fall, and at a tax rate of 100 percent, earnings presumably fall to zero at point \( O \) on the frontier.

In terms of figure 1, an obvious measure of the trade-off between

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Fig. 1
equality and efficiency is provided by the slope of the income distribution frontier. For example, if the present system of taxes and transfers places us at point \( B \) on the frontier, \( \Delta H/\Delta L \) measures the marginal cost (to \( H \)) of raising \( L \)'s income. In our simulations, we develop estimates of this trade-off by calculating the change in disposable income for each quintile of households that results from a marginal expansion of the present tax-transfer system. Note, however, that this measure of the trade-off does not identify the welfare effects of changing the income distribution; it only identifies the marginal trade-off in market incomes. The well-being of individuals also depends on their consumption of leisure, and since both individuals in figure 1 will generally be consuming more leisure as we move down the frontier, the trade-off in income-equivalent terms will be smaller than the slope of the frontier. Consider the slope at point \( B \). Since \( H \) gains leisure at the same time he sacrifices \( \Delta H \) in market income, his income-equivalent loss is smaller than \( \Delta H \). Conversely, \( L \)'s gain is greater than \( \Delta L \) because he gains leisure in addition to \( \Delta L \) in market income. Besides estimating the marginal trade-off in market incomes (\( \Delta H/\Delta L \)), we will also develop estimates of the marginal trade-off in income-equivalent terms.

These trade-offs clearly depend on a variety of factors, such as the actual distribution of market earnings, average and marginal tax rates of existing programs, and behavioral responses, all of which will be discussed later. It must be stressed, however, that the trade-off is also likely to depend on the particular policy used to effect a change in the income distribution.\(^3\) In other words, there is no such thing as a unique trade-off between equality and efficiency but instead different trade-offs associated with different policies. Thus, to investigate the issue further, we must specify a policy to be used to alter the distribution of income at the margin.

The policy we will use in our simulations, which we will refer to as a demogrant policy, is a flat-rate tax on labor income (added to preexisting taxes on labor income) that finances equal per person transfers. Although this policy makes transfers to upper-income households, which may appear to bias the results in the direction of finding a large trade-off, it is important to recognize that it is the net effect of the taxes and transfers that is crucial. In fact, this demogrant policy is equivalent to a negative income tax that applies the same marginal tax rate to transfer recipients and taxpayers. Figure 2 illustrates this point. A flat-rate tax collects tax revenues as shown by the schedule

\(^3\) For example, Baumol and Fischer (1979) argue that it may be possible to move closer to income equality by using some combination of wage subsidies and taxes (or otherwise manipulating wage rates) rather than by using income taxes and transfers.
Disposable Income

\[ Disposable \ Income \]

\[ Market \ Earnings \]

\[ O \]

\[ N \]

\[ R \]

\[ T \]

\[ L \]

\[ 45^\circ \]

\[ E \]

\[ Y^* \]

\[ Fig. \ 2 \]

\[ OL, \ while \ equal \ per \ person \ transfers \ provide \ benefits \ (ignoring \ differences \ in \ household \ size) \ as \ shown \ by \ the \ schedule \ \textit{NR}. \ The \ net \ disposable \ income \ at \ each \ level \ of \ market \ earnings \ is \ shown \ by \ the \ schedule \ \textit{NET}. \ Thus, \ such \ a \ demogrant \ policy \ is \ equivalent \ to \ a \ negative \ income \ tax \ with \ a \ breakeven \ income \ of \ \textit{Y}^* \ that \ makes \ transfers \ to \ households \ with \ incomes \ below \ \textit{Y}^* \ and \ collects \ taxes \ from \ households \ with \ incomes \ above \ that \ level. \ For \ computational \ reasons, \ it \ is \ simpler \ to \ model \ this \ policy \ as \ overlapping \ tax \ and \ transfer \ programs, \ but \ the \ economic \ effects \ should \ be \ the \ same \ as \ for \ a \ policy \ that \ only \ collects \ or \ pays \ out \ the \ net \ sums \ shown \ by \ \textit{NET}. \]

\[ Some \ readers \ have \ felt \ that \ our \ demogrant \ policy \ is \ so \ clearly \ inefficient \ in \ redistributing \ income \ that \ we \ have \ in \ effect \ chosen \ a \ straw \ man. \ This \ feeling \ reflects \ a \ confusion \ concerning \ the \ gross \ and \ net \ effects \ of \ the \ tax-transfer \ system. \ As \ line \ \textit{NET} \ shows, \ net \ transfers \ are \ received \ by \ low-income \ families \ (those \ with \ incomes \ below \ \textit{Y}^*), \ and \ the \ greatest \ transfers \ are \ received \ by \ the \ lowest-income \ families. \ Of \ course, \ it \ is \ true \ that \ benefits \ could \ be \ concentrated \ even \ more \ on \ the \ lowest-income \ families, \ but \ it \ is \ far \ from \ clear \ that \ this \ would \ yield \ a \ more \ favorable \ equality-efficiency \ trade-off \ because \ this \ would \ inevitably \ entail \ even \ higher \ marginal \ tax \ rates \ on \ transfer \ recipients \ who \ already \ face \ high \ tax \ rates. \ Hence, \ we \ have \ chosen \ to \ examine \ a \ demogrant \ policy \ for \ three \ reasons. \ First, \ we \ think \ it \ is \ a \]
reasonably efficient way to redistribute income. Second, it is an easy policy to work with computationally. And third, as we show below, a simple expansion of the current U.S. tax-transfer system would look very much like our demogrant policy.

For our estimates to provide a reasonable guide to the likely magnitudes of the trade-offs produced by marginal changes in actual programs, it is desirable for our demogrant policy to produce distributional results similar to those that would be expected from actual changes in the present system. While it is impossible to demonstrate this directly—since we do not know exactly what marginal changes the political process is likely to generate—it is possible to show that the demogrant policy has distributional effects similar to the entire present tax and transfer system. Consequently, if actual changes simply expand the scale of existing programs our assumed policy should be an accurate replication of this process.

In table 1, column 1 gives the net change in disposable income per household for each quintile that results from an additional 1 percent tax on labor income with the revenues returned as equal per person grants, assuming no behavioral responses. (The data used for these calculations are described more fully below in Sec. III.) Column 2 gives our estimate of the distributional effects of actual taxes and transfers in 1976.\(^4\) A comparison of columns 1 and 2 in table 1 shows

\(^1\) Since total transfers are only 42.6 percent as large as total taxes (because some taxes finance nonredistributive activities like national defense), to impose a balanced budget requirement we assumed that 42.6 percent of each household’s total tax burden was used to finance transfers. Combining this “redistributive tax” with the transfer received by each household yields the net change in income due to actual redistributive programs, and the results are given in col. 2.
that the distributional implications of the demigrant policy are quite similar to those of the present system. In both cases the lowest three quintiles gain at the expense of the top two quintiles. In addition, the percentage distributions of benefits among the lowest three quintiles and costs between the top two quintiles are also similar, as shown in columns 3 and 4. Although the lowest two quintiles receive a slightly smaller share of net benefits under our policy, the difference is small. In addition, we should expect that as the present system is expanded it will be increasingly difficult to concentrate benefits on the lowest-income households: when benefits are small they can be restricted almost totally to the poorest households, but as they become larger a smaller part of each additional dollar transferred can feasibly be granted to the poorest households. Thus, the small deviations in marginal distributional effects of our assumed policy from the average distributional effects of the present system are in the predicted direction.

In addition to having distributional implications similar to the present system, our assumed incremental policy has other advantages. Since taxes are levied on labor income, the major effect of this program should be to influence labor supply decisions, and there is relatively abundant evidence on the magnitudes of the labor supply elasticities required to simulate the effects of the policy (at least as compared with the evidence on saving, e.g.). Per capita transfers are more reasonable than per household transfers since they do not directly encourage household breakup, at least unless income effects have an effect on household composition. (Another possible transfer scheme, distinguishing between adults and children, was examined; in particular, simulations giving children half the adults’ transfer revealed no substantial difference from the results presented in this paper.) Finally, we suspect that most economists would agree that the demigrant policy would probably involve as favorable a trade-off as we are likely to find in practice (because labor is in such inelastic supply), so focusing on this policy may give us a good clue to the minimum cost associated with a movement toward greater income equality.

II. A Hypothetical Example

Before turning to the actual simulations, it may prove useful to illustrate with a simple numerical example how various factors interact to determine the size of the marginal trade-off in market incomes. Assume that there are three households, A, B, and C, with labor earnings of $5,000, $15,000, and $25,000, respectively. To take into account the fact that household size increases with income in the United
States, let household $A$ contain 1.5 persons, while households $B$ and $C$ each contain three persons. All households are currently subject to an effective marginal tax rate of 40 percent. To evaluate the effect on labor supply and earnings (it is assumed that the market wage rate is constant), we assume that the elasticity of labor supply relative to the net marginal wage rate is 0.15. To simplify this example, we also assume income effects on labor supply are negligible, but income effects will be taken into account in the actual simulations.

Given these assumptions, table 2 shows how we can calculate the effects of an additional 1 percent tax on labor income with the net proceeds used to finance equal per capita transfers. The 1 percent tax reduces the net marginal wage rate from 60 to 59 percent of the market wage rate, a reduction of 1.66 percent. With an elasticity of 0.15, labor supply and earnings decline by (0.15)(0.0166), or by 0.25 percent. The absolute reduction in earnings for each household is shown in column 3. The revenues generated by the 1 percent supplemental tax alone equal $450, but because of the $112.50 reduction in earnings, the revenues from the initial 40 percent rate decline by $45. Thus, the net increase in tax revenues is $405, and its distribution among households is shown in column 4. Divided on a per capita basis, the per capita transfer is $54, and the transfer for each household is shown in column 5.

Column 6 then gives the change in disposable market income for each household—the sum of the changes shown in columns 3, 4, and 5. The $23.50 increase for household $A$ is associated with a reduction of $136 for households $B$ and $C$: each dollar increase for $A$ reduces the combined incomes of $B$ and $C$ by about $6.00, or a 6:1 marginal trade-off in market incomes. Although based on hypothetical data, this example illustrates how modest labor supply responses can translate into a surprisingly large trade-off.

Intuitively, the explanation of why a large trade-off results is that we are starting from an already highly distorted position with relatively high marginal tax rates. A given change in marginal tax rates...
then represents a greater percentage change in the after-tax wage rate. Moreover, any decline in labor supply reduces tax revenues under initial tax policies more when marginal tax rates are high. Finally, it is important to recognize that marginal tax rates rise much more than proportionately to the amount of income redistributed. Using our actual data on labor incomes, we calculate that the policy described (assuming no behavioral response) increases marginal tax rates by 4.5 percentage points for each 1 percent of labor income redistributed from the top two to the bottom three quintiles. Since marginal tax rates are the source of the adverse incentive effects, it is not surprising that a small change in income distribution can produce substantial effects.\textsuperscript{5}

III. Data

We developed the data used in this study as part of a project that investigated the distribution of tax burdens by income classes (Browning and Johnson 1979). The starting point was the Current Population Survey (CPS) for March 1975, which collected income and demographic data for a representative sample of 47,414 U.S. households. The data were subsequently adjusted for underreporting and updated to correspond to 1976 levels (see U.S. Congress 1977). Several government transfers that were not already recorded by the CPS were imputed to households, including the major in-kind transfers received by households.\textsuperscript{6} In addition, two types of factor income, the net rental value of owner-occupied housing and accrued capital gains on stock, were also imputed.\textsuperscript{7} Finally, a competitive tax incidence model was used to allocate the burdens of all major taxes to households.

A more detailed description of the data base, including explanations of the methods of allocating taxes and transfers and imputing various types of income to households, is contained in Browning and Johnson (1979). The final data set is, we believe, an unusually complete representation of the income received by households and the effects of government tax and transfer programs in 1976.

Table 3 gives the information that is most relevant to the present study in summary form. Households have been ranked by before-tax income and partitioned into quintiles because our results will be presented on a quintile basis. The figures in the table give the average value per household for each quintile.

\textsuperscript{5} A further elaboration of these points is contained in Browning (1978).
\textsuperscript{6} These imputations were performed by Mathematica Policy Research for the Congressional Budget Office.
\textsuperscript{7} The data on net rental values by income class were based on the Brookings Institution's MERGE file.
### TABLE 3

**RELEVANT CHARACTERISTICS BY QUINTILE (per Household Values)**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Quintile 1</th>
<th>Quintile 2</th>
<th>Quintile 3</th>
<th>Quintile 4</th>
<th>Quintile 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Before-tax, before-transfer income</td>
<td>$2,438</td>
<td>$7,845</td>
<td>$14,357</td>
<td>$21,715</td>
<td>$46,573</td>
</tr>
<tr>
<td>2. Taxes</td>
<td>689</td>
<td>2,181</td>
<td>4,142</td>
<td>6,547</td>
<td>17,484</td>
</tr>
<tr>
<td>3. Transfers</td>
<td>2,874</td>
<td>3,317</td>
<td>2,441</td>
<td>2,117</td>
<td>2,485</td>
</tr>
<tr>
<td>4. After-tax, after-transfer income</td>
<td>4,623</td>
<td>8,981</td>
<td>12,656</td>
<td>17,285</td>
<td>31,574</td>
</tr>
<tr>
<td>5. Percentage share of col. 4</td>
<td>6.15</td>
<td>11.96</td>
<td>16.85</td>
<td>23.01</td>
<td>42.03</td>
</tr>
<tr>
<td>6. Gross labor income</td>
<td>1,781</td>
<td>6,589</td>
<td>12,691</td>
<td>19,255</td>
<td>31,177</td>
</tr>
<tr>
<td>7. Percentage shares of labor income</td>
<td>2.40</td>
<td>9.22</td>
<td>17.75</td>
<td>26.93</td>
<td>43.61</td>
</tr>
<tr>
<td>8. Persons per household</td>
<td>1.6</td>
<td>2.5</td>
<td>3.1</td>
<td>3.3</td>
<td>3.4</td>
</tr>
<tr>
<td>9. Percentage of population</td>
<td>11.5</td>
<td>18.0</td>
<td>22.3</td>
<td>23.7</td>
<td>24.5</td>
</tr>
<tr>
<td>10. Marginal tax rate</td>
<td>.544</td>
<td>.471</td>
<td>.408</td>
<td>.388</td>
<td>.446</td>
</tr>
<tr>
<td>11. Average tax rate</td>
<td>-.411</td>
<td>-.102</td>
<td>.102</td>
<td>.186</td>
<td>.305</td>
</tr>
</tbody>
</table>

The tax used in our simulation is a flat-rate tax on labor income, so the distribution of gross labor income in row 6 indicates as a first approximation how the tax will be distributed among quintiles (ignoring the changes in labor income produced by the policy). The net receipts of the tax will be returned as equal per capita transfers, so transfers per household will vary with the average size of households. Because family size rises with income, upper-income households will receive larger transfers than lower-income households. On balance, however, the tax-plus-transfer redistributes income downward. If there were no change in labor income, the lowest three quintiles would gain because their share of total population (row 9) is greater than their share of the tax base (row 7).

The estimates of marginal and average tax rates are especially important to this study because we model changes in labor supply as a function of changes in marginal and average rates (as described in the next section). The effective marginal tax rate for each household should indicate how much disposable income changes for a small change in before-tax earnings, and this depends on the combined effect of all taxes and transfers. (The implicit marginal tax rates of transfer programs are particularly important for low-income households.) Our general procedure in estimating effective marginal tax rates was to rank households on the basis of their factor earnings and then use the average reduction in transfers and the increase in taxes.
as we move from one income level to another (in $1,000 increments) as the basis for calculating the effective marginal tax rates.

This general procedure was applied to subsets of the entire population of households. Different-sized households were considered separately, and households with heads over 65 years of age were omitted from the samples. Because both personal income taxes and most transfers vary by family size and earnings, separate estimation for different household sizes is important. We eliminated the elderly from the samples to remove the bias introduced by age-related (as distinct from income-tested) transfers. When households are ranked on the basis of their factor earnings, elderly families are disproportionately represented at the bottom. What we then find is that social security and other transfers targeted on the elderly fall as we move up the earnings distribution. This, however, is not the result of marginal tax rates implicit in these programs but occurs because there are fewer elderly households higher in the earnings distribution. Thus, including the elderly would misleadingly imply that social security benefits contributed to high marginal tax rates for low-income households.

Each household in the sample is assigned a marginal tax rate using the procedure described.8 Row 10 of table 3 gives the weighted average values of the marginal tax rates for the households in each quintile. As expected on the basis of previous research, these rates are generally fairly high, especially for low-income households that frequently receive income-tested transfers.

Our procedure for estimating marginal tax rates is not without defects. In particular, we interpret the estimated rates as applying to any changes in gross labor income, yet the estimates are really weighted averages of the marginal tax rates that apply to combined capital and labor incomes. Insofar as the true marginal tax rate that applies to capital income is greater than the rate that applies to labor income, our estimates will be biased upward.9

On the other hand, there is at least one bias operating in the opposite direction that can best be explained with an example. Suppose a certain type of income were taxed at a rate of 100 percent. Such a tax would presumably raise no revenue, and our procedure based on how

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8 The elderly are included in the final data used in the simulations. They are assigned marginal tax rates corresponding to their factor earnings using the procedure described in the previous paragraph.

9 Although some taxes can be reasonably assumed to fall exclusively on capital or labor income, it is not clear how to treat personal income taxes or transfer payments. Thus, we did not attempt to estimate separate marginal tax rates for capital and labor income.
actual taxes vary with income would estimate a zero marginal tax rate—lower than the true value. In general, our data already reflect behavioral changes made to minimize the burden of taxes and so to some extent tend to understate the effective marginal rate of taxation.\textsuperscript{10}

For these reasons, our estimates of marginal tax rates on labor income may be biased, but the direction of the bias is not clear. In addition, it should be recalled that changes in the tax system since 1976 have operated to increase tax rates applying to labor income. Bracket creep due to inflation has increased marginal rates under the federal income tax,\textsuperscript{11} and the 1977 changes in the social security payroll tax have similarly increased effective marginal rates.

Average tax rates are given in row 11 of table 3. For purposes of this study, a household’s average tax rate is defined as (total tax − total transfer) ÷ (before-tax, after-transfer income).\textsuperscript{12} This rate, or, more precisely, changes in it, is used to indicate the direction of the income effect of taxes and transfers together on labor supply. Note that the average tax rate defined in this way can vary from −1 to +1 and will be zero for a household that receives transfers exactly equal to the taxes it pays.

For purposes of indicating the income effect of the present system on labor supply, this definition of the average tax rate suffers from the neglect of benefits of nontransfer government expenditures like defense and highways. For the community as a whole, we estimate a positive average tax rate of 16.77 percent, but it can be argued that the relevant rate is really zero since all tax revenues presumably finance expenditures that benefit someone. It is not clear, however, how we should distribute the benefits of nontransfer expenditures among households. More important, for purposes of simulating the effect of a change in taxes and transfers while holding nontransfer expenditures fixed, we feel the proposed measure is adequate to indicate the direction of the income effect on labor supply.

\textsuperscript{10} In a recent paper, Barro and Sahasakul (1983) make this point and demonstrate that our method of computing marginal tax rates is likely to understate the effective marginal tax rate relevant for labor supply responses. In this respect, our estimates of the efficiency cost of greater redistribution are biased downward.

\textsuperscript{11} For four-person families with median income, the marginal tax rate (applying to taxable income) of the federal individual income tax rose from 22 percent in 1975 to 24 percent in 1980. For families with one-half and double the median income, the increase was from 17 to 18 percent and from 32 to 43 percent, respectively (Economic Report of the President 1982, table 5-4).

\textsuperscript{12} Most tax incidence studies define the average tax rate as the total tax divided by before-tax, after-transfer income. For a study that examines only taxes this is perhaps appropriate, but to use the average tax rate as an indication of the direction of income effect on labor supply for simultaneous changes in taxes and transfers, it must be defined differently.
IV. Modeling Labor Supply Responses

The most important ingredient in our simulations is the presumed form of the household’s labor supply response to tax and transfer changes. Since we use a way of approximating these changes that differs from most previous work, a justification of our choice is in order. Hours of work with a given set of tax and transfer policies (\(Y_1\)) are given by

\[ Y_1 = (1 - MTR^\beta)(1 + \alpha ATR) \cdot Y_0, \quad (1) \]

where \(Y_1\) is labor supply, \(MTR\) and \(ATR\) are the marginal and average tax rates, and \(Y_0\) is labor supply with no taxes or transfers at all. The parameters \(\alpha\) and \(\beta\) can be changed to describe a spectrum of possible labor supply responses. In particular, \(\beta\), which is restricted to be nonnegative, is related to the substitution effect; the smaller the value of \(\beta\), the more labor supply responds to changes in marginal tax rates. The parameter \(\alpha\), also presumed to be nonnegative if leisure is a normal good, captures the income effect; the greater the value of \(\alpha\), the more labor supply rises when average tax rates reduce income.

There are three advantages to our labor supply specification. First, our formulation is agnostic about the determinants of \(Y_0\) (which is presumably affected by preferences, wage rates, and nonearned income) and only restricts the response of labor supply to changes in taxes and transfers. We are interested in predicting changes in the pattern of labor supply (movements away from point \(B\) in fig. 1) rather than explaining why we happen to be at point \(B\) initially. Second, equation (1) is compatible with labor supply curves that are upward sloping at low net wage rates and backward bending at high net wage rates. This property is not shared by many commonly used utility functions such as the CES function or by constant elasticity labor supply functions. Third, our formulation requires that labor supply fall toward zero as marginal tax rates approach 100 percent, a characteristic important because of theoretical considerations.

Equation (1) implies that labor supply elasticities depend on the level of average and marginal tax rates and will therefore differ across households. Table 4 provides some idea of the relationship between the parameters \(\alpha\) and \(\beta\) and the elasticities they imply at the marginal and average tax rates currently faced by U.S. households. For each household we can calculate a compensated and uncompensated elasticity implied by \(\alpha\), \(\beta\), and existing tax rates.\(^{13}\) Weighting these elas-

\(^{13}\) Our compensated elasticity is obtained by changing marginal tax rates but keeping average tax rates constant, hence “compensating” for the income lost by the higher marginal tax rate. Our uncompensated elasticity is computed by allowing both average and marginal tax rates to move by the same amount, similar to a proportional change in wages.
elasticities by hours currently supplied to the market yields average elasticities for each income quintile and for the entire population of households. Table 4 shows that elasticities are greater for lowest- and highest-income households facing relatively high marginal tax rates. The parameter β strongly affects the compensated elasticities while α, the income effect, determines the difference between the compensated and uncompensated elasticities. By suitably adjusting these parameters, therefore, we can generate a wide range of values of compensated and uncompensated elasticities.

Table 4 and our subsequent simulations embody the simplifying notion that each household, regardless of demographic composition, behaves according to the α and β for the case in question and that any changes in labor supply earn income at the household’s average wage rate. Thus, each household is treated as a single individual for labor supply purposes and all individuals are bound by the same α and β. We do not think this simplification biases the results unduly; at least, if it does, the direction of the bias is not clear a priori.14

We consider case A in table 4 to be the most plausible assumption for α and β, for the reasons described below. The implications of this “benchmark” combination of α and β are given in table 5, which shows labor supply relative to the no-tax case for various combinations of ATR and MTR. By reading down the columns in table 5 we see the effect of changing marginal tax rates (the “pure” substitution effect), and reading across the rows identifies the impact of income transfer recipients and transfer recipients are important.

14 While high-income households have more prime age married men (low elasticity), they also have more secondary workers (high elasticity). Supply elasticities of both taxpayers and transfer recipients are important.
### TABLE 5

**Labor Supply Relative to No-Tax Case (α = .2, β = 3.25)**

<table>
<thead>
<tr>
<th>MTR</th>
<th>-0.5</th>
<th>-0.4</th>
<th>-0.3</th>
<th>-0.2</th>
<th>-0.1</th>
<th>0</th>
<th>0.1</th>
<th>0.2</th>
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effects. Finally, following the diagonal beginning with $MTR = ATR = 0$, we can plot the uncompensated labor supply curve.

As table 5 suggests, the effect of the existing tax and transfer system on labor supply has been relatively modest, if these parameter values are valid. The median household, with an $ATR = 0.1$ and $MTR = 0.4$, has reduced labor supply about 3 percent as a result of the tax-transfer system, while low-income households ($ATR = -0.41, MTR = 0.54$) have probably reduced labor supply by 20 percent or so. Taking all households together, we estimate a total reduction of labor supply caused by the tax-transfer system of 5.2 percent. This compares with the estimate of Danziger, Haveman, and Plotnick (1981) that transfer programs alone (excluding the taxes that finance them) have reduced overall labor supply by 4.8 percent. Lampman (1981) has also estimated the reduction of labor supply due to social welfare programs and the taxes that finance them at 7 percent. Hence, our benchmark parameters yield estimates of the labor supply effect of the current tax-transfer system that are similar to other estimates in the literature.

Table 5 also implies a backward-bending labor supply curve; reading down the diagonal along which $ATR = MTR$, we see that labor supply rises until tax rates reach 30 percent and does not fall below the no-tax position until taxes are 50 percent.

The most important justification of the benchmark parameters would come from comparison with econometric evidence of labor supply response. Unfortunately, that voluminous literature is not easily summarized, nor is there a consensus on labor supply elasticities. Recent critical surveys of the labor supply literature yield some bounds on elasticity estimates. Keeley (1981), surveying the nonexperimental literature, gives a mean estimate of uncompensated and compensated elasticities for married men of $-0.11$ and $0.10$, respectively, with $1.28$ and $1.05$ as the corresponding figures for married women. Since women work around 30 percent of all hours, a weighted overall average would be $0.3$ and $0.37$, respectively. Keeley’s survey of the experimental literature gives a mean overall compensated elasticity of $0.16$.

Moffitt and Kehrer’s (1981) survey offers similar averages with generally lower elasticities found in the experimental results. On the other hand, Bishop (1980) contends that the true long-term labor supply response implied by the experiments is larger than conventionally estimated. He finds the overall impact of the Seattle-Denver experiment (the most recent and best executed experiment) as reduc-

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15 Other surveys by Fullerton (1982), Heckman, Killingsworth, and MaCurdy (1981), and Killingsworth (1981) are in general accord with these nonexperimental findings.
ing labor supply by about 16 percent. This also accords fairly well with our benchmark case, since table 5 shows the effect (starting from no taxes) of $MTR = 0.5$ and $ATR = -0.3$—which we believe is representative for the average participant in the experiments—as a 16 percent reduction in labor supply. The actual experiments, of course, did not start from the no-tax position, so our benchmark implies a more limited response than in the Seattle-Denver experiment.

Some recent labor supply studies have found much higher substitution elasticities than the research summarized above. Hausman (1981) estimates an inelastic uncompensated labor supply response for married men, but substantial compensated effects; using his estimates, we compute an uncompensated elasticity of about 0.3 and a substitution elasticity of about 0.6 for all workers. MaCurdy (1980), using a life-cycle model, finds uncompensated and compensated elasticities of 0.7 and 1.47 for men, respectively. Both of these estimates seem implausibly large to us but suggest that the benchmark case is not likely to overstate labor supply responses.

In short, the benchmark case $A$ accords roughly with the bulk of the econometric evidence of labor supply elasticities, evidence of the effect of the Seattle-Denver Income Maintenance experiments, and estimates of the effect of the current tax-transfer system on labor supply. Cases $B$ and $C$, with their implied overall economy-wide uncompensated labor supply elasticities of 0.41 and 0.31 (and compensated elasticities of 0.47), seem to us to be about as large as can be reasonably defended. At the other extreme, cases $D$ and $E$, with their implied overall uncompensated elasticities of 0.15 and 0.05 (and compensated elasticities of 0.21), would appear to be about as low as is plausible given available evidence. Although we find the benchmark case the most congenial set of parameters, we offer simulation results for all five cases, hoping that they will span the range of possibilities most readers find acceptable.

V. Simulation Results

Before discussing the results of the simulations, we should clarify several assumptions that were employed in the computations:

1. Wage rates are assumed to be constant. Thus, gross market earnings vary in proportion to the change in the quantity of labor supplied.

2. Capital income, in the aggregate and for each household, is assumed to be unaffected by the changes in tax and transfer policies being investigated.

3. The marginal tax rate imposed on each household by the current tax-transfer system is assumed to be constant. The change in net
revenues collected from (or dispersed to) each household by existing policies when market earnings change is calculated using this marginal tax rate. This procedure ignores possible nonlinearities in budget constraints—which we believe is plausible for the small changes in taxes and transfers and, hence, small changes in labor supply that we emphasize.

4. For purposes of computing the change in the labor supply for each household, the change in the average tax rate is estimated at current levels of market earnings. In a nonproportional tax system, the average tax rate as conventionally defined is endogenous since it depends on the amount of labor supply chosen. To apply our formula relating labor supply to tax rates, however, this rate must be exogenously given. Our procedure effectively uses the vertical displacement in the budget constraint from the initial equilibrium as an exogenous measure of the change in the average tax rate.

5. The supplemental tax on labor income and per capita transfers are subject to a balanced budget requirement. In practice, satisfying the balanced budget requirement necessitated repeated iterations since the size of the transfer that could be financed by a 1 percent tax depends on the labor supply response, and the labor supply response depends in part on the size of the transfer (through its effect on the average tax rate). In each simulation, therefore, we varied the per capita transfer until the balanced budget requirement was approximately satisfied.

More precisely, we estimated the labor supply effects of a 1 percent additional tax on labor income (and associated transfers) as follows. Letting $MTR_1$, $ATR_1$, and $Y_1$ stand for current marginal and average tax rates and labor supply, we have, using equation (1):

$$Y_2 = \frac{[1 - (MTR_1 + .01)^\beta](1 + \alpha ATR_2) \cdot Y_1}{(1 - MTR_1^\beta)(1 + \alpha ATR_1)},$$

(2)

where $Y_2$ is labor supply with the incremental policy and $ATR_2$ is the average tax rate incorporating the additional transfers as described above. Equation (2) expresses labor supply with our demogrant policy as a function of known quantities.

The Money Income Trade-Off

Table 6 presents our results for a marginal change in the tax-transfer system using a 1 percent tax on gross labor income to finance equal per capita transfers. For each combination of parameter values, we give the changes in disposable money income per household for each quintile. For purposes of comparison, the last row illustrates how
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TABLE 6
Effects of 1 Percentage Point Increase in Tax Rate
money incomes are affected if labor supply does not change at all. Note that this assumption of no labor supply response yields estimates of gains and losses that are quite far off the mark. Even for our most inelastic labor supply response, case E with an uncompensated elasticity of 0.05, the gain to the lowest two quintiles together is only half as large as the gain estimated when labor supply responses are ignored.

Our primary concern here is with the marginal trade-off implied by a movement toward greater income equality. In a many-person world, however, it is not clear how to measure this trade-off most meaningfully. Two measures are given in table 6. The first, in the next-to-last column, gives the ratio of combined income losses for the quintiles that have their disposable incomes reduced to the combined income gains for the quintiles that gain.\(^\text{16}\) For our benchmark case A, this ratio is 9.51, implying that at the margin each dollar of disposable income for the lower two quintiles costs the upper three quintiles $9.51. (A convenient way to think of this ratio is as a measure of the marginal cost of changing the disposable income of lower-income households.)

This measure of the trade-off is somewhat inaccurate because the identities of the quintiles that gain and lose depend on the labor supply response. In case A, for example, the ratio gives the loss of the top three quintiles relative to the gain of the bottom two, while in case B it gives the loss of the top four quintiles relative to the gain of the lowest quintile. An alternative way to measure the trade-off avoids this problem by aggregating the change for the top four quintiles in all cases and comparing this to the gain for the bottom quintile. This ratio is given in the last column of table 6 and may be more appropriate if our goal is primarily to assist households in the lowest quintile.

As will be noted, these measures of the trade-off are quite sensitive to the assumed labor supply response, varying from 4.20 (5.99) for case E to 26.93 for case B. One surprising finding, however, is that the trade-off is not very sensitive to the value of \(\alpha\). Note that keeping \(\beta\) constant but increasing \(\alpha\) from 0.1 to 0.3 (cases B and C, or D and E) has only a small effect on the trade-off. We have experimented with values of \(\alpha\) up to 1.0 with similar results. Increasing \(\alpha\)—which implies a larger income effect on labor supply—reduces the benefit to households that gain (they earn less with a larger income effect) but also reduces the loss to households that lose (they earn more with a larger income effect), so the net effect on the ratio is theoretically indetermi-

\(^{16}\) Note that this measure ignores intraquintile redistribution. Within a quintile, larger-sized households gain more (or lose less) from the policy than smaller-sized households.
nate. Given our formulation, these offsetting effects approximately cancel out insofar as the trade-off is concerned, so the trade-off depends mainly on compensated labor supply elasticities. This conclusion is quite important, particularly if recent research (Hausman 1981) suggesting that compensated labor supply responses are much larger than uncompensated responses (and larger than our value for case B) is supported by further work.

Although our major emphasis is on the marginal trade-off, we have also considered a large change in the tax-transfer system designed to increase the money income of the lowest quintile as much as possible. (This corresponds to point C in fig. 1, with the aggregate income of the lowest quintile measured horizontally.) This maximin outcome, first proposed by Rawls (1971), presumably defines the outer limit to which anyone would be willing to push income redistributive policies.\textsuperscript{17} Although few are likely to be as egalitarian as Rawls, identifying how close we have already come to maximizing the income of the lowest quintile is of some interest. (Actually, Rawls proposed maximizing the position of the worst-off individual, but in a world with considerable mobility over time it is impossible to identify this individual so we have chosen to focus on the lowest quintile of households.)

Table 7 gives the results of these simulations. For our benchmark case A, a supplemental tax rate of 19 percent on labor income financing per capita transfers maximizes the income of the lowest quintile, producing an increase in average income of $376 per year per household, an increase of 8.1 percent. Thus, for this case, the current tax-transfer system has already increased the disposable income of the lowest quintile to 92.5 percent of its maximum value. Achieving an additional gain of $376 results in a loss for the top four quintiles that is 30 times as great. (In these simulations, the top four quintiles lose in all five cases, so there is only one loss/gain ratio to consider.) For the other four cases, there is the expected variation in results, though the range of variation is not as pronounced as for the marginal change simulated earlier.

Since we are here investigating a very large discrete change in the tax-transfer system, we believe less significance should be attached to these estimates than to those for a marginal change. Taken at face value, however, the estimates in table 7 seem to suggest that the maximum extent to which disposable incomes in the lowest quintiles can be increased is rather limited, at least when using a tax-transfer policy of the type considered.

\textsuperscript{17} Of course, “envy” could push the optimal point beyond point C.
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The Welfare Trade-Off

To this point, our measures of gains and losses have been in terms of changes in disposable money incomes. These measures, although of some interest, are not good estimates of the changes in well-being because they ignore the value of additional leisure time to households. For the marginal change considered in table 6, we now convert the gains and losses into estimates of the income-equivalent gains and losses that value leisure. As expected, this will reduce the trade-off ratios since, when the value of leisure is included, the gains to lower-income households will be larger while the losses to upper-income households will be smaller. Nonetheless, the ratio will still exceed unity because of the additional welfare cost that results from a higher marginal tax rate on labor income.

Figure 3 can be used to illustrate how the marginal welfare cost
enters into the calculation of the income-equivalent loss to a taxpayer. (A symmetrical analysis applies to net transfer recipients, whose additional transfers are larger than additional taxes.) The budget constraint in the absence of any taxes and transfers is $YN$, but the current tax-transfer system confronts the taxpayer with budget constraint $Y_1N_1$, so the initial equilibrium is at point $A$. An additional 1 percent tax on labor income combined with a lump-sum transfer shifts the budget constraint to $Y_2N_2$—drawn greatly exaggerated for clarity. The final equilibrium is at point $B$, and the reduction in money income is shown by the distance $AJ$.

The income-equivalent loss in well-being is the sum of the additional tax revenue collected from the taxpayer and the additional welfare cost due to the added labor supply distortion from the higher marginal tax rate. Drawing line $aa$ through point $B$ and parallel to $YN$, we see that the additional tax revenue is equal to $AH$. To identify the marginal welfare cost, we assume that a lump-sum tax is added to the initial tax-transfer system ($Y_1N_1$) such that the individual can just attain $U_1$: this is shown by line $bb$, which is parallel to $Y_1N_1$. This identifies the compensated change in labor supply from the 1 percentage point increase in the marginal tax rate, $CB$, that must be used to calculate the marginal welfare cost. The marginal welfare cost equals the difference between the market valuation of this compensated labor supply change, $DC$, and the individual’s valuation of this quantity of leisure, $EC$; thus, $DE$ is the marginal welfare cost. An alternative way to see this is to note that at point $E$ the taxpayer is bearing a tax burden that is greater than the additional revenue ($AH$) generated by the policy by the distance $DE$. Thus, $DE$ is a loss in addition to the direct revenue cost of $AH$. The important point is that the compensated (not the actual or uncompensated) change in labor supply must be used to estimate the marginal welfare cost.

In our simulations, the income-equivalent loss (or gain) was estimated in the following way. First, the compensated change in labor supply is estimated by using equation (2) to calculate the labor supply that results when the average tax rate changes in the prescribed way but the marginal rate is held fixed at its initial value. (This is analogous to the shift in the budget constraint from $Y_1N_1$ to $bb$ in fig. 3, which raises the average but not the marginal rate.) Subtracting the estimated labor supply under the demogrant policy from this yields the compensated change in labor supply. Then this change in labor supply is valued at the market wage rate to yield the compensated change in market earnings ($DC$ in the diagram). From this figure the household’s valuation of the compensated labor supply change must be subtracted. We estimated this by using a net wage rate halfway
between the initial net marginal wage rate and the final one. For example, if the marginal tax rate rises from 40 to 41 percent, the household’s value for the compensated labor supply change is 59.5 percent of its market valuation. Finally, the marginal welfare cost estimates are combined with each household’s change in net tax revenues to determine the total loss or gain to the household.

Table 8 gives the results of these calculations, once again in the form of the average gain or loss per household in each quintile. As expected, in comparison to table 6 the gains to quintiles that benefit are larger while the losses to quintiles that are harmed are smaller. In the benchmark case, the income-equivalent loss to the top three quintiles is $3.49 per dollar of income-equivalent gain to the lowest quintiles, substantially less than the $9.51 trade-off rate when disposable money incomes alone are considered.

We believe these estimates suggest that the cost of moving further toward income equality by using tax and transfer programs is much higher than generally recognized. As evidence on this point, consider the words of the late Arthur Okun, who in Equality and Efficiency: The Big Tradeoff openly stated his views regarding the trade-off he would find acceptable. Okun likened moves to equalize incomes as transfers of money using a “leaky bucket”: due to the adverse incentive effects the gain to recipients is less than the costs to taxpayers. Okun states (1975, p. 94) that he would accept a leakage of 60 percent for redistribution from the top 5 percent of households to the lowest 20 percent, but a leakage of only 15 percent for a redistribution from households with incomes 30 percent above the mean to 30 percent below.

In view of Okun’s expressed opinion that government should expand its redistributive activities, we are safe in concluding that he felt that actual marginal leakages fell short of these values. Our own estimates, however, suggest that actual marginal leakages are larger than Okun would have accepted. Note that Okun’s concept of leakage corresponds to (one minus) the reciprocal of our trade-off ratio. For example, in case A the ratio of losses to the top three quintiles to the gain for the bottom two quintiles is 3.49 and means that each dollar of cost to upper-income households only provides a benefit of 29 cents to low-income households, a leakage of 71 percent. Moreover, that should be compared to an average (perhaps weighted in some way) of Okun’s 60 percent and 15 percent values since we consider the trade-off across all income classes and not just from the top to the bottom. We note that the “leakages” implied by our estimates all exceed 70 percent, except for the first measure of the trade-off for cases D and E. Even in those cases, however, the “leakage” is about 56 percent, well in excess of the unweighted average value of 37.5 percent that
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Okun found acceptable. In other words, given his expressed values, and assuming our estimates are reliable, Okun should have favored a reduced role for government in redistributing income.

Or consider Arnold Harberger’s view: “While the most eminent minds in the economics profession would be hard put to find ways of effectuating quantitatively important transfers at efficiency costs of less than 1 percent of the amounts involved, most beginning graduate students could in one afternoon invent a hundred ways of bringing about major transfers at an efficiency cost of less than 20 percent of the amounts involved” (1978, p. S115). It seems almost certain that marginal welfare costs are much larger than Harberger suggests in this passage.

VI. Conclusion

Our major conclusion is that the marginal cost of less income inequality is surprisingly high even when labor supply elasticities are relatively low. This finding does not imply that we have necessarily gone beyond the “optimal” degree of income equality; it is just an attempt to identify the real trade-off involved. We do, however, hope this research will stimulate further attempts to investigate the relevant objective trade-offs that must be made to evaluate the government’s redistributive role.

Given the narrow focus of the present paper on the labor supply effects of changes in tax-transfer policies, the overall trade-offs for actual policies may be greater or smaller. In addition to affecting labor supply, most actual redistributive policies involve other costs that we have ignored: administrative and compliance costs; effects on the composition of income and expenditures due to narrow measures of taxable income (the “loophole” problem); effects on family size and composition; effects on human capital accumulation; and effects on consumption patterns due to the use of in-kind transfers. Moreover, an important assumption in our model is that the marginal redistribution has no effect on saving. If, as seems likely, saving is adversely affected, then the marginal cost of reducing income inequality may be substantially greater than our estimates imply (Mendelsohn 1983). Because of these omissions from the model, our presumption is that actual policies are more distorting than our policy that affects only the quantity of labor supplied; if this is so, our estimates would be lower bounds to the trade-off implied by actual policies.

On the other hand, it may be that a totally different type of policy could redistribute income at a lower cost. For example, wage rate subsidies or earnings subsidies (like the earned income tax credit) may be more efficient at the relevant margin than the type of negative
income tax examined. In addition, structural changes in the present tax-transfer system might be capable of reducing the marginal trade-off.\textsuperscript{18}

Finally, our estimates show that the magnitude of compensated supply elasticities has a major influence on the trade-off between equality and efficiency. Even for the relatively narrow range of compensated elasticities we considered, from 0.2 to 0.45, the trade-off showed wide variation. The importance of further empirical investigation of the determinants of labor supply in an effort to narrow the range of uncertainty is clearly underscored by this finding.

References


\textsuperscript{18} For example, reducing reliance on government for weakly redistributive policies such as social security would allow the trade-off to be improved. Our simulations have held constant all existing programs.