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“The US fiscal system as an opportunity equalizing device”

by

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1.✲ Introduction

In democracies, at least, it is an axiom that taxation should be fair. What constitutes fairness depends, of course, on one’s theory of fairness or justice. Most Americans subscribe to some version of an equal-opportunity theory of justice. One of us has recently proposed a general conception of what equalizing opportunities requires (Roemer [1998]), and in this paper we apply that conception to the issue of income taxation in the United States. In this section, we briefly review this approach to equalization of opportunities, and indicate how the tax-and-transfer system of a country can be viewed as an instrument for equalizing opportunities for income. If fairness requires equality of opportunity[1], then a fair tax-and-transfer system is one that equalizes opportunities for some objective, which arguably should be income. (An alternative but far more controversial objective would be ‘welfare ‘—more controversial, since equalizing opportunities for welfare would require, according to our theory, an interpersonally comparable and measurable index of individual welfare.)

The popular idiom which this theory formalizes is that of ‘leveling the playing field’: equal opportunity with respect to acquiring income will have been achieved when the playing field has been leveled. What are the troughs and mounds in the playing field,

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[1] See Young (1994, chapter 6), for a quite different discussion of how income taxation might embody fairness.

in its initial state, that should be leveled? They are, we propose, the advantages and disadvantages that individuals face by virtue of circumstances beyond their control which aid or hinder their capacity to achieve the objective in question -- in our case, income. Thus, the first step in conceptualizing equality of opportunity is to specify the *circumstances* beyond the control of individuals that are relevant for the problem at hand. We next partition the population into a set of *types* , where a type consists of all individuals with the same circumstances.

What, besides circumstances, influences the value of the objective (in our case, income) the individual eventually acquires? His own *effort*, and the *policy* that may be applied to intervene in the achievement of the objective, such as tax policy. Effort should be conceived of as those actions and behaviors of the individual which society wishes to hold him accountable for – basically, everthing but circumstances and perhaps luck.

The philosophy of equal opportunity is this: the achievement of the objective by an individual should be sensitive to his effort, but not to his circumstances. That is, the equal-opportunity planner, or society, uses *policy* so that, as far as possible, the degree of the *objective* achieved by individuals will reflect their *effort*, but will be independent of their *type*, or *circumstances*. Thus, the playing field is leveled by using policy to compensate those with disadvantageous circumstances.

The language of the theory thus consists of five words: objective, circumstance, type, effort, and policy. One can see there are many ways of computing equal-opportunity policy: given the objective for opportunities that are to be equalized, there are still many decisions to be made, concerning what constitute the relevant circumstances, effort, and set of policies. For instance, one might advocate using educational investment as the appropriate policy to equalize opportunities for income, rather than the nation's fiscal system. One can study the choice of instrument using economic analysis – what is the cost of achieving a given degree of opportunity equalization with respect to different choices of the policy instrument? That problem will not be addressed here. Rather, we shall ask, to what extent does the *actual* fiscal system in the United States equalize opportunities for income among citizens? Even if our actual fiscal system does that job relatively poorly , one might argue that it would be less costly to equalize opportunities for income by intervening with a policy of educational finance rather than by altering the fiscal system.

To summarize in another way: Equality of Opportunity distinguishes between two sets of factors which influence a person's achievement of an objective, her circumstances and her effort. It seeks to *hold the person responsible* for the consequences of her effort, but not for the consequences of her circumstances. It is thus to be distinguished from the more radical Equality of Outcome view, which would use policy to equalize, so far as possible, the degree of the objective achieved by all. That view implicitly holds individuals responsible for nothing about their behavior.

As far as the history of thought is concerned, the modern conception of equality of opportunity grew out of a lively debate among political philosophers, initiated in the early 1970s by John Rawls's *Theory of Justice.* In Rawls's theory the distinction between what we have called circumstances and effort was discussed, but the 'maximin primary goods' proposal that he made inadequately captured the idea that individuals should be held responsible for their effort but not for their circumstances. Other important contributions to the debate, from which the approach we have summarized grew, were Sen (1980), Dworkin(1981a,b), Scanlon(1988), Arneson(1989), and Cohen(1989). A summary of this intellectual history can be found in Roemer (1996, Chapters 5,7, and 8).

We proceed to formalize, very quickly, the proposal outlined verbally above. More justification and elaboration can be found in Roemer (1998). Let Φ be the set of feasible policies, with generic element ϕ. Let the types of individual be denoted 1,2,…,T, with generic index t. Let $u^t(e, \phi)$ be the value of the objective achieved on average by individuals of type t under policy ϕ who expend effort e. (We assume for the moment that effort is a one-dimensional variable, an assumption we shall later drop.) Under a given policy ϕ, there will be forthcoming a *distribution of effort* among the individuals in each type. Denote the CDFs of those probability distributions as $F^t(e;\phi)$. Our aim is to use policy to equalize, so far as is possible, the average value of the objective achieved *across types* for a *given degree of effort*. But we do *not* wish to equalize the objective value for individuals who expended different degrees of effort. If we could do what has just been proposed, we would have implemented the equal-opportunity view, that the degrees of the objective achieved by individuals are sensitive to their effort, but not to their circumstances (type).

But there is a problem: the *distributions* of effort at a policy ϕ will be, in general, very different across the types. And the distribution of effort in a type is a *characteristic of the type*, not of any individual. Because we wish not to hold persons responsible for their type, we should therefore not hold them responsible for being in a type with a ‘bad’ distribution of effort. That is to say, we should not use the raw effort *e* an individual expends as the appropriate measure of effort, for it is polluted by characteristics of the effort distribution, as far as we are concerned. We must, rather, use a measure of effort from which we have purged the characteristics of the effort *distribution* of the type. The obvious choice is to measure a person's effort by the *centile* (more generally, quantile) of the effort distribution of his type at which he sits. This gives us an inter-type comparable measure of effort in which the degree of a person's effort is assessed by comparing him only to others with his circumstances. For example, those at medians of their effort distributions in different types will be declared to have expended the same *degree of effort (*as opposed to *level* of effort).

Given the functions u^t, and the distributions F^t, we can compute the *indirect objective functions,* denoted $v^t(\pi; \phi)$, which give the average value of the objective among members of type t, who are located at the π^{th} quantile of their effort distribution, when the policy is ϕ. We assert that all individuals, regardless of type, who have the same index π, have expended the same *degree of effort*, although their levels of raw effort are generally different.

Let us now fix the value of π at some number in the interval [0,1]. If we consider only this slice of the population – all those at degree of effort π in the various types – then our equal-opportunity goal would be to choose ϕ in Φ to

$$\underset{\varphi}{Max}\,\underset{t}{Min}\,v^t(\pi;\varphi). \qquad (1.1)$$

That is, we wish to make it so that the average achievement of the objective across types at the given degree of effort is as equal as possible, in the sense of making the achievement of the type with the lowest average achievement as high as possible.

Let us call the solution to program (1.1) ϕ_π. If the policies $\{\phi_\pi\}$were identical for all π in [0,1], then that well-defined policy would unequivocally be the equal-opportunity policy. Unfortunately, this will essentially never happen. We will, in general, have a continuum of policies, one for each π. Thus, we must take some second-best approach.

The approach proposed in Roemer (1998) is to create an aggregate objective function which gives the objective function of each π slice – namely the function $\underset{t}{Min}\, v^t(\pi;\varphi)$ -- its per capita weight in the aggregate. That is, we give the objective function of each 'effort centile' of the population a weight of 1% in the social objective. Thus, our equality-of-opportunity objective becomes:

$$\underset{\varphi}{Max}\int_0^1 \underset{t}{Min}\, v^t(\pi;\varphi)\, d\pi. \qquad (1.2)$$

We call the solution to program (1.2) ϕ^{EOp}.

The reader can notice that program (1.2) has two parents: Rawls's maximin, and utilitarianism. Our program is *egalitarian* with respect to individuals across types at the same degree of effort, but *utilitarian* with respect to the π–slices of individuals across effort levels. It turns out, in a way that we cannot make precise here, that the optimal policy ϕ^{EOp} always lies 'between' the pure utilitarian policy and the pure Rawlsian policy. To the extent that effort is important and circumstances are unimportant, ϕ^{EOp} will be close to the utilitarian policy and far from the Rawlsian policy; to the extent that circumstances are important and effort is unimportant, ϕ^{EOp} will be close to the Rawlsian policy and distant from the utilitarian policy. Thus Rawls and utilitarianism are located at two poles – the first ignores differential effort and hence responsibility, the second ignores differential circumstances. The equal-opportunity policy strikes a measured compromise, holding the individual responsible for her effort, but not for her circumstances.

We have not, thus far, referred to efficiency. It is intuitively clear that, in many cases, if we compensate those from disadvantageous types a great deal, we may lower the average value of the achieved objective (income, for us) in society substantially below what it would have been without the compensatory policy, for disadvantaged types maybe relatively 'inefficient' at converting resources into the objective. By 'efficiency,' many people mean the size of the aggregate pie – in our case, this is simply measured by the utilitarian objective, which is, at policy ϕ:

$$\sum_t p_t \int_0^1 v^t(\pi;\varphi)d\pi , \qquad (1.3)$$

where p_t is the fraction of the population in type t. Obviously, choosing ϕ to maximize (1.3) is a different problem from the equal-opportunity program (1.2); those concerned with the 'efficiency cost' of EOp will be concerned with the decrease in the size of the pie in moving from actual policy to the EOp policy. Expressing this decrease in average income as a fraction of average income under the current policy, we define the *efficiency cost of the EOp policy* as:

$$\frac{(\sum_t p_t \int_0^1 v^t(\pi;\varphi^{pre})d\pi - \sum_t p_t \int_0^1 v^t(\pi;\varphi^{EOp})d\pi)}{\sum_t p_t \int_0^1 v^t(\pi;\varphi^{pre})d\pi}, \qquad (1.4)$$

where ϕ^{pre} is the present policy. We shall not ignore this concern with efficiency in what follows.

2. The equal opportunity objective

Let $v^t(\pi,\varphi)$ be the level of the objective reached, on average, by individuals of type *t*, who are at the π^{th} quantile of the effort distribution of their type, when the instrument or policy is φ. The EOp program is, as we've said:

$$\underset{\varphi\in\Phi}{Max}\int_0^1 \underset{t}{Min}\, v^t(\pi,\varphi)\,d\pi \tag{2.1}$$

where Φ is the set of admissible policies.

Our objective is income. We shall choose Φ to be a set of tax-and-transfer policies, specified as functions of pre-tax income. More specifically, a generic element $\varphi\in\Phi$ is a function $\varphi(x) = a\,x^2 + b\,x + c$, where x is pre-fisc income and $\varphi(x)$ is post-fisc income. Presently, we shall impose some restrictions on Φ.

Let $G^t(\cdot,\varphi)$ be the distribution function of post-fisc income in type *t* at policy φ. We conceive of effort as all those choices and behaviors of individuals not specified by a person's type. In particular, since income is by definition a monotone increasing function of effort, we may conclude that the individual at the π^{th} quantile of the effort distribution of her type is precisely she who is at the π^{th} quantile of the pre-fisc <u>income</u> distribution of her type. Now impose the restriction that all elements of Φ be monotone increasing functions: then the individual at the π^{th} quantile of the pre-fisc income distribution is also at the π^{th} quantile of the post-fisc income distribution. Thus, we have the equation

$$\pi = G^t(v^t(\pi,\varphi);\varphi), \tag{2.2}$$

where $v^t(\pi,\varphi)$ is the average income of the individuals in type *t* at the π^{th} quantile of the effort distribution of his type, at policy φ. Since $G^t(\cdot,\varphi)$ is a strictly increasing function it possesses an inverse, and we can write

$$G^{t^{-1}}(\pi;\varphi) = v^t(\pi,\varphi). \tag{2.3}$$

Substituting into (2.1), our objective becomes

$$\underset{\varphi\in\Phi}{Max}\int_0^1 \underset{t}{Min}\, G^{t^{-1}}(\pi;\varphi)\, d\pi \tag{2.4}$$

Now there is a simple geometric interpretation of (2.4). For simplicity let there be two types, and suppose their two distribution functions, $G^1(\cdot;\varphi)$ and $G^2(\cdot;\varphi)$, for a particular φ, are as pictured in Figure 1. Then the integral in (2.4) is simply the area bounded by the vertical axis, the ordinate axis, the line at the ordinate value one, and the left-hand envelope of the graphs of G^1 and G^2.

In Figure 1, we have drawn the graphs of $\{G^t\}$ as intersecting in several places, for purposes of generality. But in actual empirical work, the distribution functions of post-fisc income of different types will not cross, if we restrict ourselves to monotone policies φ. Therefore, in our application, (2.4) says to choose φ to *maximize the area above the post-fisc distribution function of the most disadvantaged type*, bounded by the axes and line y=1.

[Figure 1 here]

3. <u>The admissible set of policies</u>

Let us now define Φ. Suppose the actual policy $\hat{\varphi}$, at present, is given by $(\hat{a},\hat{b},\hat{c})$, and the distribution pre-fisc income is $\hat{H}$ for the entire sample and $\hat{H}^t$ for type t. These are all observables. Then average post-fisc income is given by

$$\int\left(\hat{a}x^2 + \hat{b}x + \hat{c}\right)d\hat{H}(x) = m, \tag{3.1}$$

while average pre-fisc income is

$$\int x\,d\hat{H}(x) = \mu. \tag{3.2}$$

The difference μ-m is government consumption per capita, assuming a balanced budget, which we write

$$\mu - m = -\hat{a}\int x^2 d\hat{H} + \left(1-\hat{b}\right)\int x d\hat{H} - \hat{c}. \qquad (3.3)$$

The first restriction we shall impose on policies is that they be revenue neutral in the sense of holding government consumption constant. Thus, for any policy $\varphi \in \Phi$, where $\varphi=(a,b,c)$, we insist that

$$c = -a\int x^2 dH(x;\varphi) + (1-b)\int x dH(x;\varphi) + m - \mu. \qquad (3.4)$$

Equation (3.4) gives an expression for c (implicitly, since c is part of φ) as a function of (a,b). We may therefore, from now on, specify a policy as (a,b), where it is understood that the associated c is the solution of (3.4).

We shall also insist that φ be monotone increasing in pre-fisc income, which is the usual incentive-compatibility constraint. Assuming the lowest pre-fisc income is zero and the highest is x_{max} (which itself will be a function of the policy), monotonicity is equivalent to

$$b \geq 0 \qquad (3.5a)$$

$$2\, a\, x_{max} + b \geq 0. \qquad (3.5b)$$

Finally, we insist that the post-fisc income of the individual with zero income be non-negative:

$$c \geq 0 \qquad (3.6)$$

Thus Φ is the set of all quadratic functions satisfying (3.4), (3.5), and (3.6).

4. Measuring the degree of EOp

At policy (a,b), the post-fisc income of an individual income x is $ax^2 + bx + c$, where c is given by (3.4). $\varphi(x)$ includes transfers payments that the individual receives, but not his consumption of public goods provided by the government. We shall take a simple approach to allocating government consumption –namely, we assume that everyone consumes his per capita share, μ-m. Thus, we shall define an *augmented* post-fisc income distribution for type t as $\tilde{G}^t$, where

$$\tilde{G}^t(y+\mu-m;\varphi) \equiv G^t(y;\varphi). \tag{4.1}$$

That is, we simply add μ-m to everyone's post-fisc income.

Consequently, the value of the EOp objective at φ is the area above the graph of $\tilde{G}^{t'}(z;\varphi)$, where t' is the most disadvantaged type, which may be expressed as

$$\varphi(x_{\max}) + \mu - m - \int_{\mu-m}^{\varphi(x_{\max})+\mu-m} \tilde{G}^{t'}(z;\varphi)dz, \tag{4.2}$$

where $x_{\max}$ is maximum pre-fisc income in type t at φ. But this is the same as

$$\varphi(x_{\max}) + \mu - m - \int_{\varphi(0)}^{\varphi(x_{\max})} G^{t'}(y;\varphi)dy. \tag{4.3}$$

(That is, adding μ-m to post-fisc income just shifts the distribution to the right.)

Our goal is to measure the extent to which current fiscal policy equalizes opportunities for income. To do so, we will compare three situations:

1. the value of the EOp program were there no taxation –call it V_1;

2. the value of the EOp program at present policy –call it V_2;

3. the value of the EOp program at the optimal solution to the EOp program –call it V_3.

Then we shall define

$$\nu = \frac{V_2 - V_1}{V_3 - V_1} \tag{4.4}$$

as the degree to which present policy equalize opportunities for income. Note ν will be a number in [0,1], assuming that present policy does not equalize opportunity to some extent, compared to *laissez-faire*.

4. <u>Optimal</u> <u>taxation</u>

To compute values V_1 and V_3 we shall need to compute the labor supply responses of individuals to quadratic tax policies. We adopt a simple quasi-linear utility function for these purpose. Namely, we shall assume that all individuals maximize

$$u(x,L) = x - \alpha L^{1+1/\eta}, \tag{5.1}$$

where x is income and L is labor (α and η are the same for all agents). It is well-known that, in this formulation, η is the labor supply elasticity with respect to the wage. We assume there is a distribution of 'wages', F, in the population, and F^t in the type t. The wage is the individual's earnings should she work exactly one unit of time, but she may choose to work more or less than that.

Our procedure will be to observe the actual relationship between pre-fisc and post-fisc income; this turns out, for the US, to be almost exactly linear. Thus we can characterize present policy as $\hat{\varphi}(x) = \hat{b}x + \hat{c}$. Then, using the labor supply function, we invert to find the distribution of wages in each type. Then we work with the wage distribution to carry out our calculations of the effect of taxation.

Our actual individual, of wage w, faces the linear fiscal policy $\hat{\varphi}$. Thus, he solves the program

$$\underset{L}{Max}\ \hat{b}(wL) - \alpha L^{1+1/\eta}$$

which gives a labor supply of

$$\hat{L}(w) = \left(\frac{\hat{b}w}{\hat{\alpha}}\right)^{\eta} \tag{5.2}$$

where $\hat{\alpha} \equiv \alpha(1+1/\eta)$. Recall that we observe a current aggregate pre-fisc income distribution of $\hat{H}$ and $\hat{H}^t$ in type *t*. By (5.2), it follows that the pre-fisc income, *x*(*w*), of a *w*-individual is

$$x(w) = \left(\frac{\hat{b}}{\hat{\alpha}}\right)^{\eta} w^{\eta+1} \tag{5.3}$$

Since *x* is monotone in *w* (because η+1 > 0), we invert to find the distribution function of wages in type *t*:

$$F^t(w) \equiv \hat{H}^t(x(w)), \tag{5.4a}$$

and, of course, for the aggregate:

$$F(w) \equiv \hat{H}(x(w)). \tag{5.4b}$$

We can now easily compute V_1. It is the value of the EOp program associated with the policy (*a*,*b*,*c*) = (0,1,0). Pre-fisc income *and* post-fisc income are given, in this case, by

$$y = \left(\frac{1}{\hat{\alpha}}\right)^{\eta} w^{\eta+1},$$

and so the post-fisc income distribution in type *t'* is just

$$G^{t'}(y) = F^{t'}\left((\hat{\alpha}^{\eta} y)^{\frac{1}{1+\eta}}\right). \tag{5.5}$$

Since μ-*m* = 0 in this case (government consumption is zero), the value of (4.3) is

$$V_1 = x_{\max} - \int_0^{x_{\max}} G^{t'}(y)dy, \tag{5.6}$$

where $x_{\max} = \left(\frac{1}{\hat{\alpha}}\right)^{\eta} w_{\max}^{1+\eta}$.

We next compute V_3. This is more complicated, because we allow for quadratic fiscal policy. The labor supply, L, of an individual w facing fiscal policy (a,b) is the solution to the equation

$$2a\,w^2 L + b\,w - \hat{\alpha}\,L^{1/\eta} = 0 \tag{5.7}$$

Using the quadratic formula, we can solve (5.7) for w. There are two branches; the economically correct one is given by

$$w = \frac{-b + \left(b^2 + 8a\,\hat{\alpha}\,L^{1+1/\eta}\right)^{1/2}}{4a\,L} \tag{5.8}$$

We shall analyze the problem numerically, because a closed-form solution does not exist. Indeed, we shall estimate all integrals as discrete sums.

We begin by choosing 50 values of w_i, given by

w_1 = 2500

$w_i = w_{i-1}$ + 2500

w_{50} = 125,000.

(The wage \$125,000 per annum turns out to be above the .99 quantile of the wage distribution for all of out types.) Consider a hypothetical policy (a,b), with b>0. First, compute the 50 values, L_i, associated with our wage series, w_i, by solving (5.8) repeatedly. We now transform the integration in (3.4) to be with respect to w, since we know the distribution $F^t(w)$ and $F(w)$. Thus, the associated value 'c' to (a,b) is given by

$$c = -a\int \left(wL(w)\right)^2 dF(w) + (1-b)\int wL(w)dF(w) + m - \mu .$$

We estimate these integrals numerically, using our grid (w_i,L_i). We check that $c \geq 0$, our first constraint.

Second we check that

$$2a\, w_{50}\, L_{50} + b \geq 0,$$

our constraint (3.5b).

Assuming (a,b) passes these two tests, we know it is admissible, and we compute the integral in (4.3) as follows. Compute the grid of post-fisc incomes

$$y_i = a\,(w_i\, L_i)^2 + b\,(w_i\, L_i) + c. \qquad i = 1, 50$$

If G^t is the distribution function of post-fisc income then, by monotonicity, we know

$$G^t(y_i) = F^t(w_i) \qquad \text{for all i.}$$

We therefore can estimate the integral in (4.3) as

$$\sum_{i=1}^{50} \frac{F^t(w_{i+1}) + F^t(w_i)}{2} \Delta y_i\,, \qquad (5.9)$$

where $\Delta y_i = y_{i+1} - y_i$. From this we compute V_3, the value of (4.3).

We can now compute v.

6. The data and our typologies

Our analysis is based on data from the Panel Study of Income Dynamics (PSID), a longitudinal survey conducted by the University of Michigan's Institute for Social Research. The PSID began in 1968, when households of a national probability sample were interviewed. Members of those families have been reinterviewed in every year since 1968. Thus, the PSID contains information on the pre-fisc and post-fisc income of adults in 1990, but because many of these adults were children who were included in the survey in 1968, it also provides information on the socioeconomic characteristics of their parents. We restrict our sample to the Survey Research Component of the PSID because we want our analysis to be based on a sample that is nationally representative (some necessary sample restrictions prevent our sample from meeting the ideal). Because the Survey-of-Economic-Opportunity component of the PSID includes only low income households, we do not use it.

Our sample is composed of male heads of households who were between the ages of 25 and 40 in 1990. We exclude females from our sample because a significant portion of women's work is non-paid household and child-rearing work; hence, women's incomes do not correlate as well with their effort expended, as men's incomes do. Our sample is restricted to household heads because this is the only group for which detailed income/tax/transfer data are available.[2] We chose age 25 as our lower age limit because to ensure that most of the individuals in our sample had completed school in 1990, before we begin to measure their earnings. We chose age 40 as the upper age limit in order to exclude from our sample those who left home at late ages. This exclusion is important because our sample must consist of individuals for whom there is information on parental education. Individuals who are older than age 40 in 1990 will have been older than age 16 in 1968, and, therefore, will be less likely to have been living at home in 1968.

[2] Detailed income/tax/transfer data is also available for wives, but we have restricted our sample to men only.

The PSID contains detailed information on income sources as well as an estimate of family (federal) income taxes. Our measure of pre-fisc income includes the individual's wages and salaries, labor income from bonuses, professional trades, roomers, gardens, farms and other business practices, and income from assets such as rent or interest and dividends. Starting with our measure of pre-fisc income we add income from transfers such as AFDC, SSI, Unemployment and Workers' Compensation, and Retirement Income. We then subtract the PSID's tax estimate to obtain a measure of post-fisc income.[3] We delete from our sample anyone who is missing income information or for whom a component of his income is a major assignment (meaning that a component of his income was estimated by the PSID). This leaves us with a sample of 1196 men.

In order to obtain estimates of the actual mapping of pre-fisc into post-fisc income in the US, which in section 3 we have assumed can be fit well by a quadratic function, we begin by regressing individuals' post-fisc income on their pre-fisc income and pre-fisc income squared. Our estimates suggest that the observed tax-and-transfer policy is $(a,b,c)=(-2.6 \times 10^{-7}, .835, 2172)$, (the estimated standard errors are respectively 2.0×10^{-8}, .003 and 105.9). This policy shows very little progressivity – the post-fisc marginal tax rate rises from 16.5% to only 21.7% as pre-fisc income increases from zero to $100,000.

We next partition the sample into types based on circumstance. We shall study two different typologies of individuals: one where individuals are typed with respect to their *parents'* level of education, and a second where they are typed according to their

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[3] For married couples, the PSID provides an estimate of the joint taxes paid by husbands and wives. We calculate the husband's tax share by multiplying total taxes by the share

race. The first typology is applied by partitioning the sample roughly into thirds, according to whether the head of the household in which the individual was living in 1968 had completed less than 12 years of education, had obtained a high school diploma but no more, or had completed some college. The sample sizes for each of these types are 415, 392 and 389, and the CDF's of pre-fisc and post-fisc income (by education type) are shown in Figure 2[4].

We also classified individuals according to their race. For simplicity (and due to small sample sizes) we divide the sample into two types based on whether the survey respondents identified themselves as being white or black. We eliminated from our sample individuals whose primary racial designation was something other than white or black. This reduced our sample to 1185 men, of whom 69 were black. The CDF's of pre-fisc and post-fisc income by racial type are shown in Figure 3[5].

Figure 2 here: CDFs of pre-fisc and post-fisc income, by type (3 educational types)

Figure 3 here: CDFs of pre-fisc and post fisc income by type (2 racial types)

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of the couple's income associated with the husband.

[4] In the figure, the pre-fisc CDF of each type lies below its post-fisc CDF. This is because we have not yet added to post-fisc income the per capita value of government consumption.

[5] Same comment as previous footnote.

7. The results

We calibrated the utility function by assuming that the individual of median pre-fisc income, which is $27,167, supplies one unit of labor time. This generates α = 22684.4. We carried out the calculations under two different hypotheses concerning the value of the elasticity η.

Supposition 1 $\eta = 0.12$

Table 1 presents the results.

Table 1: Three SES types, $\eta = 0.12$

Observed Policy	(a, b, c) = (-2.6×10^{-7}, .835, 2172)
Change in marginal tax rate, $0 to$100 K	.165 to .217
EOp policy	(a,b,c)= (-2.03×10^{-8}, .72, 4893)
Change in marginal tax rate, $0 to $100 K	.280 to .284
ν	.835
efficiency cost of EOp[6]	1.5%

[6] This is the value of expression (1.4).

We remark, first, that the EOp policy is hardly progressive – the marginal tax rate increases only by .004% as income increases from zero to $100,000. (In the observed policy, the increase is from 16.5% to 21.7% over this interval.) The efficiency of the present tax-and-transfer system, as defined by (4.4), is high, at 83.5%. On the other hand, and not surprisingly, the efficiency cost of moving from the present regime to the EOp regime is only 1.5% -- that is, average pre-fisc income would fall by that amount were the EOp regime to be implemented.

Intuitively, the reason that the EOp regime is not more progressive is that the equal-opportunity view is not opposed to differentials in income, as long as they are due to effort, and not to circumstance. With the SES typology, income differentiation with respect to type is not great – the main cause of income differentiation is 'effort.' Consequently, EOp does not favor much progressivity.

However, the lowest (post-fisc) marginal tax rate would rise from the current 16.5% to 28%.

Figure 4 graphs the distributions functions of post-fisc income of the most disadvantaged type under three regimes: recall that it is the area above this curve and bounded by the line y = 1 which is our measure of the extent of opportunity equalization. The observed policy is colored green, the laissez-faire policy blue), and the EOp policy, red.

[Figure 4 here]

Supposition 2 $\eta = 0.03$

Table 2: Three SES types, $\eta = 0.03$

Observed Policy	$(a, b, c) = (-2.6 \times 10^{-7}, .835, 2172)$
Change in marginal tax rate, \$0 to\$100 K	.165 to .217
EOp policy	$(a,b,c)= (-2.63 \times 10^{-9}, .22, 19165)$
Change in marginal tax rate, \$0 to \$100 K	.780 to .781
ν	.304
efficiency cost of EOp	3.85%

The results are extremely different from Table 1: with this low labor supply elasticity, current policy is only 30.4% efficient with respect to equalization of income opportunities. The EOp policy, though negligibly progressive, would increase the marginal post-fisc tax rate almost by a factor of five. However, since labor supply reacts very little to tax increases, the cost of implementing the policy in terms of income per capita is still rather small, at 3.85%.

Figure 5 presents the distribution function of the post-fisc income of the most disadvantaged type under the three regimes. Note, this time, the substantial change associated with EOp, compared to Figure 4.

Finally, we present the results with a typology consisting of two types, black and white. Here, we assumed the larger value for the elasticity of labor

Table 3: Two racial types, $\eta = 0.12$

Observed Policy	(a, b, c) = (-2.6×10^{-7}, .835, 2172)
Change in marginal tax rate, $0 to$100 K	.165 to .217
EOp policy	(a,b,c)= (-2.40×10^{-7}, .32, 15009)
Change in marginal tax rate, $0 to $100 K	.680 to .728
ν	.377
efficiency cost of EOp	11.2%

The salient comparison is between tables 3 and 1, which have the same elasticity assumption. With respect to equalizing income opportunities between the races, current policy is very inefficient: it goes only 37.7% of the way to what the optimal regime accomplishes. We note the optimal regime displays some progressivity – a little less than the observed regime does. The marginal tax rate would increase by a factor of four here, compared to not even doubling in Table 1. We also note, however, the substantial cost in terms of average income of implementing the EOp regime.

Figure 6 displays the distribution functions of the black type under the three regimes.

A final remark: since we have calculated the EOp policy – that is, the optimal tax exercise of our project – by simulation methods, we know that the *true* efficiency rates, ν, are no larger than the ones reported in the tables. Having carried out these Monte Carlo calculations many times, we are, however, confident that the values of ν reported in the tables are accurate to two decimal places.

7. Final discussion

Two main observations emerge clearly from this exercise:

1. The extent to which the current tax-and-transfer system equalizes opportunities for income among socio-economically defined types in the US depends dramatically on one's view about the degree of labor-elasticity with respect to the wage;
2. The extent to which the current tax-and-transfer system equalizes opportunities for income depends dramatically on one's definition of the relevant circumstances: while the current regime may do quite well with respect to leveling the playing field with respect to troughs and mounds associated with socio-economic status, it does badly with respect to leveling the playing field with respect to troughs and mounds due to racial background.

One way of putting observation two is that the economic disadvantage associated with being black in the US is only very partially rectified by compensating individuals with regard to the socio-economic status of the family they grew up in. This suggests that, if compensatory programs are to be successful , in our society, in rectifying inequality of economic opportunity, they will have to be predicated on racial as well as socio-economic characteristics of the individuals targetted.

We wish to re-emphasize that our analysis has taken what is perhaps the most conservative possible view of what constitutes effort. We have declared that a person's degree of effort is perfectly calibrated by observing the quantile of the income distribution of his type at which he sits. Thus family connections, luck, and so on, which may cause income to be higher than otherwise, are here implicitly classified as effort. Were we to define effort explicitly, to consist of measurable behaviors of certain kinds, such as the number of years of school attended, we would undoubtedly calculate that present tax-and-transfer policy to be less efficient with regard to our goal than is indicated in Tables 1,2, and 3. That is to say, we should view the values of ν reported in those tables as upper bounds on the true values.

Finally, as we wrote in the introduction, other instruments, such as compensatory educational programs, may be both more effective with regard to equalizing opportunities for income, and more politically acceptable, than the tax-and-transfer system. (In fact, with regard to political acceptability, this is almost surely the case.) Nevertheless, it is interesting to know the extent to which our fiscal system equalizes opportunities for income, if, as we said, such equalization is an important component of fairness.

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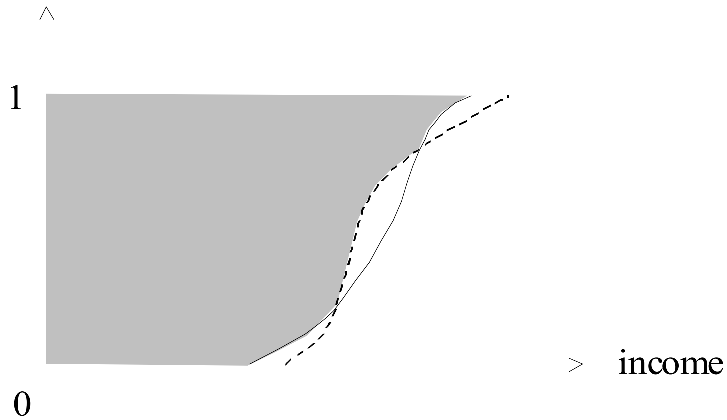
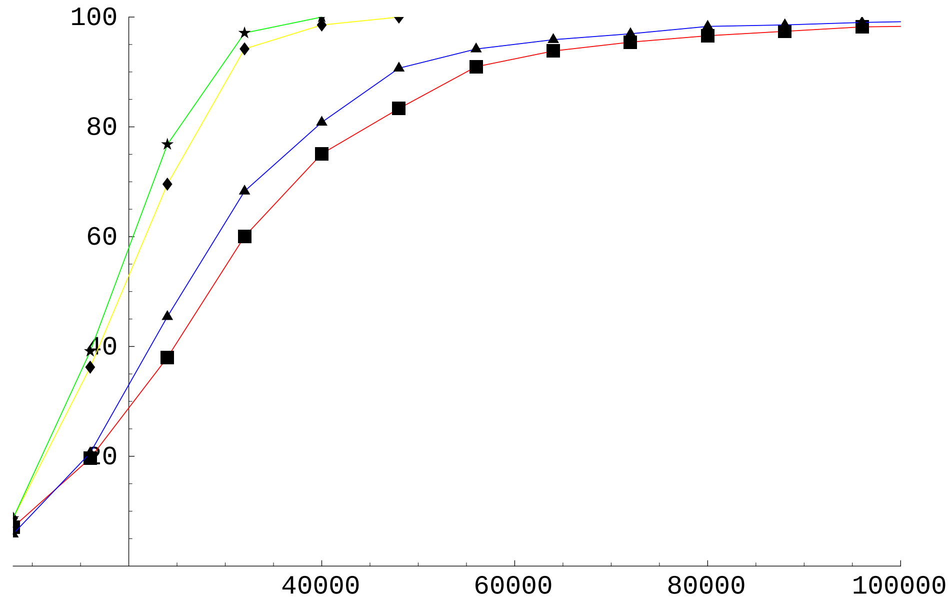


Figure 1

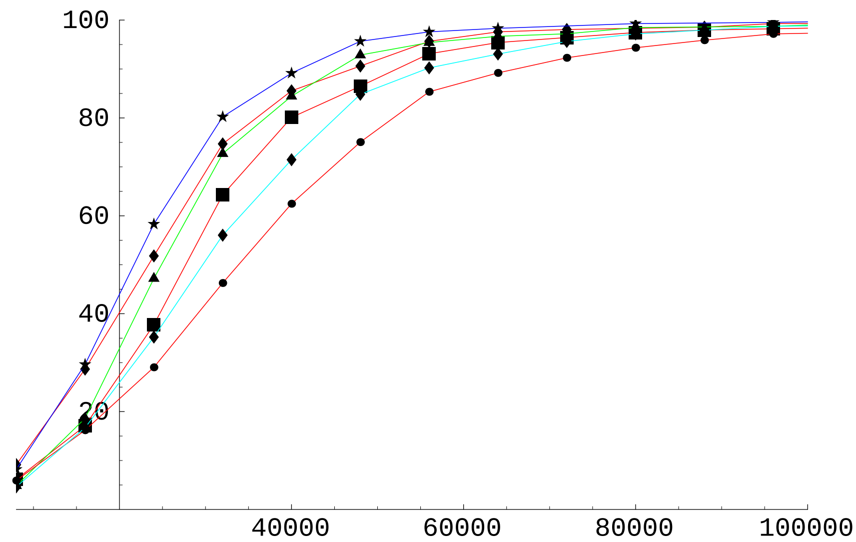
Here are the pre and post fisc black CDFs and pre and post fisc White CDFs . (Code : yellow) = black prefisc
green = black postfisc
red = white prefisc
blue = white post – fisc



This is Figure 3.

The reason that the prefisc CDFs lie below the post – fisc CDFs is that *i* have not yet added in govt consumption per capita

Here are the six CDFs for the three ed types . Code : The purple, green, and aqua curves are the postfisc CDFs for lths, hs, and coll, respectively . In each case, the red CDF lying below these three are the respective prefisc CDFs .



Above is Figure 2.

Here are the six CDFs for the three ed types. Code: The purple, green, and aqua curves are the postfisc CDFs for lths, hs, and coll, respectively. In each case, the red CDF lying below these three are the respective prefisc CDFs.

- **Green = observed, present system; blue = laissez faire; red= EOp.**
  The first plot assumes η = .12, and two types, black and white.

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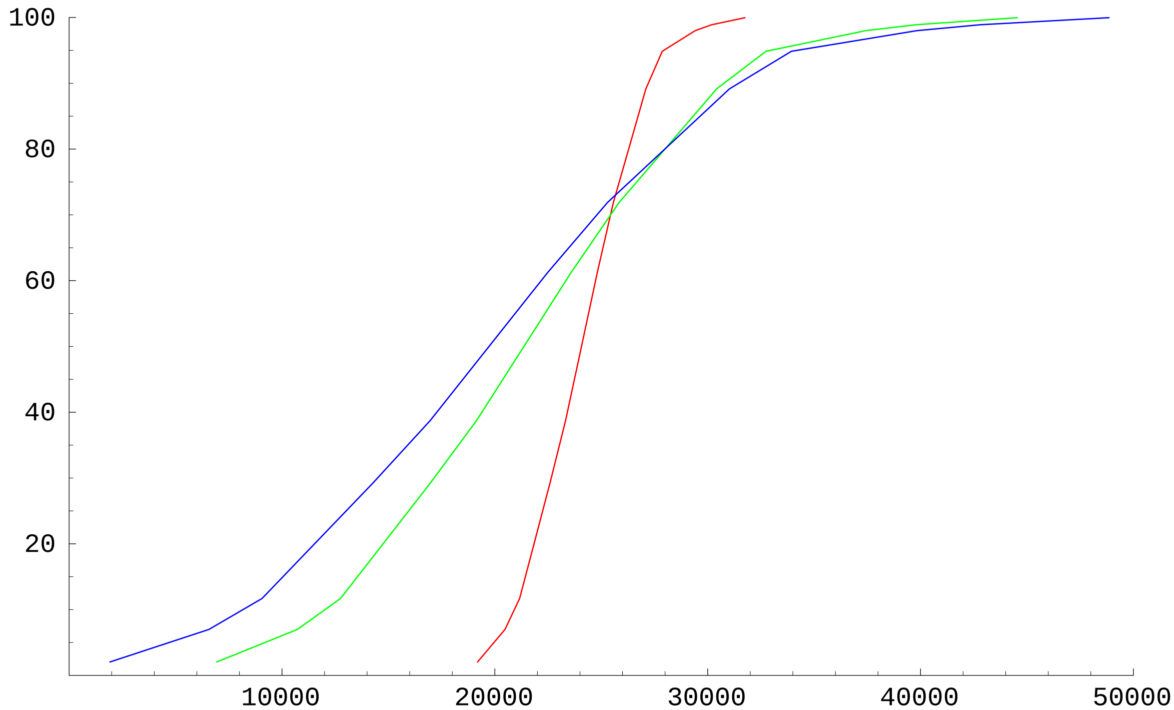


```
- Graphics -
```

- **Above is Figure 4.**

- **This plot uses the 3 ed groups for typology, and η = .12.**

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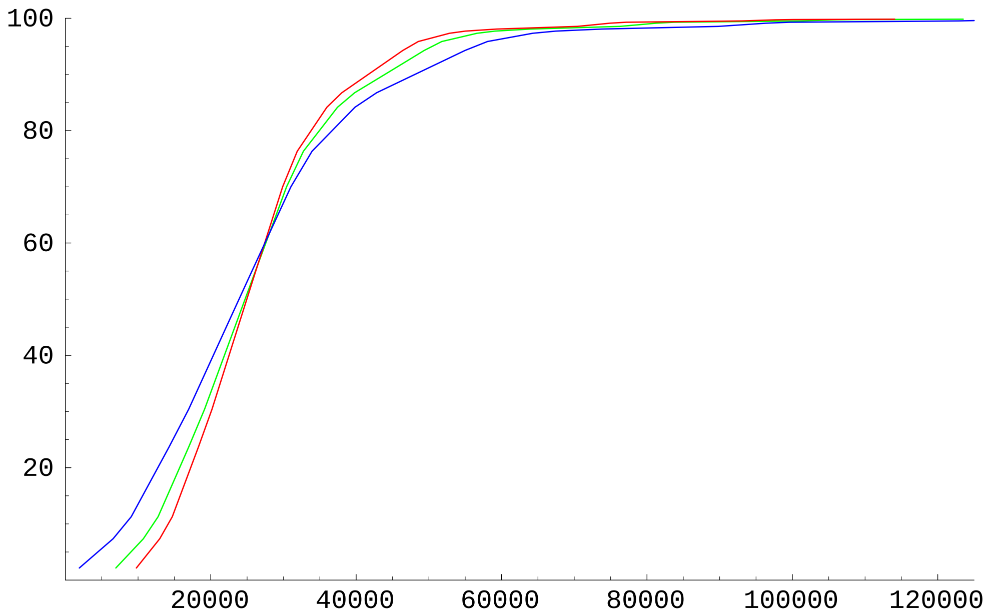


```
- Graphics -
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- **Above is Figure 5.**

- **The next plot is 3 SES types, $\eta = 0.03$.**

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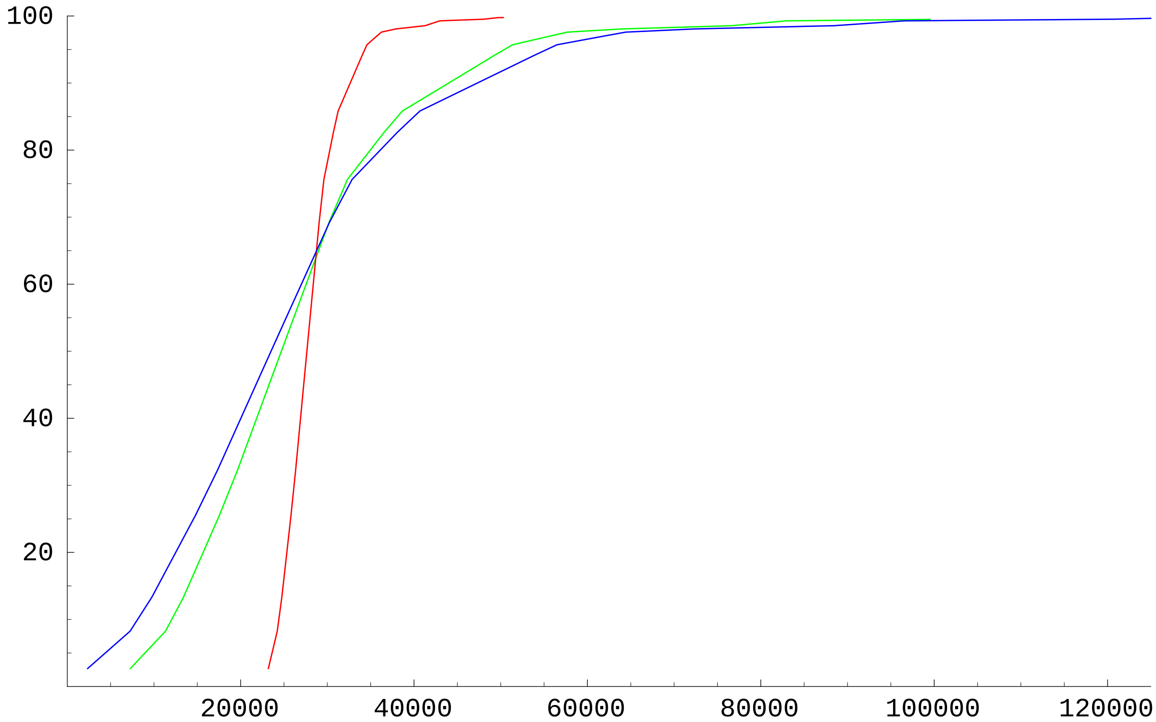

- Graphics -

- **Above is Figure 6.**