

# Income Redistribution in a Federal System of Governments

by

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There is a well-cited literature in public finance that discusses how fiscal functions should be divided among different levels of government.<sup>1</sup> The resulting conventional wisdom is that the Federal government should take primary if not sole responsibility for redistribution. The national government does not need to worry about mobility across regions in response to redistribution, while such mobility can seriously hamper redistribution by state and local governments. Given this, why do we see states in the U.S. engaged so actively in redistribution? Most state revenue comes from the personal income tax and sales taxes, rather than from user fees. A number of key social safety net programs are administered at the state level, including not only unemployment insurance but also Medicaid and TANF.

The objective of this paper is to shift from a normative to a positive perspective. What is the *equilibrium* allocation of fiscal functions across different levels of government? Using a standard description of the objectives pursued by different levels of government,<sup>2</sup> we find that sub-national governments will be actively involved in redistribution, regardless of the amount of redistribution undertaken by the national government. Given this inevitability, the national government will in equilibrium focus on correcting for any deviations between the redistribution already done by the states and the overall amount of redistribution desired by the national government.

This limited role for the national government in redistribution is most stark when there are no mobility pressures, the setting we start with in section 1. Here, the Federal government will in equilibrium entirely cede responsibility for redistribution to state governments.<sup>3</sup> To see this, consider what happens when the national government chooses any particular tax structure. Taking this policy as given, state governments have an incentive to intervene to redistribute further. At the margin, additional redistribution generates further equity gains while the efficiency costs show up entirely as a drop in Federal tax revenue. If a state is small relative to the nation, then it would ignore these

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<sup>1</sup> See, for example, Stigler (1957), Musgrave (1971, 1999) or Oates (1972, 1977).

<sup>2</sup> The underlying objectives of the national and state governments are assumed to take the same form, with the national government focusing on the welfare of all residents while each state government focuses on the welfare of residents in that state.

<sup>3</sup> This may for example explain the very limited role of the European Union in redistributing income within the E.U., deferring instead to member states to engage in redistribution.

offsetting losses in Federal revenue, and continue to expand redistribution until the equity gains are offset in welfare terms by those efficiency costs reflected in a drop in *state* revenue due to behavioral responses.

The behavioral responses to state taxes also reduce Federal revenue, so that there will be excessive redistribution to the extent that the Federal government engages in *any* redistribution. As a result, the Federal government in equilibrium would not choose to redistribute: the extent of redistribution chosen by state governments is also optimal from the national perspective, given the assumed lack of mobility and therefore lack of fiscal externalities to other states.

In section 2, we reexamine the joint choice of redistribution by state and Federal governments when individuals are mobile across states. Now, the equilibrium level of redistribution by state governments will be less than would be chosen if the state governments could coordinate, or if only the Federal government took responsibility for redistribution. In particular, redistribution by a state imposes a positive fiscal externality on other states, due to the emigration of net payers to other states and the immigration of net recipients from other states. Offsetting this, it also imposes a negative fiscal externality on the Federal government to the extent that Federal taxable income falls due to additional redistribution by a state. If these positive horizontal externalities and negative vertical externalities just offset, through the judicious choice of the extent of Federal redistribution, then the equilibrium outcomes are in fact jointly optimal.

Our theoretical results on the equilibrium redistribution policies of both state and Federal governments complement and extend those characterizing the optimal extent of redistribution in Gruber and Saez (2002), who focus on just one level of government. They implicitly derive the optimal combined redistribution to be undertaken by all levels of government, while we examine the equilibrium redistribution undertaken by each separate level of government.

In section 3, we use the framework and estimates in Gruber and Saez (2002) to infer the welfare weights and migration elasticities of different income groups needed to rationalize the observed overall state plus Federal redistribution and the observed composition of state vs. Federal redistribution. In doing so, we assume constant welfare weights and migration elasticities within each of the five tax brackets. We then solved for the five welfare weights that would generate the observed combined Federal and state tax schedules. The resulting inferred welfare weights seem quite plausible, with a dollar going to the bottom group providing as much welfare as two dollars in tax revenue, while a dollar going to the richest group providing as much welfare as only a half dollar in tax revenue. We then inferred migration elasticities through comparing state vs. Federal tax schedules. We found very high elasticities in the two highest income brackets, and very low elasticities in the bottom three brackets. This inferred pattern seems very much consistent with other evidence on migration propensities for different groups reported for example in U.S. Census (2003).

To rationalize the observed combined Federal and state tax schedules requires welfare weights that with one exception decline with income..

The above analysis of shared responsibility by state and Federal governments for redistribution applies in a closely parallel fashion to a variety of other policies jointly chosen by state and Federal governments. Section 4 provides a brief sketch of a general model determining when government functions are pursued only by the Federal government, only by state governments, or by both levels of government. Finally, section 5 provides some brief conclusions.

There is an extensive prior literature on at least some of these points. A number of papers solve for a Pigovian subsidy rate that appropriately internalizes interstate spillovers.<sup>4</sup> One of these papers, Wildasin (1991), solves in particular for the subsidy rate that helps correct state incentives when they choose the extent of income redistribution. These papers do not, though, attempt to explain the joint policy choices by Federal and state governments, and simply recognize that “decentralized redistribution is a fact of life that must be dealt with as a practical matter.”<sup>5</sup> Johnson (1988) goes one step further and notes that states have an incentive to engage in some supplementary redistribution if there is no migration, though does not determine whether this remains the case when there is migration. The role of this paper is to provide a formal analysis of the equilibrium role for state and Federal governments in redistribution.

## **1. Equilibrium redistribution in a Federal system with no mobility**

We begin by laying out the general assumptions of the model. We then derive in this section state and Federal redistribution policies when people do not relocate in response to these policies, and then reexamine these policies when relocation can occur in the following section.

### *Basic assumptions of the model*

Assume that state governments and the Federal government share the same form of objective. In particular, the state government chooses policies to maximize the sum of individual utilities of residents in the state, while the Federal government chooses policies to maximize the sum of utilities of all residents in the country.

For simplicity, states are entirely homogeneous in equilibrium, with equal distributions of income when they adopt the same tax policies. The national population is  $N$ , while the population of each state is denoted by  $n$ .

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<sup>4</sup> Recent examples include Boadway and Hayashi (2001), Buettner (2006), Bucovetsky and Smart (2006), Esteller and Sole (2002), and Köthenbürger (2002).

<sup>5</sup> See Wildasin (1991, pp. 768-9).

Individuals differ in skill levels, denoted by their wage rate  $w$ . The marginal distribution function for wage rates equals  $f(w)$  with  $\int f(w)dw = N$  nationally, and equals  $f_s(w) = nf(w)/N$  in each state, with  $\int f_s(w)dw = n$ .

We take relative wage rates as fixed throughout the analysis. One common assumption justifying this assumption is that workers with different skill levels are perfect substitutes in production, with the skilled simply providing more labor input per hour than the less skilled. Another common assumption yielding fixed relative wage rates in any jurisdiction is costless mobility of workers among many such jurisdictions, an assumption we avoid making in this paper. Even if workers are neither mobile nor perfect substitutes in production, though, we still would forecast fixed relative wage rates under the assumptions used in the Heckscher-Ohlin model. In particular, we have equalization of factor prices (relative wage rates) in a state to those prevailing in the national (world) market if: (a) the optimal skill composition within an industry given these national factor prices differs enough by industry, (b) there are at least as many industries as there are skill types, and (c) the actual skill composition of workers is in the span of these optimal skill compositions.

Each government has available the same set of policies. Each is choosing a personal income tax schedule equal to  $T_F(y)$  for the Federal government and  $T_s(y)$  in each state  $s$ , where  $y$  denotes an individual's labor income.<sup>6</sup> The resulting revenue is used to finance lump-sum transfers  $a_F$  ( $a_s$ ) by the Federal (state) government.<sup>7</sup> The tax schedule is normalized so that  $T_F(0) = T_s(0) = 0$ . Budget balance then requires that

$$\int T_F(wL(w))f(w)dw = a_F \text{ for the national government and } \int T_s(wL(w))f_s(w)dw = a_s \text{ for}$$

state governments. While policy choices by any one government do not affect the national distribution for skill types, they do potentially affect the distribution in each state.

We assume that each state is small enough that it ignores the effects of its decisions on Federal tax revenue and Federal tax policy. Each state receives too small a fraction of extra Federal revenue to matter, and its policies affect too small a fraction of national residents to have a noticeable effect on Federal tax policy. The Federal government, though, needs to take into account not only how individuals but also how state governments respond to Federal policy choices. Formally, we therefore assume that the Federal government is a Stackelberg leader, setting its tax policy first while taking into account how state governments respond.

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<sup>6</sup> We assume that  $y$  is non-negative, ignoring for example losses among the self-employed.

<sup>7</sup> Government expenditures can be for goods and services as well as monetary transfers. We assume for simplicity that these services are valued equally by all residents at an amount equal to the per capita expenditures on the services. It is straight-forward conceptually but cumbersome notationally to allow for differing values of services among residents.

### *Derivation of optimal overall tax schedules*

Before we examine the policy choice by Federal and state governments, as context consider the optimal choice of overall redistribution from the perspective of the national government. Here, consider the choice of  $a = a_F + a_s$  and  $T(y) = T_F(y) + T_s(y)$ . If it controlled both tax schedules, the national government would choose the overall tax schedule to maximize

$$(1) \quad \int U(wL - T(wL) + a, L) f(w) dw$$

Here,  $U(C, L)$  represents utility as a function of consumption and labor supply, with consumption equaling net (after-tax and plus transfer) labor income.

We first characterize the optimal tax schedule, along the lines of the analysis in Saez (2001). Begin by mapping the original distribution of skill levels into the distribution of pretax income arising under the optimal policies. The resulting density is denoted  $g(y)$ , and the implied cumulative distribution is denoted  $G(y)$ . The resulting government budget constraint is  $\int (T(y) - a)g(y)dy = 0$ , with a Lagrangian multiplier of  $\lambda$ .

Assuming based on the empirical evidence in Gruber and Saez (2002) that there are no income effects on labor supply, the first-order condition for  $a$  is

$$(2) \quad \int_0^{\infty} U_y(y)g(y)dy = N\lambda \quad \text{or} \quad \int_0^{\infty} \omega(y)g(y)dy = N$$

Here,  $U_y(y)$  denotes the marginal utility of income for those with income level  $y$ , while  $\omega(y)$  equals the marginal utility of income relative to the welfare value of a dollar in tax revenue.

If we perturb the schedule for  $T$ , raising the marginal tax rate by  $dT$  over the interval  $z$  to  $z + dz$ , then the resulting change must leave social welfare unaffected starting from the optimal tax schedule. This tax change is equivalent to a lump-sum tax of amount  $dTdz$  for those earning at least  $z$ . Those with incomes between  $z$  and  $z + dz$  also face a higher marginal tax rate, generating changes in their labor supply. Let  $\varepsilon(z)$  denote the elasticity of labor supply with respect to the after-tax wage rate for individuals with labor income of  $z$ . The initial tax schedule is optimal if these welfare effects sum to zero, implying that

$$(3) \quad \int_z^{\infty} \omega(y)g(y)dy = (N - G(z)) - g(z)\varepsilon(z)z \frac{T'(z)}{1 - T'(z)}$$

We then find that

$$(4) \quad \frac{T'(z)}{1-T'(z)} = \frac{(N-G(z))(1-\bar{\omega}(z))}{g(z)\varepsilon(z)z}$$

Here,  $\bar{\omega}(z) = \int_z^{\infty} \omega(y)g(y)dy / (N-G(z))$  is the weighted average value of the marginal utility of income for all those with income above  $z$ . Note that equation (2) implies that  $\bar{\omega}(0) = 1$ .

The expression in equation (4) reflects the classic tradeoff between the equity gains and efficiency costs of taxation. Assuming that marginal utility of income declines with income,  $\bar{\omega}(z)$  is also a declining function of  $z$ . Based on this term alone, which captures the equity gains from taxation, the optimal marginal tax rate is an increasing function of income. The efficiency costs of taxes are captured by  $\varepsilon(z)$ , the elasticity of labor supply: the more elastic is labor supply, the larger are the efficiency costs generated by tax distortions and the lower will be optimal tax rates. The relative weights on the equity and efficiency terms depend on the shape of the income distribution, as captured by the ratio  $(N-G(z))/(zg(z))$ . Saez (2001) argues that the upper tail of the income distribution can be approximated by a Pareto distribution. Under a Pareto distribution, this ratio is independent of  $z$ , implying an increasing marginal tax rate in the upper tail. However, below the mode for  $g(z)$ , this ratio is clearly decreasing with  $z$ , since the numerator decreases with  $z$  while the denominator increases with  $z$ . Together, these results forecast increasing marginal tax rates with  $z$  for upper incomes, though less clear forecasts for lower incomes.

We find that  $T'(0) = 0$ , consistent with the results of Seade (1977) that the optimal tax rate equals zero for those at the lowest income level. A lump-sum tax has the same distributional effect as a distorting tax at this income level, but the lump-sum tax avoids distorting labor supply for this income group, so dominates.

### *Derivation of optimal state tax schedule*

What redistribution will each state choose, taking as given the tax policies in other states and also the Federal income tax schedule?

Each state maximizes the sum of utility of state residents subject to the state's budget

constraint  $\int (T_s(y) - a_s)g_s(y)dy = 0$ . The analysis is virtually identical to that for the

optimal overall tax schedule. The condition characterizing the state's optimal schedule for an arbitrary Federal schedule equals

$$(5) \quad \frac{T'_s(z)}{1-T'(z)} = \frac{(n-G_s(z))(1-\bar{w}(z))}{g_s(z)\varepsilon(z)z}$$

One important implication of equation (5) is that state tax rates are positive, regardless of the Federal tax schedule, since all of the terms on the right-hand side of this equation are positive. The equilibrium does not involve just the Federal government participating in redistribution, contrary to the conventional wisdom.

This observation also rules out an equilibrium in which the Federal government itself undertakes the overall optimal amount of redistribution. If it does this, then the states will redistribute further according to equation (5), so that redistribution will be excessive from a joint perspective. The problem is that the states ignore the impact of their redistribution on Federal tax revenue, trading off the marginal equity gains from further redistribution with the offsetting losses in *state* revenue due to the resulting behavioral responses. However, the same behavioral changes also result in a loss in Federal revenue, a loss ignored by each state since they bear only the fraction of this revenue loss.

### *Derivation of optimal Federal tax schedule*

In fact, we easily find that if there is no Federal redistribution at all, then the state's optimal redistribution is optimal overall, since equation (5) then replicates equation (4). Intuitively, when there is no migration and no Federal taxes, the state is maximizing national utility in choosing its tax policies, since its choices generate no fiscal externalities. Anticipating these optimal policies, there is no need for Federal intervention.

Proceeding more mechanically, for any given tax schedule chosen by the Federal government, equation (5) characterizes the resulting state tax schedule. The objective of the Federal government is then to choose the Federal tax schedule so that the overall tax schedule satisfies equation (4). Since  $T'(y) = T'_F(y) + T'_s(y)$ , we can subtract equation (5) from equation (4) to find that  $T'_F(y) = 0$ : it is optimal for the Federal government to cede full responsibility to states for redistribution if there is no migration.

## **2. Equilibrium redistribution in a Federal system with mobility**

How do the above results change when we allow for mobility of residents across states? To begin with, the overall optimal policies do not change at all, at least if we ignore international migration. State policies do change, however, and this will induce a change in Federal policies. States now affect each other, since changes in state tax structures induce migration across state lines. In particular, states must recognize that a higher tax rate within the state will induce some of those paying the extra taxes to leave, and will induce some of those who would be eligible for the extra transfers to relocate to the state.

When making policy choices, we assume that states each take as given the policies chosen by other states as well as Federal tax schedules and transfers when choosing their own policies. We also assume that the objective function of each state depends on the welfare of the residents living in the state at the time the policy is under consideration, rather than the welfare of the population that might end up living in the state in response to any policy change.<sup>8</sup>

In order to model explicitly the factors determining household location, assume that the utility of any individual equals  $\tilde{\gamma}_s U(C, L)$  if the individual locates in state  $s$ . Here,  $\tilde{\gamma}_s$  is an idiosyncratic taste parameter, drawn from a distribution  $\Gamma(\gamma)$  that is the same for all  $s$ .<sup>9</sup> Since all states are identical, the equilibrium will result in an equal division of each skill group across states. However, if any state deviates from the common tax policy, shifting towards more redistribution, then some of the rich will leave and some poor will enter.

### *Optimal state policies given migration*

Taking such mobility into account, the first-order condition for  $a_s$  now becomes

$$(7) \quad \int_0^{\infty} \omega(y) g_s(y) dy = n\lambda_s - \lambda_s \int_0^{\infty} \frac{T_s(y) - a_s}{I_s(y)} \varepsilon_m(y) g_s(y) dy$$

Here,  $I_s(y)$  measures the individual's net of tax/transfer income in state  $s$ ,  $\varepsilon_m(y)$  denotes the elasticity of the number at any given level of income in the state with respect to the size of their net of tax/transfer income, while  $\lambda_s$  is the Lagrangian multiplier on the state's budget constraint. The migration term captures the effects of the lump-sum transfer on mobility, and then the impact of this mobility on net government revenue. Attracting net payers is a fiscal benefit, and conversely attracting net recipients is an extra fiscal cost generated by the lump-sum transfer. At least if migration elasticities are equal for all income groups, the migration term is negative, making a lump-sum transfer more expensive due to the resulting in-migration particularly of the low-skilled who impose a net fiscal burden.<sup>10</sup>

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<sup>8</sup> A complication we then ignore is that the population relevant for future policy decisions is affected by current policy decisions.

<sup>9</sup> One special case has everyone receiving the same utility if they locate in any given state. Then the state's population is infinitely elastic – to attract *any* residents it must offer the highest utility available in any other state. Another special case has extremely diverse tastes. In that case, there would be almost no migration in response to policy changes.

<sup>10</sup> While  $\int (T_s(y) - a_s) g_s(y) dy = 0$ , the term in equation (7) weights those with low net income more heavily, for whom  $T_s(y) - a_s < 0$ .



Let  $M(z) \equiv \int_z^{\infty} \frac{T_s(y) - a_s}{I_s(y)} \varepsilon_m(y) g_s(y) dy / (n - G_s(z))$  measure the weighted average migration effect for individuals with incomes above  $z$ . Equation (7) then implies that  $\lambda_s = \lambda / (1 - M(0))$ , given our normalization that  $\int_0^{\infty} U_y(y) g_s(y) / n = \lambda$ . Given the expectation that  $M(0) < 0$ , we infer that  $\lambda_s < \lambda$ : a lump-sum tax is partly self financing, from a state's perspective, since it induces relatively more of the poor to emigrate, improving the budget.

Consider next the expression characterizing the welfare effects of a perturbation in marginal tax rates in the interval  $z$  to  $z+dz$ . The revenue effects of the tax change now include an added term equal to  $-\lambda_s \int_z^{\infty} \frac{(T_s(y) - a_s)}{I_s(y)} \varepsilon_m(y) g_s(y) dy$ . The tax change imposes a lump-sum tax on those with incomes above  $z$ , inducing migration just for this subset of residents.

Solving for the optimal tax rates, now including this migration term and recognizing that  $\lambda_s = \lambda / (1 - M(0))$ , we find that

$$(8) \quad \frac{T'_s(z)}{1 - T'(z)} = \frac{(n - G_s(z)) [1 - \bar{w}(z)(1 - M(0)) - M(z)]}{g_s(z) \varepsilon(z) z}$$

Relative to the situation without migration, there are two new terms. First, the utility costs of the tax receive more weight than the revenue effects, given that  $\lambda_s < \lambda$  due to the ease of collecting revenue instead through a lump-sum tax. This in itself lowers tax rates, particularly at lower incomes where  $\bar{w}(z)$  is larger. In addition, any modification of the tax schedule has its own effects on migration, captured by  $M(z)$ .  $M(z) < 0$  when  $z$  is small and migration elasticities are relatively equal, reflecting a revenue gain from inducing exit particularly of relatively low income residents. However, the term changes sign and becomes positive (reflecting a revenue loss) for any  $z > z'$ , for some  $z'$  below the value where  $T_s(z) = a_s$ . A tax increase for higher income residents leads to emigration just of net payers;  $z'$  is the income level where a tax increase leads to just offsetting revenue effects due to the exit of net payers and net recipients. Overall, the combined migration terms have no net effect on the optimal tax rate at  $z = 0$ , but lead to a reduction in tax rates at other income levels, and more so the higher the income level.

Even with this migration term, we still conclude that states will always engage in some redistribution, regardless of the amount of Federal redistribution. If, to the contrary, they engage in no redistribution, then the migration terms are zero, implying as before a net gain from at least some redistribution. Redistribution takes place to take advantage of

these equity gains until the resulting losses in state revenue due to migration as well as a drop in labor supply just offset the equity gains.

### *Optimal Federal policies given migration*

We can proceed mechanically as we did without migration to derive an equation characterizing the optimal Federal tax rate at any given income level by subtracting equation (8) from equation (4). We now find that

$$(9) \quad \frac{T'_F(z)}{1-T'(z)} = \frac{(N-G(z))[M(z)-M(0)\bar{w}(z)]}{g(z)\varepsilon(z)z}$$

While the migration response lowered state tax rates, these terms raise Federal tax rates, since  $M(z) > M(0)$  and  $\bar{w}(z) < 1$ . It is still the case that  $T'_F(0) = 0$ . The migration expression grows with  $z$ , in itself leading to a progressive Federal rate structure (increasing marginal tax rates).

The larger are migration effects, the smaller are state tax rates relative to Federal rates. As the migration elasticity increases without bound, state tax rates shrink towards zero, so that only the Federal government engages in redistribution. But conversely, we know from the prior section, that if the migration elasticities equal zero, then Federal rates equal zero.

### **3. Solution for key parameters, given observed policies**

In this section, we take observed state and Federal tax structures as given and solve for both the distributional tastes and the migration elasticities that would generate the observed policies. These estimates serve to assess the plausibility of the above model for the behavior of governments. For example, the inferred migration elasticities can be compared with the admittedly limited empirical evidence on these elasticities to judge whether they seem reasonable. The inferred distributional weights can similarly be compared with those implied by conventional specifications for the utility function, again to judge plausibility.

In estimating these parameters, we build on the procedure used in Gruber and Saez (2002). First, we consider five brackets for the income tax schedule, corresponding to the four taxable income intervals that Gruber and Saez (2002) used in their study,<sup>11</sup> plus a fifth category for those who currently owe no personal income taxes and have adjusted income (defined below) less than \$10,000. Second, we make use of their estimates for

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<sup>11</sup> The intervals they used varied by year. In 1992, they equaled \$0 to \$10,000, \$10,000 to \$32,000, \$32,000 to \$75,000, and above \$75,000 in taxable income. The intervals were adjusted in other years to correct for income growth across years, implying for example that break points in 1990 were 92.9% of the above values.

the elasticity of taxable income in the top three tax brackets of 0.284, 0.265, and 0.484,<sup>12</sup> and follow their assumption for remaining individuals by using the estimate from Moffitt (1992) of 0.4 for the labor supply elasticity of individuals in the bottom two brackets.<sup>13</sup>

Our estimation sample starts with the cross-section Individual Master File of individual tax returns from the Statistics of Income (SOI) for 1990.<sup>14</sup> We then supplement this sample of taxpayers with a sample of non-taxpayers drawn from the Current Population Survey for 1991, identifying non-filers as those who would not be required to file and who would not be eligible for the EITC credit. We scale this group up or down to match the total number in the CPS by income group, compared to the number in the SOI by income group, and append these individuals to the SOI sample.

We next need to measure the combined actual state and Federal tax schedules, focusing on 1990 to correspond to the figures used in Gruber and Saez (2002). To do this, we make use of TAXSIM, as described in Feenberg and Coutts (1993), to calculate the state and Federal personal income tax payments for each individual.<sup>15</sup> To calculate sales tax liabilities, we make use of the optional sales tax tables from 1986, with all figures adjusted to reflect the income growth to 1990. We supplement this with an estimate for the implicit tax embodied in existing transfer programs of 45%, taken from Dickert, Hauser, and Scholz (1995), applied to the first \$10,000 of AGI.<sup>16</sup>

The resulting Federal and state tax revenue is then paid back as lump-sum transfers to each household, implicitly capturing both transfer payments and the benefits arising from expenditures on public services. Implicit here is the simplifying assumption that the aggregate dollar benefits from expenditures on public services equal the dollar expenditures, and that these dollar benefits are equal for all households.

We approximate the resulting figures for tax payments net of the lump-sum transfer, both in total and separately for Federal and state governments, with a five bracket schedule, as a function of “adjusted” income. Adjusted income is defined to equal taxable income,

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<sup>12</sup> The elasticity of taxable income includes more behavioral responses than just changes in labor supply. As argued by Feldstein (1995), all that matters is the effects of any behavioral responses on tax revenue, so that our formula is robust to any type of behavioral response affecting personal income tax revenue in that tax year. These calculations, though, ignore any implications of changes in behavior for tax revenue in other tax years, for corporate or payroll tax revenue, for future tax penalties resulting from increased current evasion, or for any compensating welfare benefits from extra itemized deductions (due to possible externalities from increased charity, home ownership, or state and local spending). See Saez, Slemrod, and Giertz (2009) for further discussion.

<sup>13</sup> The Gruber-Saez elasticities measure the responsiveness of taxable income to taxes. The remaining elasticity for the two lowest tax brackets we treat as measuring the responsiveness of AGI to taxes.

<sup>14</sup> We limit the sample to married couples filing jointly who do not report an exemption for being 65 or older. In addition, we drop couples with AGI < \$100 (0.8% of the sample), and those with excess itemized deductions (beyond the standard deduction) exceeding AGI (0.1% of the sample).

<sup>15</sup> For confidentiality reasons, state is not reported for those with AGI > \$200,000. These individuals were assigned randomly to states, based on the location pattern for those with \$100,000 < AGI < \$200,000.

<sup>16</sup> We assume that the revenue resulting from this implicit tax rate, arising from the withholding of transfer payments as individuals earn more, is divided equally between Federal and state governments, approximating statutory sharing rules that, however, vary by state.

ignoring any capital gains income, plus the standard deduction and the couple's exemptions. By sample selection, this figure is non-negative for all individuals. The first tax bracket variable then equals  $\min(y_i, \$10,000)$ , where  $y_i$  now represents adjusted income. The remaining brackets are defined as in Gruber and Saez (2002), but adding the standard deduction plus average exemptions (\$13,000) to each break point. We then regress actual tax payments net of lump-sum transfers for each individual, based on both Federal and state tax codes, against a constant (to capture the lump-sum transfers) and five income variables measuring the amount of a couple's income falling into each of the five tax brackets. The estimated coefficients should then approximate the effective marginal tax rates in each of these tax brackets.

The resulting estimated tax rates in the five brackets along with the estimated size of the lump-sum transfers are listed in Table 1. This five parameter approximation to the actual tax schedule fits extremely well. Both Federal and state schedules are estimated to have a U-shaped schedule of tax rates, with higher rates in the bottom bracket reflecting the assumed 45% withholding tax on the first \$10,000 of AGI, though including as well offsetting subsidies from the EITC.<sup>17</sup> Couples are estimated to face Federal marginal tax rates ranging from 15% to 31% in the four remaining tax brackets. Estimated state marginal tax rates (combining state income and sales taxes) are much smaller, ranging between 3.5% and 6.2% in the four remaining brackets.

To solve for the distributional parameters that would lead to the observed overall net tax payments, we make use of the analogue of equation (4), solving for the optimal marginal tax rates in each of five tax brackets rather than for a continuous optimal schedule. We measure each individual's economic position by their adjusted income. The tax brackets correspond to those used in the estimation of actual tax schedules. Let  $\bar{y}_i$  denote the average adjusted income in bracket  $i$ , let  $y_i^m$  ( $y_i^M$ ) be the minimum (maximum) income in this bracket, and let  $g_i$  equal the population size in bracket  $i$ . If we then solve for the first-order condition for  $T_i'$ , the optimal marginal tax rate in bracket  $i$ , we find that

$$(10) \quad \frac{T_i'}{1-T_i'} = \frac{(y_i^M - y_i^m) \sum_{j>i} g_j(1-\omega_j) + g_i(1-\omega_i)(\bar{y}_i - y_i^m)}{g_i \varepsilon_i \bar{y}_i^A}$$

Here,  $\bar{y}_i^A$  denotes the average taxable income in the top three brackets, but average AGI in the bottom bracket, accounting for the different sources of elasticity estimates.

Using our estimates in Table 1 to calculate the tax rates on the left-hand side of equation (10), we then solve these five equations for the welfare weights  $\omega_i$ . The estimates for these welfare weights are reported in column 2 in Table 2. Here, we find that, except for

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<sup>17</sup> Note that some of those with adjusted income below \$10,000 have AGI above \$10,000, so are not subject to the implicit tax rate of 45%. These individuals have large itemized deductions relative to their AGI.

the second lowest income bracket, welfare weights fall with income. The anomaly in the second lowest bracket reflects a somewhat higher tax rate in this bracket than would have been expected given monotonic welfare weights, perhaps reflecting the phase-out of the EITC in the second bracket.

In deriving these figures using equation (10), no use was made of the additional first-order condition for the optimal lump-sum tax, which still implies that  $\bar{\omega} = 1$ . Yet when we calculate  $\bar{\omega}$  using the above estimates for the welfare weights in each of the four brackets, remarkably we estimate that  $\bar{\omega} = 1.017$ .

In order to infer the migration elasticities implicit in observed tax schedules, let  $\varepsilon_m^i$

denote the migration elasticity in bracket  $i$ , let  $\tau_i \equiv \int_{y_i^m}^{y_i^M} \frac{T_s(y) - a_s}{I_s} g(y) dy / g_i$  denote the

average taxes net of transfers as a fraction of after-tax post-transfer income for

individuals in tax bracket  $i$ , and let  $\tau_i^y \equiv \int_{y_i^m}^{y_i^M} y \frac{T_s(y) - a_s}{I_s} g(y) dy / (\bar{y}_i g_i)$  denote the

weighted average net tax/transfer/income in this bracket, weighted by income. Given these definitions, we can express the optimal state tax rates in each tax bracket by

$$(11) \quad \frac{T_{si}'}{1 - T_i'} = \frac{W_i + \sum_k g_k \varepsilon_m^k \tau_k \left( (y_i^M - y_i^m) \sum_{j>i} \omega_j g_j + (\bar{y}_i - y_i^m) g_i \omega_i \right)}{g_i \varepsilon_i \bar{y}_i^A} - \frac{(y_i^M - y_i^m) \sum_{j>i} g_j \varepsilon_m^j \tau_j + g_i \varepsilon_m^i (\tau_i^y \bar{y}_i - \tau_i y_i^m)}{g_i \varepsilon_i \bar{y}_i^A}$$

Here,  $W_i$  denotes the numerator in equation (10), which we solved for using data on the combined Federal and state tax structures. Given our estimates in Table 1 for the state tax rates in each of the five tax brackets and the estimated values for the  $\omega_i$  found in Table 2, we solve equation (11) for the five migration elasticities that would generate the state tax rates. Results are reported in column 3 in Table 2. Since there is a strong prior presumption that the migration elasticity is positive (higher benefits and lower taxes make the state more attractive), the negative estimates for migration elasticities in the bottom three brackets imply at least some inconsistency between the observed tax schedules and those that would be implied by the theory.<sup>18</sup>

<sup>18</sup> The specific figures in brackets 3 and 4 mean little, however. In these brackets,  $\tau_i$  is close to zero, so that large variation in the elasticity is needed to induce small changes in forecasted tax rates.

How important is this inconsistency? Qualitatively, the results imply very high migration elasticities among higher income couples and very low elasticities for the rest of the population, a pattern that is consistent with other evidence reported for example in U.S. Census (2003).<sup>19</sup> An underlying question, though, is whether the remaining anomalies signal some important conceptual omission from the theory, e.g. governments do not choose policies to maximize any weighted sum of individual utilities, or whether the problems largely arise from noisy estimates for tax rates and labor supply elasticities.

To give a sense of the degree of inconsistency between forecasted and observed tax rates, we tried imposing a 0.5 migration elasticity for the lower three groups, consistent with a prior from the past literature that lower-skilled workers are relatively immobile, and then estimated the migration elasticities for the upper two brackets so as to replicate the observed state tax rates for these two groups. The estimated migration elasticities for the top two groups are now 15.5 and 7.4, so high but not quite as dramatic as the figures in Table 2. The forecasted tax rates for the bottom three groups are 0.23, 0.04, and -0.7, compared with the actual rates of 0.23, 0.4, and 0.5. Except for the middle group, the figures closely correspond.

The negative forecasted tax rate for the middle group merits further comment, though. Ignoring migration elasticities, the theory clearly forecasts positive tax rates, assuming a desire to redistribute from rich to poor. Once migration elasticities enter, however, there is no longer an assurance that optimal tax rates are positive. Formally, while the expression  $1 - \bar{w}(z)$  in the numerator of equation (5) is clearly positive, there is no guarantee that the expression  $1 - \bar{w}(z)(1 - M(0) - M(z))$  in the numerator of equation (8) is positive – both migration terms are negative for higher income groups. Intuitively, taxes at lower incomes are now more attractive, since they induce exit of net recipients, while taxes at higher income levels are now more harmful since they induce exit of net payers. A negative tax rate on middle income groups could help reconcile these two pressures.

#### **4. General results on roles for Federal and state governments**

The above results on the respective roles for Federal and state governments in redistributive policies are a special case of a more general analysis. The aim of this section is to sketch out this general analysis for which levels of government will actively be involved in handling any particular policy.

The equilibrium policy "assignment" can take one of three possible forms. First, only the Federal government undertakes an activity. Second, only state governments undertake the activity, and third both levels of government in equilibrium engage in the activity with the Federal government intervening to offset interstate spillovers generated by state policy choices.

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<sup>19</sup> Note, though, that the Census reports differences across groups in migration rates, and distance of migration, but not the responsiveness of these rates to changes in economic incentives.

To assess the equilibrium assignment for any given policy, we undertake the following sequence of thought experiments. First, let the Federal government choose the optimal value of a policy from its perspective, assuming no state provision of this policy. Given this policy choice, will states choose to intervene? If not, then this policy is solely a Federal function. Second, let state governments choose the optimal value of a policy from their perspective, assuming no Federal provision of the policy. Given these policy choices, will the Federal government choose to intervene? If not, then this policy is solely a state function. In all other cases, both levels of government will be involved. In this setting, the Federal government chooses a level of intervention (anticipating the state response) so that the combined policies are optimal from a national perspective.

Consider then the first thought experiment. Assume that the national government chooses some policy intervention,  $X$ , to maximize national welfare  $W = \sum_h V_h(w_h^n, a, G)$ .

Here, we assume that tax revenue is entirely used to finance either government provided goods,  $G$ , or financial transfers,  $a$ . We then know that  $\partial W / \partial X = 0$ .

When will a particular state government  $r$  have an incentive to intervene? Each state is assumed to maximize  $W_r = \sum_{h \in r} V_h$ , where  $W = W_r + \sum_{s \neq r} W_s$ . State  $r$  will undertake no

further supplementary expenditures  $X_r$  only if  $\partial W_r / \partial X_r < 0$ .<sup>20</sup> If this were the case, we then infer that  $\sum_{s \neq r} \partial W_s / \partial X_r > 0$ , given that the national policy was chosen so that

$\sum_s \partial W_s / \partial X = 0$ . States then fully cede provision to the Federal government only if any additional provision creates on net a positive externality for other states.

Consider, for example, the choice of funding for some pure public good,  $G$ , that provides dollar benefits to each resident in the country equal to  $b(G)$ , where  $b(\cdot)$  is a positive concave function with  $b(0) = 0$ . Assume this good is financed with a lump-sum tax,  $\tau$ . From a national perspective, the optimal choice of  $\tau$  is characterized by  $Nb'(G) = 1$ . Given the level of provision that is optimal from the national perspective, any additional provision by some state  $r$  generates net welfare from its perspective of  $nb'(G) - 1 < 0$ , so that it will not choose to intervene: this intervention creates a positive externality to other states. Here, the equilibrium outcome is that the national government chooses the jointly optimal policy, with no further state intervention.

If each state has intervened optimally from its perspective, when will the Federal government choose not to intervene further? If states are all identical, then the national government would not gain from any change in each state's policy choice only if

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<sup>20</sup> An implicit assumption here is that states cannot provide a negative amount of  $X_r$ , thereby undoing some of the Federal provision. There may be examples of such negative provision, though, e.g. when the Federal government allocates funds to the states for the purpose of providing some public good, but the state is able to divert some of these funds to other state uses.

$\sum_{s \neq r} \partial W / \partial X_r = 0$ , so that each state's policy choice has no net effect on the welfare of other states. In all other cases, the Federal government has an incentive to intervene, possibly through increased expenditures when these externalities are positive or through a Pigovian tax when these externalities are negative.

For example, let each state choose  $\tau_r$  to finance a local public service,  $G_r$ . From its perspective, the optimal choice of  $\tau_r$  satisfies  $nb'(G_r) = 1$ . If there are no interstate spillovers of benefits, then this choice is also the optimal one from the perspective of the national government, and it would have no incentive to intervene.<sup>21</sup>

In all other cases, we expect to see joint provision of the public program by both state and Federal governments. In particular, the Federal government will not be the only provider of an activity if supplementary provision by the state imposes a negative externality on the Federal government. Redistribution by a state is a clear example of such an activity that imposes a negative externality on the Federal government. In addition, it creates a positive externality on other state governments, and the optimal Federal policy should lead to no *net* fiscal externalities.

## 6. Conclusions

This paper has examined the equilibrium allocation of fiscal responsibilities between Federal and state governments, focusing on income redistribution. The traditional presumption, dating back to work by Oates (1972) and Musgrave (1971), is that the national government should take sole responsibility for redistribution. Compared to the national government, states face the handicap when undertaking redistribution that net payers can leave the state and net recipients can migrate to the state.

Equilibrium choices, though, lead to a very different allocation of responsibilities across different levels of government. In particular, we find that states will in equilibrium play an active role in redistribution, regardless of the amount of redistribution undertaken by the national government. Given this, the role of the national government in equilibrium is confined to correcting for the effects of interstate migration on a state's choice of tax structure.

These results reflect a form of “subsidiarity.” The Federal government must recognize that states will intervene in many settings, regardless of the level of intervention by the Federal government. Given this, our model forecasts that the Federal government in equilibrium will confine its focus to assuring sufficient supplementary provision so that the total provision is appropriate. If there are no interstate spillovers, then the national government will play no role.

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<sup>21</sup> Note in particular, that this policy change does not lead to migration, since starting from the optimal policy any marginal change in the policy leaves utility of residents unaffected on net.



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**Table 1**  
**Estimated Tax Schedules**

	Combined	Federal	State
	(1)	(2)	(3)
Lump-sum transfer	13,326 (1.254)	9,182 (0.650)	4,145 (1.039)
Implicit tax rate on adjusted income:			
Below \$10,000	0.390 (0.001)	0.157 (<0.001)	0.233 (0.001)
Between \$10,000 and \$23,000	0.194 (0.001)	0.159 (0.001)	0.035 (0.001)
Between \$23,000 and \$45,000	0.200 (.001)	0.150 (0.001)	0.049 (0.001)
Between \$45,000 and \$88,000	0.323 (0.002)	0.268 (0.001)	0.055 (0.001)
Above \$88,000	0.374 (0.002)	0.312 (0.001)	0.062 (0.002)

Notes: These results are based on OLS regressions of taxes paid on the amount of adjusted income falling into each of the five brackets shown, with the dependent and all independent variables normalized by AGI to address heteroskedasticity. Adjusted income is equal to taxable income plus the standard deduction and exemption amount. The sample is for the SOI/CPS sample of filers and non-filers in FY 1990, and the regression is weighted using the appropriate sampling weights. The values shown in the three columns are the estimated coefficients on the constant term (multiplied by negative one) and the amount of income in each bracket for the combined, federal, and state tax systems, respectively. Note that the top three brackets map to taxable income brackets with minimums of \$10,000, \$32,000 and \$75,000, respectively, since the standard deduction plus the average exemption amount is about \$13,000. All figures are in 1992 dollars.

**Table 2**  
**Parameter Estimates Consistent with Observed Tax Rates**

	Fraction of the sample	Estimates for $\bar{\omega}_i$	Estimates for $\varepsilon_i^m$
	(1)	(2)	(3)
Lowest bracket	7.0%	2.03	-0.19
Second bracket	15.9%	0.54	-1.04
Third bracket	36.8%	1.24	-6.39
Fourth bracket	33.8%	0.90	22.36
Top bracket	6.6%	0.48	8.14