

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.¹ The resulting conventional wisdom is that state or local governments should take responsibility for the provision of public services whose benefits are confined within the boundaries of these political jurisdictions. The national government then focuses on the provision of public services that benefit the nation as a whole. In addition, an issue that will be the focus of this paper, the 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 or local governments.

Given this conventional wisdom, 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 handled 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 conventional description of the objectives pursued by different levels of government, 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 should entirely cede responsibility for redistribution to state governments.

In this conventional model, the underlying objectives of the national and state governments 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

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

state. The national government chooses a set of redistributive policies that maximize the national objective, trading off equity and efficiency at the margin.² 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 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, since the extent of redistribution chosen by state governments is also optimal from the national perspective, given the assumed government objectives. The key difference between Federal and state governments is simply that the Federal government takes into account the effects of its decisions on the welfare of all residents, whereas each state in setting its policies worries only about the welfare of state residents.

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 state and the immigration of net recipients from other states. 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.

In section 3, we examine another possible Federal response to the limits on state redistribution due to mobility pressures: a Pigovian subsidy. A subsidy, by internalizing the horizontal fiscal externalities, can encourage the jointly optimal amount of redistribution. One U.S. policy that may be serving as such a Pigovian subsidy is the deductibility for itemizers of extra state taxes.

Supplementary Federal redistribution and Federal Pigovian subsidies can equally well achieve the jointly optimal extent of redistribution in the setting we initially examine. Sections 4 and 5 then explore reasons why these two policies may not be perfect substitutes. In section 4, we allow states to impose a proportional labor income tax either on individuals or on firms. While the incidence of the tax does not depend on whether by statute the demander or the supplier pays the tax, the market-clearing wage rate equals

² One measure of the marginal efficiency costs is the resulting drop in national tax revenue induced by the behavioral responses to any additional redistribution.

the before-tax wage rate in one case and the after-tax wage rate in the other case. The lower market wage rate when the state imposes the tax on businesses rather than on individuals lowers the taxable income among state residents under both the Federal income tax and the Federal payroll tax. Conversely, a Pigovian subsidy that takes the form of allowing state income tax payments to be an itemized deduction under the Federal personal income tax would be lost if the state taxes businesses rather than individuals. A Federal personal income tax therefore encourages states to tax businesses while the Pigovian subsidy encourages them to tax individuals. In section 4, we solve for the combination of the two policies that avoids any distortion to state choices. Remarkably, we find that the rates roughly correspond to those prevailing under current law.

Section 5 then examines the degree to which supplementary Federal redistribution and a Federal Pigovian subsidy are not equivalent when states are heterogeneous. Results vary dramatically depending on the specific source of heterogeneity across states.

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 6 examines briefly another such policy: environmental externalities. While the national government intervenes regularly to address environmental externalities, so do the states, with California in particular often taking the lead on many environmental policies. Again, we forecast that states have an incentive to intervene regardless of the extent of Federal intervention. Given this, the role of the Federal government is again a supplementary one, correcting for interstate spillovers.

Section 7 provides a brief sketch of the 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 9 provides some brief conclusions.

There is an extensive prior literature on at least some of these points. A number of papers solve for the Pigovian subsidy rate, implemented in one form or another by the Federal government, that appropriately internalizes interstate spillovers.³ One of these papers, Wildasin (1991), solves in particular for the subsidy rates that help 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."⁴ 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.

³ Recent examples include Boadway and Hayashi (2001), Buettner (2006), Bucovetsky and Smart (2006), Esteller and Sole (2002), and Köthenbürger (2002).

⁴ See Wildasin (1991, pp. 768-9).

1. Equilibrium redistribution in a Federal system with no mobility

In order to make clear the forces giving state governments a dominant role in redistribution, consider first the following stylized setting:

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.

Each government has available the same set of policies. Again to keep the analysis simple, assume that each is choosing a linear personal income tax schedule equal to $T = -a + bY_h$ for the national government and $T_s = -a_s + b_s Y_h$ in each state s . Here, a (a_s) represents the federal (state) lump-sum transfer while b (b_s) is the Federal (state) marginal tax rate on each household's taxable income, Y_h . For convenience, we assume in the discussion that the tax base equals labor income.⁵ We ignore any spending on public services, and focus solely on the choice of redistributive taxes. As a result, $a = b\bar{Y}$ and $a_s = b_s \bar{Y}_s$, where \bar{Y} and \bar{Y}_s represent mean incomes in the country and in state s .

Assume in addition that all states are identical, except perhaps for their total population. Otherwise, states can tailor their tax policies to local circumstances in ways that the Federal government cannot, given our implicit assumption that the Federal government must impose the same tax rate in all states. In particular, assume that the density function for wage rates in the country as a whole is $f(w)$ while the density function for wage rates in state s satisfies $f_s(w) = N_s f(w) / N$, where N_s is the population of state s and N is the national population.

State decisions can affect Federal tax revenue. We assume, however, that each state is small enough that it ignores the effects of its decisions on Federal tax revenue, since too small a fraction of extra Federal revenue is returned to residents in that state to matter. 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.

We also assume that the incidence of a labor income tax falls entirely on workers. As justification, assume that firms have constant returns to scale, and that the country is a price taker in the international market for both goods and capital. Firms break even when

⁵ The analysis would take the same form if the state uses a retail sales tax rather than an income tax. The main change is simply that individual consumption relative to average consumption replaces individual income relative to average income in the expressions found below.

they locate in a state only if $p = c(w^*, r)$, where $c(\cdot)$ is the unit cost function, w^* is the market wage rate for a standardized quality of worker, r is the user cost of capital, and p is the output price. With both p and r set on world markets, w^* is entirely determined by this break-even condition for firms.⁶

Before we examine the simultaneous 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 $a^* = a + a_s$ and $b^* = b + b_s$. The government chooses the overall tax rate b^* to maximize

$$(1) \quad \int_w V(w(1-b^*), a^*) f(w) dw$$

Here, $V(w(1-b^*), a^*)$ represents the indirect utility of an individual, where utility depends on the net-of-tax wage rate plus the lump-sum transfer. The first-order condition for b^* , taking into account how a^* adjusts so that net government revenue remains zero, equals

$$(2) \quad \int_w \alpha_w (E(wL) - wL) f(w) dw = -\bar{\alpha} b^* NEw \frac{\partial L}{\partial b^*}$$

Here, α_w denotes the marginal utility of income for a household with wage w , while $E(wL)$ equals average equilibrium labor income for households in the population. The term $Ew \partial L / \partial b$ captures the average drop in an individual's tax base brought on by a higher tax rate, while N denotes the national population. The right-hand side then represents the excess burden of the tax, weighted by the average marginal utility of income. The left-hand side measures the equity gains from the tax. Those with below average labor income receive a net transfer while those with above average labor income pay a net tax. When those with below average labor income receive more weight, i.e. have a higher marginal utility of income, the term on the left-hand side is positive. At the optimal policy, marginal equity gains just equal marginal efficiency costs.

What redistribution will then exist in equilibrium, when both Federal and state governments are simultaneously choosing such policies? With simultaneous policy choices, the utility for any given household equals $V(w(1-b-b_s), a+a_s)$

⁶ This conclusion continues to hold if we allow as well for some firms selling goods that are not traded across state lines, as long as the state remains a location in which firms selling in the national market can profitably locate.

The first-order condition for b_s in each state, taking into account how a_s but not a responds to the tax change, equals

$$(3) \quad \int_w \alpha_w (E(wL) - wL) f_s(w) dw = -\bar{\alpha}_s b_s N_s Ew \frac{\partial L}{\partial b_s}$$

The same condition holds in each state. Summing these conditions across states, we have

$$(3a) \quad \int_w \alpha_w (E(wL) - wL) f(w) dw = -\bar{\alpha} b_s N Ew \frac{\partial L}{\partial b_s}$$

This first-order condition for state tax policies then differs from equation (2) only in that $b^* = b + b_s$ is replaced by b_s when measuring the excess burden. To the extent that $b > 0$, states put too little weight on the excess burden term, and overall redistribution as a result is excessive from the perspective of the national government.

Just to reinforce this point, consider what happens if the national government sets b equal to the tax rate that is jointly optimal. State policies are still determined by equation (3a). States certainly engage in additional redistribution. To see this, simply note that if they do not undertake any redistribution, then the excess burden term in equation (3a) equals zero. The equity gain is positive if there is any remaining income inequality, so that some state redistribution is certainly attractive, from the state's perspective. Overall redistribution will be excessive, since states ignore the impact of their decisions on Federal revenue.

In order to achieve the jointly optimal amount of redistribution, the national government must then set $b = 0$. With and only with this policy choice does the equilibrium amount of redistribution equal the amount that is jointly optimal. Ignoring mobility across states, redistribution in equilibrium is solely a state function, with no redistribution occurring at the national level.

It is important to emphasize that the conventional wisdom regarding the allocation of responsibility for the provision of public goods remains correct in this setting without mobility. Consider the choice of funding for some pure public good, G , that provides dollar benefits to each resident in the country equal to $g(G)$, where $g(\cdot)$ is a positive concave function with $g(0) = 0$. Assume this good is financed with a lump-sum tax, τ . From a national perspective, the optimal choice of τ is characterized by $Ng'(G) = 1$. From a state's perspective, if it alone controlled the spending level, the optimal choice of τ would satisfy $N_s g'(G) = 1$. Here, the equilibrium outcome is that the national government chooses the jointly optimal policy. With this policy in place, states will not provide any additional G . Only the national government in equilibrium provides goods that are pure public goods from the national perspective.

Similarly, let each state choose τ_s to finance a local public service, G_s . From its perspective, the optimal choice of τ_s satisfies $N_s g'(G_s) = 1$. 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.

2. Equilibrium redistribution in a Federal system with mobility

How do the above results change when we allow for mobility of residents across states?

States now affect each other. We assume that states each take as given the policies chosen by other states as well as Federal tax revenue when choosing their own policies.

When states need to take mobility of residents into account, they must recognize that a higher tax rate within the state will induce some of the net payers to leave and will induce more net recipients to locate within the state.

We 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.⁷

In order to model explicitly the factors determining household location, assume that the utility of any individual equals $\tilde{\gamma}_s V(w(1-b-b_s), a+a_s)$. Here, $\tilde{\gamma}_s$ is an idiosyncratic taste parameter, drawn from a distribution $T(\gamma)$ that is the same for all s . 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, then some of the rich will leave and some poor will enter.⁸

Taking such mobility into account, the first-order condition for state tax policy now becomes

$$(3b) \int_w \alpha_w (E(wL) - w_h L_h) f_s(w) dw = -\bar{\alpha}_s [b_s N_s Ew \frac{\partial L}{\partial b_s} + \int_w b_s (wL - E(wL)) \frac{\partial f_s(w)}{\partial b_s} dw]$$

The added term reflects the effects of the tax change on mobility, and then the impact of this mobility on net tax revenue. Since some net payers will tend to leave and some net

⁷ One complication we then ignore is that the population relevant for future policy decisions is affected by current policy decisions.

⁸ What if we assume instead that individuals but not firms are costlessly mobile? If individuals are costlessly mobile, then after-tax wage rates are equated across states for individuals with any given pre-tax wage rate. As a result, any attempt at redistribution within the state would be entirely undone through changes in pre-tax wage rates. Firm demand for various skill groups will change, though, in response to the changes in relative wage rates. In this setting, redistribution generates efficiency costs and no equity gains from the state's perspective, so would not occur according to our model.

recipients will enter, the expression is negative, adding to the excess burden of additional redistribution.

Equation (3b) now differs from equation (2) for two separate reasons. First, the state government ignores the effects of its policy changes on Federal tax revenue, leading to too much redistribution. Second, it takes into account mobility of residents across states, in itself leading to too little redistribution. (While this mobility has no effect on aggregate tax revenue, it leads to a loss of tax revenue in state s and an offsetting gain in tax revenue in other states.)

Note, however, that states will still engage in at least some redistribution. In particular, if $b_s = 0$, then the right-hand side of equation (3b) is zero while there are still positive marginal benefit from some redistribution as long as there is *any* income inequality.

Given this behavior of state governments, consider again the choice of Federal policy. Previously, without mobility, the optimal Federal policy was to set $b = 0$ and undertake no redistribution. Now the optimal policy is to choose b so that the overall redistribution is optimal. This requires

$$(4) \quad b_s NEw \frac{\partial L}{\partial b_s} + \sum_s \int_w b_s (wL - E(wL)) \frac{\partial f_s(w)}{\partial b_s} dw = (b + b_s) NEw \frac{\partial L}{\partial b_s}$$

Equivalently, it requires that

$$(4a) \quad \sum_s \int_w b_s (wL - E(wL)) \frac{\partial f_s(w)}{\partial b_s} dw = b NEw \frac{\partial L}{\partial b_s}$$

or

$$(4b) \quad \frac{b}{b_s} = \frac{\sum_s \int_w (wL - E(wL)) \frac{\partial f_s(w)}{\partial b_s} dw}{NEw \frac{\partial L}{\partial b_s}}$$

The greater the mobility response relative to the labor supply response to state taxes, the larger should be the Federal role in redistribution. States, though, will always engage in some redistribution unless the tax base drops to zero in response to *any* attempt at redistribution.

To approximate the value of the right-hand side of equation (4b), we make the simplifying assumption that the percent change in $f(w)$ in response to any given percent change in a household's after-tax income available in state s is the same for all

individuals. This implies that $(\partial f(w) / \partial Y_h)(Y_h / f(w)) = \mu$ for some elasticity parameter μ . It then follows that

$$(5) \quad \frac{\partial f(w)}{\partial b_s} = \frac{\mu f(w)}{Y_h} \frac{\partial Y_h}{\partial b_s} = \frac{\mu f(w)}{Y_h} (E(wL) - wL)$$

Similarly, assume that the uncompensated elasticity of labor supply with respect to the net-of-tax wage rate is some constant θ , while the income elasticity of labor supply is $\phi < 0$. We then know that

$$(6) \quad w \frac{\partial L}{\partial b_s} = w \frac{\partial L}{\partial w_n} \frac{\partial w_n}{\partial b_s} + w \frac{\partial L}{\partial Y_h} (E(wL) - wL) = wL(-\theta + \phi \frac{E(wL) - wL}{Y_h})$$

Here, w_n is the individual's net-of-tax wage rate.

Using equations (5) and (6), we can calculate numerically the value of b/b_s through use of a data set of individual incomes, for any given values of μ , θ , and ϕ . To come up with plausible values for these three parameters, we need to draw on past empirical work.

With respect to the uncompensated labor supply elasticity, the empirical evidence at least for prime-aged men suggests a value close to zero, while the estimated labor supply elasticity for other groups tend to be on the order of 0.4. Consistent with this, we explore values for θ in the range from 0 to 0.5. To approximate the income elasticity, note that the compensated labor supply elasticity equals the uncompensated elasticity minus the income elasticity. Estimates of the compensated labor supply elasticity vary widely. The macro literature has gravitated towards a value of 1.0, consistent with a Cobb-Douglas utility function. The micro literature finds lower values, in the range of 0.3. Here, we will try both values.

For μ , we make use of general equilibrium estimates from Kennan and Walker (2008).⁹ They develop and estimate a model of location choice where moves are motivated by potential improvements in the expected present discounted value of income. Simulations of the long term impact of an increase in a given state's wages yield estimates of the elasticity of labor supply (i.e., population) with respect to wages in the neighborhood of .5.

Given these elasticity estimates, will we make use of data from the CPS to construct an estimate for the expression in equation (4b), in order to estimate the equilibrium value of b/b_s implied by our model.

⁹ Note, though, that Kennan and Walker (2008) focus on a low income population, as the estimates are derived from a sample of male high school graduates with no higher education.

3. Equilibrium Pigovian subsidies

An alternative type of response by the Federal government to the limits that mobility imposes on redistribution by state governments is to subsidize such redistribution. In this section, we examine the use of such subsidies.

In designing a Pigovian subsidy to encourage more redistribution, several complications must be confronted.

First, the subsidy is not intended to encourage additional local public expenditures, only more redistribution. In particular, consider a tax structure of the form $-a_s + \tau_s + bY_h$, where we again have $a_s = b\bar{Y}_s$. The amount τ_s is then used to finance a privately provided public good, generating utility to each resident with dollar value $g(\tau_s)$. The optimal value is characterized by $g'(\tau_s) = 1$, from both the state and the national government's perspective.

To avoid distorting the choice for τ_s , any subsidy shouldn't affect the net tax payments for an individual earning \bar{Y}_h , whose tax payments are entirely user fees.¹⁰ A subsidy encouraging redistribution can enhance the transfer going to the poor, $b(\bar{Y}_h - Y_h)$ and/or lessen the payments above user fees by the rich, $b(Y_h - \bar{Y}_h)$.

In the U.S., we certainly have seen matching grants from the Federal government for particular forms of safety-net expenditures, though in recent years many of these have been converted to block grants. These Federal payments are provided, though, only for particular forms of safety-net programs. State EITC payments or other reductions in income tax payments for the poor are not covered by these subsidies. Nor are a variety of public expenditures aimed particularly at the poor, e.g. added costs of education for students with learning disabilities or subsidies to public hospitals to handle non-insured medical care. We find it plausible to assume that most Federal payments to help finance state transfer programs are de facto Federal transfers to the poor, administered by the states, rather than Pigovian subsidies encouraging state aid to the poor.¹¹

Instead, the closest match to a Pigovian subsidy encouraging more redistribution by states is the availability of state tax payments as an itemized deduction, for those who itemize.

¹⁰ If, due to Tiebout sorting and zoning, property tax payments approximate user fees, then these payments should also not be subsidized, at least on these grounds.

¹¹ Medicaid, though, continues to be a shared expense of state and national governments. Here, the motivation for the intervention may not simply be redistribution. Another motivation could be an attempt to lessen the problems arising from lemons problems in the market for health insurance.

This deductibility would encourage redistribution without distorting a state's choice of τ_s as long as individuals are allowed as a standard deduction an amount at least equal to τ_s . Roughly speaking, the richest quarter of taxpayers itemize, so that the standard deduction should plausibly exceed τ_s for most all taxpayers.

Assume in particular that the Federal government gives all individuals with income above some value y a rebate equal to the fraction ρ of their state income and sales tax payments above those owed by someone with income of y . In order for this subsidy to leave the income distribution unaffected, assume in addition that state taxes now equal

$$-a_s + b_s wL + \frac{\rho}{1-\rho} b_s y^+, \text{ where } y^+ = \max(0, wL - y).$$

State tax revenue increases due to the subsidy. Now,

$$a_s = b_s E(wL) + \frac{\rho}{1-\rho} b_s \frac{N_s^+(y) \bar{y}^+}{N_s}, \text{ where } \bar{y}^+ = E(wL - y | wL > y), \text{ the state's}$$

population is N_s , and the number of residents with $wL > y$ is $N_s^+(y)$.

How large a Pigovian subsidy would be sufficient in itself to generate the extent of redistribution that would be optimal from the perspective of the national government? With any given subsidy, the first-order condition from the state's perspective arising from an increase in b_s differs from the first-order condition for b_s from the national perspective due to the terms

$$(8) \quad \rho^* N_s^+ [\bar{y}^+ + b_s E \frac{\partial y^+}{\partial b_s}] + b_s \int_w (wL + \rho^* y^+ - E(wL) - \rho^* \frac{N_s^+}{N_s} \bar{y}^+) \frac{\partial f_s(w)}{\partial b_s} dw$$

Here, $\rho^* = \rho / (1 - \rho)$.

The optimal value of ρ^* is then chosen so that the expression in equation (8) equals zero. Some of these terms can be measured directly using micro data sets. The terms measuring behavioral responses we will approximate using the same assumptions described in the previous section.

A Pigovian subsidy and supplementary Federal redistribution are perfect substitutes in achieving the overall level of redistribution desired by the Federal government. We will then compare the combined impact of these two policies with the overall combined impact sufficient to offset the effects of mobility on the amount on the redistribution undertaken by state governments.

4. State Personal vs. Business Taxes

One strong result in the above model is that that the Federal government can equally well achieve its desired amount of redistribution either through supplementing the redistribution chosen by the states or through introducing a Pigovian subsidy to induce states to provide the level of redistribution that is jointly preferred. In the next two sections we explore various reasons why these two policies may not be perfect substitutes.

One restrictive assumption so far is that the only form that redistribution can have at the state level is a linear personal income tax or retail sales tax. However, a state can equally well impose a proportional tax on labor income through a payroll tax imposed on firms.¹² A standard result in tax incidence is that the market equilibrium is left unaffected by the choice whether to impose a tax on demanders or suppliers. That would be true here as well, but only if we ignore the simultaneous presence of Federal taxes.

The key difference between these two ways of implementing a proportional income tax is the resulting market wage rate. Under the personal income tax, individuals are paid a gross-of-tax wage rate, and then owe taxes on the resulting income. Under a business payroll tax, individuals are paid a net-of-tax wage rate and then owe no further taxes on this income. Net income is unaffected, but market wage rates do change.

By shifting to having firms rather than individuals make the statutory tax payments, market wage rates fall. As a result, individual taxable income under the Federal personal income tax and under the Federal payroll tax for Social Security both fall.

The resulting tax savings from the use of business taxes to residents in the state can be substantial, at least under current law. The Federal payroll tax rate is 15.3 percent. To be conservative, following the results in Diamond and Gruber (1999), assume that half of the non-Medicare component of the payroll tax is offset by future additional Social Security benefits, lowering the effective payroll tax rate by 6.2 percent. If labor income falls proportionately in a state, Federal income tax payments fall by some fraction of this fall in labor income reflecting the average marginal tax rate of employees in the state, weighting by the size of their labor income. We estimate that this weighted average personal tax rate is 22.5 percent.¹³ Since the employer half of the payroll tax is implicitly deductible under the personal income tax, the overall effective marginal tax rate on labor income faced by state residents equals $.225 + .091 \times (1 - .225) = .30$. As a result, 30 percent of a state's tax payments can potentially be offset by Federal tax savings if the state by statute has firms rather than individuals make these tax payments.

What happens to any Pigovian subsidy if the state shifts from imposing a tax on individuals to instead imposing it on firms? If the subsidy is implemented through

¹² For example, half of the payroll tax payments under Social Security by statute are made by firms and half by workers.

¹³ These calculations are based on data from the 2004 Statistics of Income individual income tax public use data file. Tax rates are calculated using the internet TAXSIM version 8.0 (see <http://www.nber.org/taxsim> and Feenberg and Coutts (1993)), and includes the role of the EITC and AMT.

allowing state income and sales tax payments as an itemized deduction, then this subsidy is lost if the state shifts to a business tax.

With a Federal Pigovian subsidy, states prefer to use a personal tax, while with a Federal income tax states prefer to use a business tax. If the two forms of state taxes are perfect substitutes, then these incentives favoring one or the other form for the tax are irrelevant. However, in practice there are a variety of reasons why the two forms are not perfect substitutes. Under a personal income tax, the tax paying unit is a household rather than an individual and taxable income can be defined net of various deductions and exemptions. While we have assumed that the tax base is labor income, a personal income tax can also include financial income as well as business income in part earned out of state. None of these attributes are possible under a business payroll tax. However, tax enforcement is easier with a business tax, since the governments then does not need to monitor the situation of each household.

There are efficiency reasons then for the Federal government to avoid distorting a state's choice between imposing taxes on individuals vs. businesses. This requires using a combination of Federal income taxes and Federal Pigovian subsidies chosen so as to leave no net incentive for the state to prefer one form of tax over the other. Such neutrality requires that the Federal tax savings be the same, whether a dollar is collected in one form or the other. The Federal income plus payroll tax savings per dollar of state business taxes equal $.091 + .909b$. The savings per dollar collected in personal income taxes, assuming as before a subsidy at rate ρ for any state personal income tax payments made by those with incomes greater than some value y , equals $\rho N_s^+ \bar{y}^+ / [(1 - \rho)NE(wL)]$. Equating these two expressions, we find that the following relationship avoids any distortion to state decisions between personal and business taxes:

$$(9) \quad b = -.1 + 1.1 \frac{\rho}{1 - \rho} \frac{N_s^+ \bar{y}^+}{NE(wL)}$$

To compare the rates implied by this condition with those in fact prevailing in the U.S., we make use of data from the 2004 Statistics of Income individual income tax public use data file. We find that ρ (the average tax loss per dollar of state and local tax deductions among itemizers) was .26. The total taxable income among itemizers was found to equal 70% of total taxable income among all taxpayers. Equation (9) then indicates no distortion to the form of state tax if $b = .17$. The actual (weighted average) tax rate we find in the data is .225. The figures do at least roughly correspond. They also suggest that the existing subsidy rate is too low relative to the current statutory tax rate. With $b = .225$, equation (9) holds if $\rho = .3$.

While we have focused in this section on state business payroll taxes, the analysis of other state business taxes would be closely parallel. Consider for example the incidence of a state tax on each firm's income to capital. In general, the range of possible prices that might adjust includes output prices, wage rates, required (after local tax) rates of return to capital, and land prices. For firms selling on (inter)national markets, output

prices cannot respond to local taxes. Those providing financing to the firm can also invest instead in other states, so that the required (after local tax) rate of return to capital cannot respond to local taxes.

The incidence of any state and local taxes on businesses must then result in a fall in wage rates and/or land prices. If land is a minor input to a firm's production (or if the firm can costlessly locate to land with no scarcity value), then the incidence of state and local taxes on business must fall entirely on wage rates.¹⁴ Mathur and Hassett (2006) and Arulampalam et al. (2007) provide evidence that cross-country differences in corporate income taxes are passed almost entirely to wages.

With business taxes resulting in a fall in wage rates, whether the business tax base is payroll or capital income, the above analysis does not in fact depend on the specific nature of the business tax base. With a tax on business capital income, though, there is an additional distortion to a firm's capital/labor ratio, and additional efficiency costs.

5. Policy when states are heterogeneous

Another key assumption underlying our result that Federal income taxes and Federal Pigovian subsidies are equivalent policies is the assumption that states are homogeneous, in particular having the same income distribution and the same behavioral responses to taxes. These alternative policy responses are no longer equivalent when states are heterogeneous. The objective of this section is to explore possible sources of heterogeneity in order to examine their implications for equilibrium redistribution by the states and the optimal Federal response. We assume throughout, though, that the Federal government must employ the same tax schedule in all states, or provide the same Pigovian subsidy in all states.

One possible source of heterogeneity is differences in the income distribution across states. Certain industries for example could have a comparative advantage in a particular state due to local geography, and employ a different composition of skill groups than other industries.¹⁵

When the income distribution differs by state, state choices for tax policy will also differ. To take an extreme case, if incomes are all equal in a state, then the state's optimal policy is no redistribution at all --- there are no equity gains but there remain efficiency costs from use of an income tax. States with many poor but few rich may have higher tax rates

¹⁴ See Haughwout and Inman (2000) for a derivation of the incidence of state and local taxes in a setting where firms do use land as an input.

¹⁵ Another reason for differences across states could be agglomeration economies in particular industries, as in Krugman(1993). The resulting competition among states for the location of such industries can be mutually costly, generating a reason beyond those we highlight for a greater role for the Federal government in redistribution.

on the rich but smaller transfers to the poor, and conversely for states with many rich and few poor.

From the Federal perspective, even if it could make use of different tax schedules in different states, it would not choose to do so. The optimal policy instead would be to have equal tax rates, and equal transfers, in all states.

Within the above structure the natural way to move towards this outcome is to employ a Pigovian tax rather than a Pigovian subsidy on states to the extent that they redistribute, and then to compensate through use of a larger Federal tax rate. If the Pigovian tax is high enough to induce states to abandon any redistribution, then the Federal government can achieve its optimal amount of redistribution. While it is hard to think of examples of policies that in fact impose a tax on states to the extent that they engage in redistribution, the Federal government has certainly been shifting in recent years towards various restrictions limiting the deductibility of state tax payments against Federal taxable income, thereby reducing the size of a preexisting subsidy.¹⁶

A second possible source of heterogeneity could be differences in the mobility of households across location. For example, if the dispersion of non-monetary tastes, γ_s , for living in a state varies by state, then mobility responses will be smaller in states with more dispersed preferences.¹⁷ As a result, states where the population is less mobile will choose higher tax rates, since one source of efficiency cost from a higher rate becomes less important.

The jointly optimal tax structure does not vary by state. Imposing a uniform supplementary Federal tax does not directly affect these differences in overall tax rates by location, and cannot achieve the optimal outcome from the national government's perspective..

If the Pigovian subsidy rate could vary by state, then the optimal policies would employ a high subsidy rate in states where mobility is high and tax rates are low, and a low subsidy rate in states with low mobility and high tax rates. Existing rules under the AMT provide a crude approximation to such variation in Pigovian subsidy rates, since state taxes are deductible only to the point that overall ordinary personal income tax liabilities remain greater than AMT liabilities. Any further state tax payments are no longer deductible. As a result, itemizers in low-tax states are subsidized at the margin, but itemizers in high-tax states are not.

A third type of heterogeneity by state could be in labor supply elasticities.¹⁸ States where

¹⁶ Among these changes are use of the AMT, which does not provide any deduction for state taxes. As important is simply the reduction in marginal tax rates, reducing the size of the subsidy for those who itemize.

¹⁷ A stylized example of such a situation is the claim we have often heard that some people can't live anywhere but New York City, while others could never conceive of living there.

¹⁸ For example, employees in some jobs may be less sensitive to wage rates because job satisfaction is a more important supplementary attraction of the job in some industries, and these industries may tend to

this elasticity is low will choose higher tax rates since the resulting excess burden is lower, and conversely.

Now, if the Federal government could vary its tax rates by state, it would choose to do so in order to impose a higher tax rate on those with a lower labor supply elasticity.¹⁹ Such rate variation by state is assumed infeasible under the Federal income tax. Adding a uniform supplementary Federal income tax then cannot achieve its desired extent of redistribution.

Assuming no Federal income tax, though, the optimal Pigovian subsidy would remain the same in all states: the optimal subsidy rate is simply proportional to b_s . A policy allowing a credit in proportion to state income tax payments above some amount y continues to be sufficient to induce states to choose the optimal tax policies from the national government's perspective.

Depending on the source of heterogeneity, then, we can justify a variety of responses, depending on the source of heterogeneity, with responses ranging from no use of state income taxes or no use of Federal income taxes.

6. Application to environmental policies

According to the above results, when policies are employed jointly by state and Federal governments, the role of the Federal government is to come up with policies that internalize any externalities generated by state policies or that supplement state policy choices to achieve the jointly optimal overall policy.

This line of reasoning arises for any policies chosen jointly by state and Federal governments, and not just tax policy. In the language of the EU, the result is "subsidiarity," deferring to state governments except to the degree that there are interstate spillovers.

Consider as a second example the choice of environmental policy. To highlight the similarity of the federalism issues here, assume for simplicity that all households are identical, eliminating any distributional role for environmental taxes. Assume though that there is some product that people consume that generates an externality. In particular, assume that the utility of any household equals $V(w, P, q_s + t_s + t, E(X_s, X) + a_s + a)$, where P is a price vector for all goods that do not

locate in particular states. Alternatively, leisure activity could be more of a draw in some states than in others.

¹⁹ By the same reasoning, it could gain by imposing a different tax rate on labor income by industry, or by age or gender, yet is not observed to do so. One challenge to the optimal taxation literature is to explain such implicit constraints on tax policy. One hypothesis, for example, could be that a commitment to uniform treatment avoids costly variation in tax structure as the identity and composition of the current majority party changes.

generate externalities, q is the price for a particular good that does generate an externality, t and t_s represent possible Federal and state Pigovian tax rates, and $E(X_s, X)$ measures the dollar equivalent externality affecting this individual where X_s is the amount of the good consumed in state s while X is national consumption of this good. As before, a and a_s represent the lump-sum return of Federal and state Pigovian tax revenue to households.²⁰

If states are homogeneous, the optimal choice for the combined state and Federal Pigovian tax rates from the perspective of the national government satisfies

$$(11) \quad t_s + t = N_s E_1 + N E_2,$$

where E_i represents the derivative of E with respect to its i 'th argument. The externality generated by each additional unit of consumption of X_s is measured by the right-hand side of equation (11). The optimal Pigovian tax imposes an additional cost equal to this amount on the purchase of each unit of X_s .

Taking the Federal Pigovian tax rate as given, a state's choice of its own Pigovian tax rate would satisfy

$$(12) \quad t_s = N_s (E_1 + E_2)$$

Each state takes into account only those externalities borne by residents in the state, so would choose a smaller tax rate than the jointly optimal rate. The rate is certainly positive, though, regardless of the Federal tax rate, as long as marginal externalities remain.

Given equations (11) and (12), the optimal value for the Federal tax rate t satisfies

$$(13) \quad t = (N - N_s) E_2$$

The role of the Federal government then is to deal solely with interstate externalities.

Instead of using a Pigovian tax, the Federal government could instead dictate the maximum level of externality, e.g. by imposing a constraint on emissions. If emissions are proportional to consumption of X , as assumed here, then the price of X will rise to the point that aggregate consumer demand just equals the allowed production of X .²¹

²⁰ We focus on externalities generated from the location of consumption, though there would be a parallel analysis for externalities generated by the location of production.

²¹ To preserve a market equilibrium, even with a price above the marginal cost of production, producers could be required to buy permits from the government. Alternatively, some allocation rule for permits is needed, with those receiving the permits receiving the associated rent equal to the difference between the price and the marginal cost of production.

With this policy imposing a constraint on producers, leading to a higher market price for the good, states will still choose to intervene. Their optimal Pigovian tax continues to satisfy equation (12). In the face of this Pigovian tax, the national government's constraint on emissions should lead to a market price equal to that generated by the Pigovian tax described by equation (13). Again, the national government simply needs to address interstate externalities.

7. General results on roles for Federal and state governments

The above results on the respective roles for Federal and state governments in redistributive and environmental policies are special cases 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.

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, each state chooses its level of intervention. Given these choices, the Federal government chooses a supplementary level of intervention.

Consider then the first thought experiment. Following our prior set-up, assume that the national government chooses some policy intervention, X , to maximize national welfare $W = \sum_h V_h(w_h^n, a_h, G)$. Here, we assume as before that tax revenue is entirely used to finance either government provided goods, G , or financial transfers, a_h . 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 $W_s = \sum_{h \in s} V_h$, where $W = \sum_s W_s$. State r will undertake no further supplementary expenditures X_r only if $\partial W_r / \partial X_r < 0$.²² If this were the case then we

²² 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

then infer that $\sum_{s \notin r} \partial W_s / \partial X_r > 0$, 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 on other states. This was the case in our example above with Federal provision of a national public good. If any state provides any additional amounts of this good, other states benefit.

If each state has intervened optimally from its perspective, when will the Federal government choose not to intervene further? If states are all identical, simplifying the notation, then the national government would not gain from any change in each state's policy choice only if $\sum_{s \notin r} \partial W / \partial X_r = 0$, so that each state's policy choice has no net effect on the welfare of other states. This was the case above when states chose the level of provision of a local public good. In all other cases, the Federal government has an incentive to intervene, either through increased expenditures when these externalities are positive or through a Pigovian tax when these externalities are negative.

In all other cases, we expect to see joint provision of the public program by both state and Federal governments. We have shown in particular that there will be joint provision of both redistribution and environmental protection.

As discussed in Gordon (1983), externalities can take many forms. Some policies may have direct effects on the utility function of nonresidents. Nonresidents benefit from local public goods to the extent that benefits are not limited by state boundaries. Nonresidents are directly affected by any change in consumption or production of a good creating externalities. There are also fiscal externalities generated by state policies, affecting not only other states but also the Federal government.

8. Conclusions

The objective of this paper is to examine the equilibrium allocation of fiscal responsibilities between Federal and state governments, focusing on two particular settings: income redistribution and environmental externalities.

The traditional presumption, dating back to work by Oates (1972) and Musgrave (1971), is that states will provide goods whose benefits go just to residents in the state. Only with state control can the level of provision match the preferences of residents within each state, and the competition among states for residents provides added incentives to efficiently provide the desired services. The national government will provide goods that are pure public goods from a national perspective, and also take sole responsibility for redistribution.

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.

In examining more carefully the equilibrium choices for tax structure and spending by state and Federal governments, we find several striking differences from these traditional presumptions. First, 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, and to address possible conflicting objectives of state governments due to heterogeneity across states.

We find the same pattern of results for environmental policies. Again, in equilibrium, the states will play an active role in correcting for these externalities, regardless of the level of intervention chosen by the national government. Given this, the national government is confined to dealing with cross-state spillovers.

We do still find, though, that when the national government provides a pure public good, in equilibrium the states will not undertake any additional provision of such a good.

National intervention to correct for cross-state spillovers, whether from migration in response to a redistributive tax or cross-border externalities, can take a variety of forms. One would be to make use of a Pigovian tax/subsidy that is designed to internalize the spillovers that occur in equilibrium. A second would be to additional provision, designed so that the total Federal and state provision equals the amount that the Federal government finds optimal.

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, the Federal government must 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 plays no role.

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