

DEADWEIGHT COSTS AND THE SIZE OF GOVERNMENT*

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ABSTRACT

We provide a model for analyzing effects of the tax system and spending programs on the determination of government spending and taxpayer welfare. An improvement in the efficiency of either taxes or spending would reduce political pressure for suppressing the growth of government and thereby increase total tax revenue and spending. We demonstrate the similarity of the political responses to revenue shocks, spending shocks, changes in tax efficiency, and changes in spending program efficiency. Empirical analysis of oil shocks, intergovernmental grants, and other autonomous changes in taxes or spending indicates that cause and effect is not only from spending to tax structures.

I. INTRODUCTION

MOST economists would recognize that government revenue grew at a rapid pace during the twentieth century partly because of the introduction over time of personal and corporate income taxation, social security taxes, value-added taxes (VATs), and other efficient and broad-based taxes, although they would recognize too that the direction of causation is not fully clear. But they usually reject this commonsense outlook when actually evaluating the effects of, say, the substitution of a flat income tax for the present progressive structure,¹ or when determining and evaluating the consequences of neglecting to tax sales over the Internet.² For in these types of exercises,

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¹ David E. Altig *et al.*, *Simulating Fundamental Tax Reform in the United States*, 91 *Am. Econ. Rev.* 574 (2001).

² Austan Goolsbee & Jonathan Zittrain, *Evaluating the Costs and Benefits of Taxing Internet Commerce*, 52 *Nat'l Tax J.* 413 (1999).

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they invariably make the tacit or explicit assumption that government spending is independent of the system of taxation. This assumption is fine as part of the decomposition of a total effect into two separate effects. The usual one calculates the effect of a change in the form of taxation on efficiency and other behavior for a given amount collected. However, typically neglected is the second step for both positive and normative public policy analyses, which is to determine the effects of a change in the tax system on the total amount taxed and thereby spent on government programs. For example, few economic or other analyses of the effects of shifting to a flat tax incorporate the consequences for total tax revenue and government spending. Our summary of the empirical evidence suggests that the consequences are often important and must be added to the usual analysis to give a complete picture of the effects of tax reform.

Symmetrical issues arise in considering the effects of reforming government spending programs, such as spending on welfare, social security, and medical care. Spending program reforms are usually analyzed holding program size fixed, while induced changes in the scale of a program after it has become more or less efficient are neglected.

Our goal is to take a few steps toward closing this gap and include changes in tax and spending induced by alterations in the tax systems and spending programs. Formalizing this view of government growth helps derive a number of additional implications for public policy. Our approach imbeds the analysis of taxes and expenditures in a simple model of interest group competition for political favors. This approach incorporates not only the effects on efficiency of changes in the tax and spending systems but also the equilibrium responses in rates of taxation and spending. The reason for equilibrium responses is that changes in the tax and spending systems alter the gains to interest groups from spending additional resources on trying to influence political outcomes.

These equilibrium responses are related to in character, but analytically separate from, the changes in private individual and corporate behavior induced by alterations in the system of taxing and spending. Although these responses in the private sector are also sometimes neglected, in recent years economists have become much more aware of their importance. They frequently now try to include them when estimating the effects on tax revenue, expenditures, and private behavior of changes in taxation and public programs. But these are still "partial equilibrium" political analyses because political behavior is held constant when considering alterations in the tax and spending systems and induced responses are neglected. We show how the "general political equilibrium" responds to the tax system and how this political response is implied by the more commonly recognized private-sector responses to taxation.

Others have also suggested that a shift to a more efficient tax system would induce increases, perhaps substantial increases, in government spending

through a negative effect on the incentives of taxpayers to fight higher tax rates. But our interest group model also predicts several other “novel” implications about political responses that sometimes enormously affect the consequences of alterations in the tax and spending systems for total tax revenues and government expenditures.

One is that more efficient spending of government tax receipts induces greater political activities by subsidy recipients that leads to greater taxation and government spending. Another implication of our model of interest group competition is that “exogenous” increases in spending or revenue owing to a war or a rise in the revenue of major oil producers raise total spending and total tax collections, but less than dollar for dollar. Moreover, the response is closely related to the political response to a tax or spending reform. For example, an increase in oil “tax” revenue would reduce other taxes, although total collections—including oil revenue—would increase.

The relationship between responses to tax reform and exogenous changes in government revenue can be used to calibrate more accurately a model of tax reform that has forecasts of both private and public-sector responses to the reform. Our estimates suggest that, even if we accept previous studies’ estimates of the private behavioral effects of a flat income tax, growing public-sector spending makes the aggregate efficiency gains much less than estimated by those studies. We show that politically inactive taxpayers may be hurt even by a reform that makes all taxes more efficient for all taxpayers.

We examine differences in government expenditures across nations as a function of the differences in the efficiency of their tax systems, changes within countries in the size of their government sectors as the efficiency of their tax systems change over time, and the effects of wartime and of oil shocks on taxation and spending. We also consider whether the causation mainly goes from government spending to tax efficiency rather than the reverse. Although no one of these tests is fully convincing, the totality of the evidence supports the importance of equilibrium political reactions to changes in the efficiency of tax and spending systems.

H. Geoffrey Brennan and James M. Buchanan pioneered the economic analysis of the political repercussions of the tax system.³ Governments are

³ James M. Buchanan & Roger D. Congleton, Proportional and Progressive Income Taxation with Utility-Maximizing Governments, 34 *Pub. Choice* 217 (1979); and H. Geoffrey Brennan & James M. Buchanan, *The Power to Tax: Analytical Foundations of a Fiscal Constitution* (1980). Later contributions were made by John Douglas Wilson, Are Efficiency Improvements in Government Transfer Policies Self-Defeating in Political Equilibrium? 2 *Econ. & Pol.* 241 (1990); Alex Cukierman, The Revenue Motive for Monetary Expansion, in *Central Bank Strategy, Credibility, and Independence: Theory and Evidence* 47 (Alex Cukierman ed. 1994); and Per Krusell, Vincenzo Quadrini, & Jose-Victor Rios-Rull, Are Consumption Taxes Really Better Than Income Taxes? 37 *J. Monetary Econ.* 475 (1996). See also Sam Peltzman, The Growth of Government, 23 *J. Law & Econ.* 209 (1980); Douglass C. North, The Growth of Government in the United States: An Economic Historian’s Perspective, 28 *J. Pub. Econ.* 383 (1985); Stanley Fischer & Lawrence H. Summers, Should Governments Learn to Live with Inflation? 79 *Am. Econ. Rev. Papers & Proc.* 382 (1989); Robert E. Hall & Alvin Rabushka,

modeled in this literature as leviathans, benevolent social planners, or winners of a majoritarian election. Although this work has the important insight that a shift to a more efficient tax system increases government revenue and spending, our model of political competition adds many additional implications. For example, a leviathan approach to the size of government⁴ is silent about the effects of changes in the efficiency of government spending programs on taxation and spending. Moreover, since governments tax as much as possible, this model does not imply that autonomous increases in tax collections reduce other types of taxation or that autonomous increases in spending—such as during wars—would increase tax rates and tax collections. Nor does the leviathan model allow for the possibility that taxpayer political efforts can directly limit the size of government.

Other models of the public-sector feature a benevolent social planner who maximizes a welfare function that depends on the utilities of different individuals. Although a social planner would increase spending if taxes or spending became more efficient, this model cannot explain why there are highly inefficient tax and spending programs in the first place.⁵ Nor can it explain, without arbitrarily specifying the form of the “social welfare” function, why small groups, such as sugar growers, or millionaire octogenarians, can get so many political benefits, why the semiconductor, automobile, and steel industries in the United States have been successful in having quotas placed on competing imports, or why valuable television and radio spectrums have been given away rather than auctioned off to high bidders. Moreover, practically all uses of the social planner model neglect the induced effects of changes in efficiency on spending, even when the models are avowedly “general equilibrium.” Given these weaknesses of the planner model, it is important to have an analysis that includes the planner model as a special case but also incorporates differences in the political power of various interest groups in order to explain obvious deviations from social welfare maximization. Our model of interest group competition achieves this goal since its equilibrium policy is, except in a limiting case, generally not the policy that would be chosen by a planner.

The planner approach might seem to justify tax reform evaluations that

The Flat Tax 48 (2d ed. 1995); and Casey B. Mulligan, Government Gets Fat on the Flat Tax, *Chi. Sun Times*, May 4, 1996, at 14, for further analysis of, or comments on, the effect of taxes on the politics of spending.

⁴ Brennan & Buchanan, *supra* note 3; Mancur Olson & Martin McGuire, The Economics of Autocracy and Majority Rule: The Invisible Hand and the Use of Force, 34 *J. Econ. Literature* 72 (1996).

⁵ The social planner approach can explain apparently “inefficient” policy by showing that the policy is actually efficient once technological, informational, and other constraints are recognized. This, for example, is the approach of Albert L. Nichols & Richard J. Zeckhauser, Targeting Transfers through Restrictions on Recipients, 72 *Am. Econ. Rev.* 372 (1982); and Edgar O. Olsen, Pareto-Desirable Redistribution in Kind: Comment, 70 *Am. Econ. Rev.* 1028 (1980).

hold revenue constant, because most planner problems can be studied using an envelope theorem that says the social welfare consequences of marginally improving tax efficiency are equal to the partial derivative of social welfare with respect to the tax efficiency parameters, holding total tax revenue constant. No such envelope theorem is applicable in our model, however, because the equilibrium amount of tax revenue does not maximize anything, except in the limiting case referenced above. Furthermore, even in planner models, the induced responses of total tax revenue to reform must be included when the changes are large or when discussing outcomes that are different from social welfare.

II. THE SIZE OF GOVERNMENT AND POLITICAL COMPETITION

A. *The Influence Function as a Model of the Size of Government*

Consider a simple model of competition for political power between two interest groups, Taxpayers and Beneficiaries. Assume that the government has a balanced budget and the political competition results in Taxpayers being taxed T to finance equal subsidies G to Beneficiaries. Taxpayers spend resources, A , on lobbying legislators, influencing voters, et cetera to persuade them to vote to keep taxes relatively low. Similarly, Beneficiaries spend resources, B , also trying to influence legislators and the electorate to raise the transfers to them.

A complete analysis of the political sector would formally model the process of government decision making. Since, by analogy with standard supply and demand analyses of the firm and consumer sectors, our focus is on the relationship between the political sector's inputs and outputs rather than on its inner workings, we do not open the "black box" of political institutions and deal with a reduced-form function that is the end result of what may be a complicated process of electoral voting, legislative decisions, and executive branch initiatives. In this reduced form, government spending and taxes directly depend on the amounts spent by Taxpayers and Beneficiaries on gaining political influence:

$$T = G = F(A, B), \quad \text{where } F_a < 0, F_b > 0, F_{aa} > 0, \text{ and } F_{bb} < 0.$$

The derivatives mean that increased political pressure by Taxpayers lowers government spending and taxes, while increased pressure by Beneficiaries raises government spending and taxes and both effects are subject to diminishing returns. We do not assume that $F(0, 0) = 0$.

These restrictions on the first and second derivatives of the political outcome function are weak and plausible; fortunately for the generality of our analysis, they are consistent with many underlying voting and other political processes. Our assumption that F is a stable function over time is a stronger assumption, but that too would be implied by reasonable models of political

processes that are stationary over time. Since we require few additional assumptions about the reduced-form influence function, the absence of an explicit model of the political process does not preclude a useful analysis having valuable implications about government taxation and spending. This paper derives those implications from minimal restrictions on the properties of the influence function.

Our analysis is not relevant unless some interest groups overcome incentives for their members to free ride—perhaps because the groups are small, ethnically or racially homogeneous, or for other reasons—and actively participate in trying to influence political outcomes. Of course, literally thousands of groups are unable to overcome free riding and are politically inactive. Gary Becker discusses more systematically the cost of overcoming free riding in the context of this model of interest group competition.⁶

Our analysis may apply to nondemocratic as well as democratic governments. John Douglas Wilson shows how $F(A, B)$ can be derived from voter models, although these models have to endogenize preferences, where special interests would spend resources to affect “preferences” of the electorate.⁷ Becker points out that dictators are not free to arbitrarily choose policy and are subject to pressures from various groups.⁸ Hence, policies may depend on deadweight costs even in totalitarian countries. If interest groups and deadweight costs play a role in nearly all political systems, then perhaps an interest group approach to the determinants of public spending may abstract from less important institutional differences between democracies and nondemocracies. Several empirical studies suggest that the size and composition of government budgets are in fact similar for democracies and nondemocracies, conditional on measures of economic development.⁹

The same analysis of taxes and spending applies to regulations. If one considers a particular type of regulation that varies in magnitude—such as

⁶ Gary S. Becker, A Theory of Competition among Pressure Groups for Political Influence, 98 Q. J. Econ. 371 (1983).

⁷ Wilson, *supra* note 3.

⁸ Gary S. Becker, Public Policies, Pressure Groups, and Dead Weight Costs, 28 J. Pub. Econ. 329 (1985).

⁹ For example, William Easterly & Sergio Rebelo, Fiscal Policy and Economic Growth: An Empirical Investigation, 32 J. Monetary Econ. 436 (1993); Peter H. Lindert, The Rise of Social Spending, 1880–1930, 31 Explorations Econ. Hist. 1 (1994); Fred C. Pampel & John B. Williamson, Age, Class, Politics, and the Welfare State (1989); and Casey B. Mulligan, Ricard Gil, & Xavier Sala-i-Martin, Social Security and Democracy (Working Paper No. 8958, Nat'l Bur. Econ. Res. 2002). We are not aware of an explicit test of the proposition that democracies and nondemocracies respond to deadweight costs in similar ways, although some results reported in the literature might be interpreted as such a test. For example, we believe that taxes have become more efficient over time, but the effect of democracy on public spending does not seem to have changed (for example, Lindert estimates a zero effect early in the twentieth century, and Easterly and Rebelo estimate a zero effect later). Gross domestic product (GDP) per capita may proxy for the efficiency of tax collection, and Mulligan, Gil, and Sala-i-Martin find no interaction between democracy and GDP per capita in social security spending regressions with cross-country samples.

cafe standards for gas mileage—one can model the determinants of the magnitude of these regulations by an influence function that depends on spending to lower these regulations by groups harmed and spending to raise them by groups who benefit. The same propositions tend to hold for regulations as for taxes and spending.¹⁰

B. Deadweight Costs and the Equilibrium Size of Government

We assume a one-period Nash noncooperative equilibrium between the spending by each active group, where each group maximizes its net income, given the spending by other groups. In the two active group case, Taxpayers minimize the sum C_A of its political spending and the cost to members of its group of the taxes assessed against it, given the spending by Beneficiaries, B .¹¹ The cost of the taxes equals the sum of tax revenue and Δ , the deadweight cost (DWC) of taxes. So Taxpayers minimize

$$A + T + \Delta(T) = C_A,$$

$$\Delta'' \geq 0.$$

The DWC of taxes is itself a function of the amount transferred T , and we assume that function is nonconcave. The sign of Δ is often positive, although we do not rule out $\Delta < 0$, which occurs, for example, when the behavioral changes induced by taxes deliver a Pareto-improving allocation. If this also occurred for marginal taxes, then $\Delta' < 0$.

Similarly, Beneficiaries maximize the difference S_B between the value to Beneficiaries of subsidies received and the amount they spend on political activity, given the spending by Taxpayers. The value of the subsidy equals the difference between the amount received from the government and Γ , the DWC of spending. So Beneficiaries maximize

$$G - \Gamma(G) - B = S_B.$$

Subsidies also have a DWC because in many cases Beneficiaries change their behavior in order to obtain the subsidy. The value of Γ depends on the amount subsidized G , and we assume Γ is nonconcave. It is often positive, although we do not rule out $\Gamma < 0$.

¹⁰ Casey B. Mulligan & Gary S. Becker, Accounting for the Growth of Government (unpublished manuscript, Univ. Chicago, March 2000), develops in more detail the interest group analysis of regulation and the interaction between regulation and taxes and spending.

¹¹ We capitalize “Taxpayers” and “Beneficiaries” to refer to the model’s (mutually exclusive) interest groups and use lowercase when referencing “real world” taxpayers.

The first-order conditions for each group with respect to A and B in a Nash equilibrium are¹²

$$dT/dA\{1 + \Delta'\} = F_a\{1 + \Delta'\} = -1$$

and

$$dG/dB\{1 - \Gamma'\} = F_b\{1 - \Gamma'\} = +1.$$

The top equation implies a reaction function $A(B)$, and the bottom equation a reaction function $B(A)$. The reaction functions are two equations in the two unknowns, A and B , as a function of the political reduced-form function F and the DWC schedules for taxes and spending, $\Delta(T)$ and $\Gamma(G)$. We model a change in the political process as a shift of the function F , a change in the efficiency of the tax system as a shift of the function $\Delta(T)$, and a change in the efficiency of the subsidy system as a shift of the function $\Gamma(G)$.

It would seem that, by using the Nash equilibrium concept, our analysis is quite different from an analysis of the public sector that is based on social welfare maximization. This appearance is accurate in the sense that benevolent social planners, as usually modeled, do not expend the decision-making resources A and B . But when it comes to policy outcomes, Becker's results suggest that our model and the planner model are similar.¹³ Our Appendix B shows that, for any weight $\theta \geq 1$ on Beneficiary surplus, the equilibrium policies from our model in a limiting case have a level of government spending G that maximizes a social welfare function of the form $\theta[G - \Gamma(G)] - [G - \Delta(G)]$. In other words, the comparative static results we derive for the size of government also apply in models of "socially optimal" government spending. We discuss this point further below but note that the relevant weight θ corresponds to political power, not to the weight derived from the usual ethical considerations. In particular, richer persons or steel producers may have a large weight, while poor persons or dry cleaners may have a small weight.

We distinguish three concepts of the DWC or "inefficiency" of the tax system: (1) average DWC, $\Delta(T)/T$, (2) total DWC, $\Delta(T)$, and (3) marginal DWC, $\Delta'(T)$. For the usual reasons, total DWC will tend to be a convex function of revenue collected so that all three measures vary with the size of government. However, we do not assume that average and marginal DWCs are necessarily positive for any amount of taxation, so that we allow for efficiency-enhancing taxes (and spending).

It is important to distinguish tax systems whose DWCs differ for a given size of government from tax systems whose DWCs differ merely because

¹² The conditions $\lim_{A \rightarrow 0} \Delta'(F(A, B)) > -1$ for any $B \geq 0$ and $\lim_{B \rightarrow 0} \Gamma'(F(A, B)) < 1$ for any $A \geq 0$ are sufficient to guarantee that each group applies a strictly positive amount of pressure.

¹³ Becker, *supra* note 6, at 384.

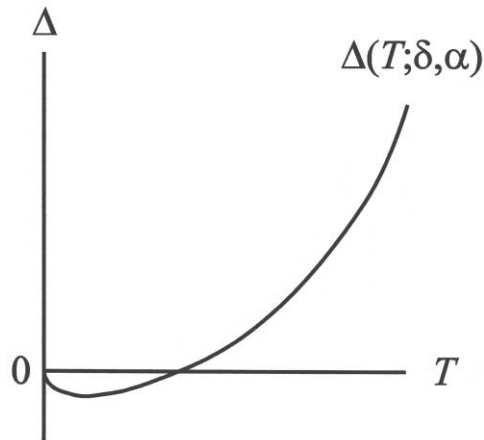


FIGURE 1.—The deadweight cost schedule for one tax system

different amounts of revenue are raised. In other words, we distinguish a shift from a movement along the function $\Delta(T)$ as shown in Figure 1.

We introduce exogenous parameters δ and α that shift $\Delta(T)$. The parameter α shifts the function $\Delta(T)$ without changing its slope; a smaller α corresponds to a parallel downward shift of the curve in the diagram. The value of α might, for example, fall over time because of reductions in the overhead costs of administering and complying with a tax system. The parameter δ changes the slope of the function $\Delta(T)$ by the same amount at all levels of T ; a smaller δ corresponds to a clockwise twist of the curve in the diagram. Movements along the curve $\Delta(T)$ involve changes in DWCs and the size of government but are not changes in the “efficiency” of the tax system. Changes in α or δ that reduce average or marginal DWCs for a given T are increases in the “efficiency” of the tax system. We introduce the parameters β and γ to similarly shift and twist the function $\Gamma(G)$.

Flat tax proposals have some element of reducing α to the extent the proposals involve reducing compliance costs without changing incentives to behave in one way or another. But the most significant effect of a flat tax may be in reducing the incentive to reallocate activities in order to avoid taxes, which amounts to a reduction in the slope of the function $\Delta(T)$. The passage of the Sixteenth Amendment in 1913, which permitted the federal government to levy direct taxes in addition to or instead of the taxes it was already using, is modeled by reducing δ because direct taxes, by themselves or in combination with other taxes, are likely to bring in a given revenue with less behavioral change. The amendment may have increased α because administrative and compliance costs are necessary to collect direct taxes. Economic development, since it is accompanied by monetization of activities,

likely reduces both α and δ because tax administration and compliance are easier to enforce when households and firms maintain accounting systems for other purposes.

Notice that $T = G$ is the net transfer from Taxpayers to Beneficiaries. Members of the net taxed group may receive some subsidies, and members of the net subsidy group may pay some taxes. Typically, greater DWCs are suffered per dollar of net transfer when cross hauling occurs than in its absence. So a downward shift of the $\Delta(T)$ function may be due to a reduction in the amount of gross taxes paid by Taxpayers per dollar of net taxes they pay. Similarly, an increase in the amount of gross subsidies received by Beneficiaries per dollar of net subsidies received would produce a downward shift of the function $\Gamma(G)$.

Cross hauling is only one reason why the amount transferred from Taxpayers to Beneficiaries, T , is not identical to the size of the government budget. For example, regulations are an important way to increase redistribution without increasing the government budget. The size of the budget may be a good proxy for the amount of redistribution if budgets, tax expenditures, and regulation are highly correlated, as they appear to be over time.¹⁴ However, some recent cross-country studies suggest that spending and taxes may substitute for regulation, in which case the observed relation between tax efficiency and government revenue may overstate the relation between tax efficiency and a more comprehensive (budget plus regulatory) measure of the size of government.¹⁵

The comparative statics of the system of first-order conditions are easily derived. For δ changes, we have

$$dA/d\delta = -F_a/[D_a(1 - A'B')]$$

and

$$dB/d\delta = B'[dA/d\delta],$$

where $D_a = (-F_{aa}/F_a + F_a^2\Delta'') > 0$ since $F_{aa} > 0$ and $\Delta'' > 0$. The term A' is the slope of the Taxpayer reaction function and B' the slope of the Beneficiary reaction:

$$A' = \frac{(-F_a F_b)\Delta'' - F_{ab}/(-F_a)}{F_a^2\Gamma'' + F_{aa}/(-F_a)}, \quad B' = \frac{(-F_a F_b)\Gamma'' + F_{ab}/F_b}{F_b^2\Gamma'' + (-F_{bb})/F_b}. \quad (1)$$

When the DWC of the tax system increases and $A'B' < 1$, Taxpayers fight harder to reduce taxes by spending more on political activities. The effect on B depends on the slope of its reaction function, which in turn depends on properties of the functions F and Γ . If F_{ab} were far enough from zero, B

¹⁴ Mulligan & Becker, *supra* note 10.

¹⁵ *Id.*; Simeon Djankov *et al.*, The Regulation of Labor (Working Paper No. 9756, Nat'l Bur. Econ. Res. 2003).

could increase enough so that government grows. We rule out by assumption such extreme equilibrium values for F_{ab} by assuming

$$-F_b F_{aa}/(-F_a) < F_{ab} < F_a F_{bb}/F_b. \quad (2)$$

This restriction is a form of “strategic separability” since it means that an exogenous increase in Taxpayer pressure, or an exogenous decrease in Beneficiary pressure, decreases equilibrium taxes and spending.¹⁶ It is clear from the equations for A' and B' that, if there are diminishing returns to pressure and convex DWCs, strategic separability implies $A'B' < 1$.

We then have an important

PROPOSITION 1. A shift to a tax system with higher marginal DWC (a higher δ) raises pressure by the taxpaying group and lowers total taxes and government spending.

A similar analysis applies to changes in the DWC of government spending. It is easily shown that

PROPOSITION 2. A shift to a system of subsidies with higher marginal DWC (a higher γ) lowers pressure by subsidy recipients and lowers total taxes and spending.

Even if the procedures for making public decisions do not build in complementarity between the pressure applied by the two groups (in our notation, even if $F_{ab} = 0$), changes in Taxpayer pressure affect Beneficiary pressure and vice versa, as long as Δ'' and Γ'' are not zero. However, even when Beneficiaries react to changes in Taxpayer pressure—perhaps because of increased tax efficiency—(or Taxpayers react to changes in Beneficiary pressure), the net result must be more government spending since Beneficiaries (or Taxpayers) change pressure only in response to changes in A (or B).

Some tax and spending systems may just differ by additive terms α or β . Compliance and information costs may be “fixed” DWCs, which, if reduced, would lower DWCs without affecting the marginal DWC functions. Since each lobby’s marginal condition depends on the tax system only through the marginal DWC functions, an increase in the DWC of the tax system that does not affect marginal DWCs (an increase in α holding δ fixed) does not change the equilibrium size of government or pressure by either group. Similarly, an increase in the DWC of the spending system not affecting marginal DWCs (an increase in β holding γ fixed) does not change the equilibrium size of government or pressure by either group.

However, a “marginal” DWC in our analysis is the change in the DWC with respect to the marginal political decision—not necessarily with respect to a marginal change in private behavior. Compliance and information costs, for example, are fixed costs from an individual’s point of view (he must pay them only if he is subject to some positive tax), but they may be marginal

¹⁶ If F were either additively separable or homogeneous of degree zero, then any Nash equilibrium would be “strategically separable.”

costs from a political point of view if the relevant political margin is the fraction of the population to be covered by the tax.

Modern public finance analysis of the effects of taxes on government revenue and individual behavior, and of spending on costs and behavior, consists largely of analyses of DWCs. We carry over that emphasis to the study of political behavior so that, just as changes in private behavior affect how much revenue a tax will bring to the treasury, changes in private behavior also determine the political success of the tax.

Propositions 1 and 2 imply that the government sector tends to grow when it uses more efficient taxes as Taxpayers fight less strongly against higher tax rates. Yet the typical economic analysis takes government spending as given when analyzing the effects of changes in the tax system and so ignores politically induced responses of tax rates, and hence of government spending, to changes in the efficiency of the tax system. The response of spending to the tax system in our analysis does not depend on whether the outcome of the political competition is efficient or inefficient since we do not assume that Δ , Γ , Δ' , or Γ' are necessarily positive, only that DWCs are convex.

Proposition 1 is applicable to recent discussions of replacing the current income tax structure with a flat tax that allows few deductions from income in assessing taxable income. Such a flat tax is usually advocated by persons who believe not only that the current tax code is too cumbersome, but who also want to reduce the intrusion of government into economic decision making. Proposition 1 implies that political reactions to an improvement in efficiency owing to a flat tax would expand, not contract, tax collections and government spending. By the same reasoning, flattening the income tax might hurt the rich and help the poor via an expansion in government spending, even while a spending-constant income tax flattening might relatively benefit the rich.

Some economists have argued that VATs and some other taxes on private spending are easier to increase over time because they are hidden from consumers.¹⁷ They sometimes cite the growth over time of VAT tax rates. However, proposition 1 suggests a different reason why VATs increase over time: they are more or less flat taxes that raise government revenue more efficiently.

Value-added taxes can be compared with social security taxes, which are also essentially flat taxes, but they are not hidden from consumers to the same extent since, like income taxes, social security taxes are partly deducted

¹⁷ The idea is sometimes referred to as "fiscal illusion"; see, for example, Charles J. Goetz, *Fiscal Illusion in State and Local Finance*, in *Budgets and Bureaucrats* 176 (Thomas E. Borcharding ed. 1977); and James M. Buchanan & Richard E. Wagner, *Democracy in Deficit* (1977). It dates back at least to John Stuart Mill, *Principles of Political Economy* (1970). Wallace E. Oates, *On the Nature and Measurement of Fiscal Illusion: A Survey*, in *Studies in Fiscal Federalism*, 431 (Wallace E. Oates ed. 1991), is a recent survey of the literature.

explicitly from earnings.¹⁸ The rapid growth over time in social security taxes suggests that the growth in VATs is not entirely explained by the visibility of their collection. Also notice that social security taxes were just as visible under President Clinton as they were under Presidents Johnson, Nixon, Ford, or Carter, but it was President Clinton who uncapped the Medicare portion of the social security tax in order to raise additional revenue. Prior to Clinton's administration marginal personal income tax rates declined from 70 percent to less than 40 percent (for some time, the top rate was less than 30 percent), and this decline may have politically facilitated his uncapping the social security tax because marginal personal income tax rates are one important determinant of the marginal DWC of social security taxes. Might a change to an even flatter income tax pave the way for further payroll tax hikes for high-income taxpayers?

While economic analyses of tax efficiency have usually ignored the effects of tax systems on the size of government, lobbyists and politicians have not. Perhaps this explains why advocates of larger government are frequently supporters of the flat tax.¹⁹ Lobbyists for Civil War veteran pension programs were keenly aware that their success depended on efficient sources of revenue.²⁰ Jean Baptiste Colbert, Louis XIV's finance minister, is alleged to have said that "the art of taxation consists in so plucking the goose as to obtain the largest possible amount of feathers while provoking the smallest possible amount of hissing."²¹

Marginal DWC schedules vary over time and across countries. Sam Peltzman discusses some technological constraints that limit the kinds of taxes available to governments in undeveloped economies.²² Constitutions sometimes also limit the available taxes, as in the United States before the passage of the Sixteenth Amendment in 1913.²³ The marginal DWC of taxes is also partly determined by special interests who lobby for tax exemptions that narrow the income tax base and affect the marginal DWC of the income tax.

Government redistribution in this approach might be modeled as a two-

¹⁸ Casey B. Mulligan & Xavier Sala-i-Martin, *Gerontocracy, Retirement, and Social Security* (Working Paper No. 7117, Nat'l Bur. Econ. Res. 1999); and Mulligan, Gil, & Sala-i-Martin, *supra* note 9, show that in a cross section of countries, countries relying relatively more heavily on "employee" contributions have programs that spend the same or more than do those in other countries, even though "employee" contributions are more visible to workers than the "employer" contributions.

¹⁹ Hall & Rabushka, *supra* note 3, at 48.

²⁰ Dora L. Costa, *The Evolution of Retirement*, ch. 8 (1998).

²¹ H. L. Mencken, *A New Dictionary of Quotations on Historical Principles from Ancient and Modern Sources* 1178 (H. L. Mencken ed. 1960).

²² Peltzman, *supra* note 3, at 221, 257.

²³ The experience with the Sixteenth Amendment (including the Civil War usage of income and estate taxes before the passage of the amendment) suggests that constitutional restrictions are not fully enforced when political pressure changes.

staged “game,”²⁴ where in the first stage tax and spending systems are chosen, while in the second stage, groups try to maximize their political surplus, taking these systems as given. A more complete analysis of the first-stage problem is beyond the scope of this paper, but the properties of the second-stage game derived in this paper are a necessary part of a fuller analysis.

Propositions 1 and 2 might also be applied to the cross-country relation between trade openness and the size of government. A first application might stress that taxes have higher marginal DWCs in countries in open economies because the taxpayers in those economies have greater scope for adjusting their behavior in response to taxes. Perhaps this partly explains why intrusive totalitarian regimes often permit only limited trade with foreigners or why financial repression is correlated with the amount of inflation tax revenue.²⁵ On the other hand, David Cameron and Dani Rodrik find a positive cross-country correlation between government spending and (exports + imports)/GDP.²⁶ Richard Goode and others have tried to explain this with something like DWCs—namely, that trade taxes may be the most efficient taxes available in some countries—but more work needs to be done to determine whether our approach is consistent with these observations.²⁷

More efficient government spending induces greater political activities by subsidy recipients that leads to greater taxation and government spending. Taxpayers might therefore prefer inefficient subsidies. One variant of this occurs when subsidies are distorting because they are targeted to a particular type of beneficiary and the targeting is achieved by making subsidy eligibility conditional on beneficiary behavior, such as a means test. Both public finance and political economy literatures have featured the trade-off between a relatively small targeted program whose eligibility requirements distort behavior and a larger program with more liberal eligibility requirements that might distort behavior less.²⁸ Both taxpayers and members of the targeted group may prefer the targeted program despite the inefficiencies it creates—the

²⁴ Positive constitutional economics usually has a two-stage analysis (for example, Charles Austin Beard, *An Economic Interpretation of the Constitution of the United States* (1913); and James M. Buchanan & Gordon Tullock, *The Calculus of Consent* (1962), are two pioneering studies), where the first stage seeks to explain why one constitution rather than another is adopted, often through competition among groups who recognize how a constitution will later affect their interests.

²⁵ On the second point, see Nouriel Roubini & Xavier Sala-i-Martin, *Financial Repression and Economic Growth*, 39 *J. Dev. Econ.* 5 (1992).

²⁶ David R. Cameron, *The Expansion of the Public Economy: A Comparative Analysis*, 72 *Am. Pol. Sci. Rev.* 1243 (1978); Dani Rodrik, *Why Do More Open Economies Have Bigger Government?* 106 *J. Pol. Econ.* 997 (1998).

²⁷ Richard Goode, *Government Finance in Developing Countries* 146 (1984).

²⁸ See Nichols & Zeckhauser, *supra* note 5, for a public finance with this feature. George J. Stigler, *The Theory of Economic Regulation*, 2 *Bell J. Econ. & Mgm't Sci.* 4 (1971); Becker *supra* note 6, at 386; Bruce L. Gardner, *Efficient Redistribution through Commodity Markets*, 65 *Am. J. Agric. Econ.* 225 (1983); and William R. Dougan & James M. Snyder, *Are Rents Fully Dissipated?* 77 *Pub. Choice* 796 (1993), are related political economy studies.

former because the targeted program has a smaller budget and the latter because the targeted program has a larger budget per beneficiary. While the literature emphasizes the advantages of targeting for increasing budget per beneficiary, taxpayer preference for a smaller program may be the main reason why the targeted program is politically successful. Spending program inefficiency may be politically successful when those inefficiencies do not serve the purpose of targeting spending, merely because inefficiencies reduce support by beneficiaries and thereby program size.

Our model assumes that Taxpayers do not care about the net gains accruing to Beneficiaries. This may be unrealistic if the main Beneficiaries are the poor or other groups that elicit sympathy. But none of the political implications of the analysis would be very different if Taxpayers maximized a weighted average of Taxpayer cost ($C_A = A + T + \Delta(T)$) and Beneficiary surplus ($S = G - \Gamma(G) - B$), where the weights are independent of political activities.²⁹ Propositions 1 and 2 (and later propositions 3 and 4) are still valid under the same strategic separability conditions. These implications do not depend on altruism because it does not eliminate disagreement about the marginal transfer between those taxed and those subsidized, it only reduces the amount of disagreement. Political pressure must still be used to resolve this disagreement. We comment later on some normative implications that may depend on the presence of Taxpayer altruism.

C. “Budget Shocks” and “Tax Efficiency”

We now generalize the government budget equation to allow spending and taxes to change for “exogenous” reasons:

$$T + E = F(A, B) = G + D,$$

where D measures government spending, such as spending on the military to conduct or prevent a war, that is exogenous to political pressure and E measures government revenues, such as the oil revenue enjoyed by governments of oil-producing countries, perhaps aid or reparations from other nations, or the sale of government enterprises, that are exogenous to pressure. As before, T measures taxes levied on Taxpayers, and G measures subsidies enjoyed by Beneficiaries because of political pressure.

The economic relevance of the distinction between D and E is that, holding constant A and B , the pressure applied by the two groups, more D means less spending (G) enjoyed by Beneficiaries. Similarly, E is “exogenous taxes” in the sense that, holding constant the pressure applied by the two groups,

²⁹ Gary S. Becker & Casey B. Mulligan, *Is Voting Rational or Instrumental?* (unpublished manuscript, Univ. Chicago, October 1999), builds another model with similar implications. It really is a model of endogenous Taxpayer altruism because the influence function F there is derived from political advertising to change Taxpayer willingness to vote for a spending program.

more E means fewer taxes T levied on Taxpayers.³⁰ It is straightforward to prove

PROPOSITION 3. An increase in exogenous government spending increases pressure by subsidy recipients and thereby increases total government spending, but less than dollar for dollar. An increase in exogenous government revenue decreases pressure by Taxpayers and thereby increases total revenue, but less than dollar for dollar.

Family economists have considered whether and how family spending patterns depend on which family member receives more income. Some claim that family spending patterns are different when, say, fathers receive income than when mothers do and interpret this behavior as evidence of insufficient altruism or cooperation in the family.³¹ The related behavior observed in the public sector is that income windfalls are spent differently when governments receive them rather than when they are received directly by citizens. In particular, a larger fraction of government windfalls are spent on public programs than is spent out of private income windfalls. The behavior is sometimes called the “flypaper effect,” and James Hines and Richard Thaler survey the literature estimating its magnitude.³² Both interest group and social planner analyses can explain why private and public windfalls have very different effects on government spending, as long as there are convex DWCs of taxes and spending.³³ So flypaper effects may just be evidence of convex DWCs in collecting and spending tax revenue, and hence they imply little about whether political and private behavior are rational (Hines and Thaler allege that flypaper effects are evidence of irrational behavior in the public sector) or whether they derive from interest group or planner models that include convex DWCs.³⁴

³⁰ In other words, D and E differ mainly in their incidence, holding political pressures (A , B) constant, rather than the side of the ledger on which they appear. Our formulation above is simple and convenient for many purposes, although it blurs this distinction, and thereby implies an apparently strange auxiliary result that equal increases in D and E and decreases in endogenous government spending G . See Appendix A for further discussion.

³¹ For example, Shelly J. Lundberg, Robert A. Pollak, & Terence J. Wales, Do Husbands and Wives Pool Their Resources? Evidence from the United Kingdom Child Benefit, 32 *J. Hum. Res.* 463 (1997).

³² James R. Hines, Jr., & Richard H. Thaler, The Flypaper Effect, 9 *J. Econ. Persp.* 217 (1995).

³³ See Jonathan H. Hamilton, The Flypaper Effect and the Deadweight Loss from Taxation, 19 *J. Urb. Econ.* 148 (1986), for a demonstration of this result in a planner model. Hines & Thaler, *supra* note 32, at 221, dismisses Hamilton’s argument on the grounds that “the marginal deadweight losses from taxes are typically far too small to reconcile the large differences between propensities to spend out of changes in grants and changes in private incomes.” However, both our interest group and planner models have the magnitude of the flypaper effect determined by the second, rather than the first, derivative of DWCs. Nor can small marginal DWCs explain why Hamilton’s analysis has been overlooked, because the convexity of DWCs is an important determinant of dG/dE in his model as well.

³⁴ David F. Bradford & Wallace E. Oates, An Analysis of Revenue Sharing in a New Approach to Collective Fiscal Decisions, 85 *Q. J. Econ.* 416 (1971), is an early paper comparing

As long as default is not an option, government debt service can be modeled as an “exogenous” increase in spending that has the effect of raising the average DWC of taxes and decreasing the quantity of other spending. Our analysis implies that an increase in debt reduces future spending because servicing the debt requires an increase in the marginal DWC of future taxes.³⁵

Propositions 1–3 require the “strategic separability” restrictions on the cross-derivative of the influence function $F(A, B)$. Although these are weak restrictions, some important results relating the effects of changes in exogenous government revenue, exogenous government spending, and tax system efficiency still apply even without separability. In particular, for all values of F_{ab} , greater tax efficiency (lower δ) has the same qualitative effects on pressure by A and B and on total government spending $F(A, B)$ as does greater exogenous government revenue (higher E). Similarly, greater spending efficiency (lower γ) and greater exogenous government spending (higher D) have the same qualitative effects regardless of F_{ab} . The quantitative effects of δ , γ , D , and E are also closely related through the convexity of DWCs:

PROPOSITION 4. Even if F_{ab} violates assumption (2), the magnitude of the effects of δ and E on A , B , and $F(A, B)$ differs only by the factor Δ'' , the convexity of tax DWCs. Similarly, the magnitude of the effects of γ and D on A , B , and $F(A, B)$ differs only by the factor Γ'' , the convexity of spending DWCs.

This proposition implies that under general assumptions about competition among interest groups, there is a close relationship among different factors affecting the pressure by Taxpayers to restrain the growth of programs subsidizing Beneficiaries. This relationship implies that the effects on the size of government of changes in the efficiency of spending and taxes should be related to the effects of exogenous changes in spending or taxes, such as a “peace dividend” at the end of a war, or the higher revenue enjoyed by oil-producing governments during an “oil price shock.”

flypaper effects in planner and political models of the public sector, but its models have income effects but no DWCs of redistribution. A complete analysis would decompose the spending response into income effects, substitution effects (especially those resulting from DWCs), and political effects. We have ignored the income effects (is redistribution a luxury good?), and more work needs to determine how the political effects in our model differ from those in other political models. Less studied is the effect of federal grants to particular state government agencies on the spending by other state government agencies. More work also needs to be done to determine the magnitude of this allocative flypaper effect, as observed (see Katherine Baicker, *Government Decision-Making and the Incidence of Federal Mandates*, 82 *J. Pub. Econ.* 147 (2001), for one empirical study of interagency effects) and as implied by rational actor models of public decisions.

³⁵ See Torsten Persson & Lars E. O. Svensson, *Why a Stubborn Conservative Would Run a Deficit: Policy with Time-Inconsistent Preferences*, 104 *Q. J. Econ.* 325 (1989), for a similar result in a different political model.

D. *Welfare Implications*

Economists have typically preferred lump-sum taxes because they have no effects on efficiency, aside from those on fertility and mortality. This preference ignores the political general equilibrium effect on government spending of different kinds of taxes. Once the induced effects on government spending are taken into account, it is no longer clear that lump-sum taxes and transfers are the best. Our model can be used to determine which system of taxes and spending redistributes surplus and which generates Pareto-improving changes. These results are relevant both for normative evaluations of tax system changes³⁶ and, as suggested by the constitutional economics literature, for a positive analysis of the determination of constitutions and legal institutions related to taxes and spending.

Since δ , the measure of the marginal DWC of taxes, does not affect a Beneficiary's surplus directly and a reduction in δ reduces pressure applied by Taxpayers, Beneficiaries must be better off from a more efficient tax system. However, the analysis is not symmetric for more efficient spending systems. Although γ , the measure of the marginal DWC of spending, does not directly affect Taxpayers' net income, a lower γ increases pressure applied by Beneficiaries so that more efficient spending makes Taxpayers worse off.

Economists, journalists, and others have often pointed out that many government spending programs are inefficient—including farm price supports, government administration of schools, and “in-kind transfers.” It would appear that Taxpayers would benefit if these programs became more efficient—if farmers received monetary payments rather than acreage restrictions or if students received vouchers rather than free tuition at public schools. But our analysis raises doubts about the validity of this partial political equilibrium analysis. Taxpayers might prefer inefficient spending programs because subsidy recipients would exert less political pressure to expand inefficient programs. For example, cash payments to farmers might make taxpayers worse off than less efficient acreage restrictions because farmers would fight harder politically to receive greater payments.³⁷

This general political equilibrium implication of the interest group analysis sharply distinguishes our analysis from even a general political equilibrium social planner approach. A social planner always prefers efficient forms of taxation and spending regardless of how these affect taxation and spending, since he chooses the “social optimum” levels of taxes and spending. There-

³⁶ Since we assume that each political group seeks to maximize its aggregate surplus, our analysis is not readily applicable to normative (or positive) questions that depend on the distribution of surplus within groups.

³⁷ Taxpayer altruism may weaken, but need not eliminate, taxpayer opposition to efficient spending. Some members of the subsidized group may also oppose proposals to enhance spending efficiency, especially if they relax “barriers to entry” into the subsidized group (Stigler, *supra* note 28, at 4; Dougan & Snyder, *supra* note 28, at 796).

fore, the existence of so many apparently inefficient tax and spending programs is strong evidence against the general applicability of the planner model.

While those subsidized benefit from greater tax efficiency, we cannot sign the effect of a lower marginal DWC of taxes (lower δ) on Taxpayers' equilibrium net income. Holding Taxpayer pressure constant, lower δ decreases the DWC and increases the net income of Taxpayers. They further increase their net income by reducing their pressure to equate political costs and benefits (holding Beneficiary pressure constant). If Beneficiaries react to Taxpayer pressure by reducing or holding constant their own pressure, then any reaction by Beneficiaries would further increase Taxpayer net income and Taxpayers would be still better off from more efficient taxes. Since the convexity of DWCs tends to generate a positively sloped reaction function for the Beneficiaries, the more likely result (but not a result guaranteed by our various second derivative restrictions—see equation (1)) is that Taxpayers are better off with a lower δ . A reduction in the average DWC of taxes (lower α) unambiguously enhances Taxpayer welfare because it does not induce any change in equilibrium pressures.

Similar reasoning shows that lower average DWCs of spending (lower β) makes Beneficiaries better off. But lower marginal DWCs (lower γ) might make Beneficiaries worse off. Holding their pressure constant, a lower γ decreases their DWC and increases their net income. Beneficiaries further increase their surplus by increasing their pressure in response to a lower γ in order to equate political costs and benefits (where they compute costs and benefits holding A fixed). If Taxpayers reduce their own pressure, their reaction further increases Beneficiaries' surplus. However, the convexity of Δ is likely to generate a positively sloped reaction function for Taxpayers (see equation (1)), and Taxpayers would respond to lower γ with more pressure. This additional Taxpayer pressure would hurt Beneficiaries and may dominate the effect of γ and greater Beneficiary' pressure on their net income. So the effect of γ on the equilibrium welfare of Beneficiaries cannot be signed without further restrictions on F_{ab} .

Taxpayers may prefer more efficient taxes despite the induced growth in government because the government may expand largely as a result of the taxpaying group's collective decision to cut resistance. However, the next section shows that, when taxpaying groups do not apply political pressure collectively, free-riding, unorganized Taxpayers are more likely to oppose efficient taxes. We show also that free riding among subsidy groups, on the other hand, strengthens the gain to those subsidized of more efficient subsidies.

In a planner model, government spending expands in response to more efficient taxes in much the same way as it does in our two-interest-group economy (see also Appendix B). Efficient taxes may hurt Taxpayers in the planner model because the planner desires to redistribute from Taxpayers

and this redistribution is cheaper with more efficient taxes. This important difference between the planner model and our two-group model (even limiting cases of it in which equilibrium government spending coincides with the planner's optimum) is due to the absence of socially costly political pressure in the planner model that responds to tax and spending efficiency. Growing government costs Taxpayers in both setups, but Taxpayers in the interest group setup also enjoy the gains associated with reducing their expenditure on political resistance. But this difference between the planner and interest group approaches diminishes when we expand the number of interest groups and thereby reduce the level and changes in the amount of resources spent on political pressure, as we do in the next section.

III. INTERACTIONS WITHIN POLITICAL GROUPS

The welfare analysis in the previous section assumes that both Taxpayers and Beneficiaries act collectively. In a more realistic analysis, some taxpayers and some subsidy recipients would act collectively, but others who are taxed and subsidized may be unable to act politically because they are free riding on a collective political good (see Mancur Olson's pioneering analysis).³⁸ One way to introduce free riding in our framework is to assume that political pressures by different taxpayer (or subsidy) groups are substitutes in the influence function. For example, some taxpayers may fight for a reduction in tax rates that ultimately benefits all taxpayers, or unions may push for restrictions on immigration that also benefit some nonunion workers.

Consider M Taxpayer and N Beneficiary groups and the extreme case that the size of government depends on the sum of expenditure by all groups:

$$G = T = F(\Sigma_1^M A_i, \Sigma_1^N B_i),$$

where A_j minimizes $A_j + a_j F(\Sigma_1^M A_i, \Sigma_1^N B_i) + \Delta_j(a_j F)$ subject to $A_j \geq 0$, $\Sigma_1^M a_i = 1$ and B_j maximizes $b_j F(\Sigma_1^M A_i, \Sigma_1^N B_i) - \Gamma_j(b_j F) - B_j$ subject to $B_j \geq 0$, $\Sigma_1^N b_i = 1$.

It is easy to show from the first-order conditions that no more than one taxpaying group—the one with highest marginal cost $a_j(1 + \Delta'_j)$ —and no more than one subsidy group—the one with the greatest marginal surplus $b_j(1 - \Gamma'_j)$ —apply political pressure. These two groups may be “active,” but all other groups would free ride on pressure by these active groups. Moreover, the potential for free riding discourages pressure even by the group of Taxpayers and subsidy recipients, i and j , respectively, with the greatest marginal cost and greatest marginal surplus because they receive only the fractions a_i and b_j of the total benefits generated by their pressure. No groups may be active, even though $F(0, 0) \gg 0$, and pressure by Taxpayers could greatly

³⁸ Mancur Olson, *The Logic of Collective Action* (1965).

reduce the tax burden and pressure by subsidy recipients could greatly increase subsidies.

As in Section II, a decrease in the DWC of taxes or spending of any active groups increases the size of government. Taxpayers are still hurt by more efficient spending. Those subsidized would prefer more efficient taxes to be levied on the politically active Taxpayers (as might the politically active Taxpayers), but other Taxpayers unambiguously oppose such a reform because it reduces pressure applied by active Taxpayers. Therefore, free riding among Taxpayers is an additional reason why most Taxpayers might be against “reforms” of the tax system lowering the marginal DWC of taxation. As suggested by Brennan and Buchanan, a fiscal constitution may be one way that taxpayers rationally seek to limit the efficiency of the tax system, although this presumes that the free riding among taxpayers is different in the constitution-making stage than in the political competition occurring after the constitution is in place.³⁹

The multigroup framework also makes it easier to endogenize the choice of a tax system. Consider two types of taxes with different DWC-revenue schedules and each type harms one of two equally powerful and equally sized taxed groups. Since the group harmed by the relatively inefficient tax applies more pressure, the efficient tax is utilized more heavily.⁴⁰ But since the average and marginal DWC of the more efficient tax increases with the amount of revenue raised, an exogenous increase in the size of government raises its DWC. When its marginal DWC becomes as high as that of the less efficient tax, the political equilibrium may begin to rely on both taxes. In other words, a schedule relating the DWC to revenue for the entire tax system (like that shown in Figure 1) may itself be the outcome of a competition among taxpayers, with the schedule for the whole system traced out as an envelope of the DWC-revenue schedule for each particular tax.⁴¹ A greater reliance on less efficient taxes by exogenously larger governments is consistent with the decline in tax efficiency observed when governments are burdened by greater defense spending.⁴²

This analysis helps to interpret some of the empirical public finance literature. Some of that literature concludes that the behavioral effects of taxes

³⁹ Brennan & Buchanan, *supra* note 3.

⁴⁰ This is also proposition 4 of Becker, *supra* note 6.

⁴¹ Also note that a movement along the system's DWC-revenue schedule may be associated with a growing fraction of revenue coming from the less efficient tax. This implication is relevant for interpreting some of the empirical relations between revenue and DWC measures.

⁴² Gary S. Becker & Casey B. Mulligan, *Deadweight Costs and the Size of Government* (Working Paper No. 6789, Nat'l Bur. Econ. Res. 1998).

and subsidies are often small.⁴³ Since our analysis implies that taxes will be targeted toward groups with smaller behavioral responses rather than “representative” groups, we are not surprised when studies exploiting policy variations find smaller responses to prices than do other studies.

IV. REVENUE CREATION AND THE GROWTH OF GOVERNMENT: EVIDENCE

We review, extend, and interpret evidence on the correlation between the size of government and proxies for the efficiency of the tax system. Consistently measuring “tax efficiency” and the “size of government” for a number of countries is difficult, as is obtaining good-quality data. It is also difficult to separate the effects of tax efficiency from the effects of a number of other potential determinants of government size, so we must admit that there are multiple explanations of positive correlations between government size and tax efficiency measures. However, studies of budget shocks and government spending—the “flypaper effects” discussed earlier—can help to distinguish our explanation from at least one other, namely, that efficient tax systems are a response to a large demand for government spending.

A. *Measuring Tax Efficiency and the Size of Government*

In our analysis, the “size of government” refers to the amount of redistribution, but studies often measure the ratio of government spending (or government revenues) to gross domestic product (GDP). Cross hauling, tax expenditures, and regulation are all reasons why government spending is not the same as government redistribution, but our presumption, and the presumption in most studies, is that all forms of redistribution are highly correlated over time and across countries. Through the term D , our analysis also explicitly recognizes that some government spending is not redistributive. Since high-frequency GDP fluctuations lead to fluctuations in the ratio of government spending to GDP, which are unrelated to the size of government, we sometimes (as indicated in the text) compute the ratio of government spending to trend GDP.

The equilibrium average, marginal, and total DWCs of taxes can be positively or negatively correlated with the size of government across countries, depending on the covariance of exogenous government spending D , exogenous government revenue E , and the level and first and second derivatives

⁴³ See, for example, the studies surveyed by Jerry A. Hausman, Taxes and Labor Supply, in *Handbook of Public Economics* 213 (Alan J. Auerbach & Martin Feldstein eds. 1985), although Martin Feldstein, Tax Avoidance and the Deadweight Loss of the Income Tax, 81 *Rev. Econ. Stat.* 674 (1999), suggests that behavioral responses have been underestimated because of insufficient measures of the various forms of tax avoidance, and Assar Lindbeck, Hazardous Welfare-State Dynamics, 85 *Am. Econ. Rev.* 9 (1995), suggests that responses are greater in the long run.

of the DWC functions $\Delta(T)$ and $\Gamma(G)$. This implies that the United States, for example, may have lower average and total DWCs of taxes even if its tax system were less efficient. Hence, empirical tests of our approach ideally use proxies for the marginal DWC at a given size of government rather than proxies for equilibrium DWCs.

We have argued elsewhere⁴⁴ that European tax systems rely more heavily on VAT, payroll, and other more relatively efficient taxes than does the United States. Agricultural economies also have less efficient tax systems because of the ease of substitution away from market activities and monetary transactions.⁴⁵ For example, a landowner can easily pay much of his agricultural labor in-kind, rather than in cash, by providing housing, food, and other goods. In-kind payments are more difficult for tax authorities to monitor and value. Robert Haig and Carl Shoup suggest that sales taxes are easier to levy in economies with larger retail firms,⁴⁶ which might also induce a negative relationship between agricultural activity and tax efficiency. For these reasons, the fraction of the labor force in agriculture can be viewed as a proxy for the tax inefficiency that we predict is negatively related with the size of government.

Other proxies for the efficiency of taxes found in the literature are population, the “modernization” of industry, the administrative efficiency of government, and “corporatism.” The first proxy is supposed to be negatively correlated with tax efficiency, while the other three are supposed positively correlated.⁴⁷ Irma Adelman and Cynthia Morris construct an index of government administrative efficiency, which, in their sample of middle-income and less developed countries, they believe represents the organization of administrative services by the government and the government’s ability to create favorable financial institutions and tax instruments.⁴⁸ They also construct an “indicator of the extent of modernization of production techniques in industry as of about 1961.”⁴⁹ Since their measure is based in part on the “diversity and range of goods produced in the modern industrial sector,” we expect it to be correlated with tax efficiency for the same reason that agricultural activity might be.

William Easterly and Sergio Rebelo suggest that bigger countries rely more on income taxes than on trade taxes and thus can have bigger governments—see their analysis of the composition of trade versus income taxes.⁵⁰ Lawrence

⁴⁴ Becker & Mulligan, *supra* note 42.

⁴⁵ George J. Stigler, *The Irregularities of Regulation* 4 (1986); and James B. Kau & Paul H. Rubin, *The Size of Government*, 37 *Pub. Choice* 261 (1981).

⁴⁶ Robert Murray Haig & Carl Shoup, *The Sales Tax in the American States* 25 (1934).

⁴⁷ See Becker & Mulligan, *supra* note 42, and the related literature for a detailed discussion.

⁴⁸ Irma Adelman & Cynthia Taft Morris, *Society, Politics, and Economic Development: A Quantitative Approach* 76 (1971).

⁴⁹ *Id.* at 97.

⁵⁰ Easterly & Rebelo, *supra* note 9.

Summers, Jonathan Gruber, and Rodrigo Vergara and Olson point to corporatism as another source of cross-country differences in tax efficiency.⁵¹ A corporatist economy is one in which allocative decisions are made collectively. Summers, Gruber, and Vergara explain that, to the extent that corporatist economies make labor supply decisions collectively, the marginal DWCs of labor income taxes are reduced because decision makers internalize at least some of the effect of labor supply on tax revenue.⁵²

B. Cross-Country Findings

In a study of fiscal policy and economic growth in a broad cross section of countries for the period 1970–88, Easterly and Rebelo find that the larger a nation's population and per capita income, and the greater its reliance on income rather than trade taxes, the larger is its government's size, as measured by total government revenue's share of GDP.⁵³ They obtain similar results in a 28-year panel of 118 countries.

Sam Peltzman includes a measure of "modernization" to explain the different sizes of government found in a sample of 42 less developed countries for the period 1960–70.⁵⁴ He suggests that the modernization measure is a good proxy for tax collection costs and finds—holding constant population, a democracy indicator, and a measure of income inequality—a substantial positive correlation between modernization and a variety of measures of the size of government.⁵⁵

Consistent with our model, Summers, Gruber, and Vergara find a strong positive correlation between corporatism and labor income tax revenue in their sample of 17 countries for the period 1980–84; they also find that corporatism is associated with less nonlabor income tax revenue and more total tax revenue. Of course, it may be that both corporatism and heavy labor income taxes indicate only a willingness of citizens to interfere in labor markets or only the political weakness of those harmed by labor market interference. Below we show how to test the hypothesis that government grows in response to greater tax efficiency even when measures of tax efficiency are endogenous.

⁵¹ Lawrence H. Summers, Jonathan Gruber, & Rodrigo Vergara, Taxation and the Structure of Labor Markets: The Case of Corporatism, 108 Q. J. Econ. 385 (1993); and Mancur Olson, *The Rise and the Decline of Nations* (1982).

⁵² Summers, Gruber, & Vergara, *supra* note 51, at 385. Mancur Olson, An Appreciation of the Tests and Criticisms, 9 Scandinavian Pol. Stud. 65 (1986), appropriately qualifies the argument, pointing out that free riding among subcoalitions of a "collective" organization might be just as important as the free riding among organizations.

⁵³ Easterly & Rebelo, *supra* note 9.

⁵⁴ Peltzman, *supra* note 3.

⁵⁵ Among his other regressors, only inequality has much explanatory power, where countries with more equality have bigger governments. See Section IVA for a description of the modernization measure.

The previous studies include proxies for tax efficiency, such as modernization, but these variables might also proxy for income or other factors that have an independent influence on public spending. As a check on our interpretation of the previous results, we propose two measures of the efficiency of the tax system: revenue raised by social security, payroll, and sales taxes, as a ratio to other tax revenue (measure *a*), and the ratio of the “economy-wide” average individual income tax rate to the top statutory individual income tax rate (measure *b*).

The first measure is based on the presumption that social security, payroll, and sales taxes (especially VATs) are the most efficient taxes because they are relatively broad based and often have a flat rate structure. It is a typical public finance result that broad-based and flat (or regressive) taxes are efficient because they do not substantially distort behavior (such as savings behavior) per dollar of revenue raised.⁵⁶ By construction, a country that scores low on our first measure of efficiency raises less revenue from social security, payroll, and sales taxes, relying instead on individual income, wealth, property, corporate income, excise,⁵⁷ import, estate, use, poll, stamp, inflation, and other taxes. The more important among these taxes are the individual income, corporate income, property, excise, import, and inflation taxes. Import taxes are often thought to be inefficient because the same revenue could be raised by taxing domestic and foreign goods of the same type at a single lower rate without distorting the relative consumption of domestic and foreign goods. A similar argument applies to excise taxes on a narrow set of goods because of the substitution away from the taxed goods. Although the occasional use of a capital levy may be quite efficient, a long-term reliance on “capital levies” such as corporate income and property taxes is usually inefficient relative to a consumption or wage tax because the anticipation of capital levies distorts the allocation of economic activity over time.⁵⁸

We use two data sources for measuring general government revenues and

⁵⁶ See Charles L. Ballard, John B. Shoven, & John Whalley, The Total Welfare Cost of the United States Tax System: A General Equilibrium Approach, 38 Nat'l Tax J. 125 (1985); or Charles L. Ballard, John B. Shoven, & John Whalley, General Equilibrium Computations of the Marginal Welfare Costs of Taxes in the United States, 75 Am. Econ. Rev. 128 (1985). “Flat” taxes such as payroll and VATs are often “on top of” more distortionary taxes (such as progressive personal income taxes), so increasing flat tax rates can be highly distortionary. But because of the distinction between shifts of and movements along the $\Delta(T)$ schedule, we use flat tax rates for the computation of our measure *a* regardless of the taxes they are “on top of.” Our measure *a* presumes that the average and marginal DWC of taxes is lower when a greater share of the marginal tax dollar comes from increasing the rate of flat taxation rather than increasing the rate of other taxation.

⁵⁷ Excise taxes might also be included in the “efficient tax” category, although some (for example, Ballard, Shoven, & Whalley, Total Welfare, *supra* note 56) argue that the variability of excise taxes across goods is particularly inefficient.

⁵⁸ See Larry E. Jones, Rodolfo E. Manuelli, & Peter E. Rossi, Optimal Taxation in Models of Endogenous Growth, 101 J. Pol. Econ. 485 (1993); and Kenneth L. Judd, Optimal Taxation: Theory and Evidence (unpublished manuscript, Stanford Univ. 1989), for arguments for the occasional use of capital levies but against their long-term use.

the revenues from particular taxes—the International Monetary Fund’s *Government Finance Statistics* and the Organisation for Economic Co-operation and Development’s *Revenue Statistics* (hereafter *GFS* and OECD, respectively). Both data sets are used in the literature, and it is well known that the *GFS* covers many more countries with poorer data quality (in terms of comparability over time and across countries, and even keypunch errors) and OECD covers fewer countries with good data quality. We form two country cross sections—a 91-country cross section using *GFS* revenue measures and a 24-country cross section using OECD measures. For the *GFS* cross section, our measure a is constructed by summing general government social security, general government payroll, and federal sales taxes⁵⁹ and expressing the sum as a fraction of other general government revenues (including inflation taxes and capital revenue) and averaged over the available years 1973–90. For the OECD cross section, our measure a is the sum of general government Social Security contributions, other payroll taxes, value-added taxes, and sales taxes expressed as a fraction of other tax revenues and averaged over the years 1970–90.⁶⁰

The simple correlation between total tax revenue’s GDP share and measure a is .28 and .34 in the *GFS* and OECD, samples, respectively. This positive correlation is seen for the *GFS* sample in column 1 of our Table 1, where a coefficient of .09 (standard error = .03) is displayed from a regression of total tax revenue’s share on measure a . The second column shows how this correlation can be “explained” by GDP per capita, the fraction elderly, and/or “openness.”⁶¹ Hence, it might be argued that GDP per capita has an independent influence on government size, so that tax efficiency as measured by a does not lead to bigger government. The next columns report measure a results for the OECD sample, where it also appears that much of its correlation is associated with GDP or the fraction elderly (see columns 3 and 4).

Our analysis collapses all of the political details into the influence function F and focuses on deadweight costs and other economic variables. But political institutions may have their own influence on government size, so we add some “political institutions” variables to the regressions. POLITY IV’s Democracy index is one measure of political institutions that is available for

⁵⁹ We do not have data on sales taxes by state and local governments, except from the OECD source, where it is aggregated with federal revenues. We do measure general government taxes on goods and services, although this measure also includes sales taxes, use taxes, and profits of fiscal monopolies. Results using the general government goods and services taxes are very similar to those reported in the text for federal sales taxes. Ballard, Shoven, & Whalley, *Total Welfare*, *supra* note 56, and others argue that state and local sales taxes are quite inefficient because their rates substantially vary across goods and regions.

⁶⁰ For the countries that appear in both samples, the two measures a derived from the two data sources are correlated .98.

⁶¹ Measured as the log of exports plus imports over GDP. This variable is used by Rodrik, *supra* note 26, to explain government spending.

TABLE 1
REGRESSION ESTIMATES OF THE LINKS BETWEEN TAX EFFICIENCY AND THE SIZE OF GOVERNMENT

INDEPENDENT VARIABLES	SPECIFICATION									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Tax efficiency	.09 (.03)	-.01 (.03)	.07 (.04)	-.01 (.03)	.05 (.04)	.55 (.18)	.24 (.12)	.33 (.11)	.26 (.13)	.26 (.14)
Measured as	BMa	BMa	BMa	BMa	BMa	BMb	BMb	BMb	BMb	BMb
Other controls:										
Log(GDP per capita), 1972–89 average		.00 (.01)	.10 (.04)			.01 (.02)				
Fraction elderly		2.01 (.33)		2.54 (.51)		1.27 (.41)	1.74 (.43)	1.86 (.38)	1.75 (.62)	1.72 (.63)
Openness		.07 (.01)			.07 (.03)	.05 (.02)	.05 (.02)	.03 (.02)	.05 (.02)	.04 (.03)
Political institutions					-.02 (.06)	-.04 (.04)		-.08 (.03)		.01 (.01)
Political institutions measured as					Pres	Democ		Pres		Dist
Tax source	<i>GFS</i>	<i>GFS</i>	OECD	OECD	OECD	<i>GFS</i>	OECD	OECD	OECD	OECD
Countries	91	91	24	24	24	55	22	22	20	20
<i>R</i> ²	.08	.61	.33	.60	.28	.72	.73	.80	.65	.66

NOTE.—The dependent variable is total government revenue/GDP (*Government Finance Statistics (GFS)* sample) or total tax revenue/GDP (Organisation for Economic Co-operation and Development (OECD) sample). Ordinary least squares standard errors are displayed in parentheses below coefficient point estimates. Tax revenues and tax revenue ratios are averaged for 1970–90 or 1973–90 in the OECD and *GFS* samples, respectively. Tax efficiency measures are BMa: social security, payroll, and sales taxes, as a ratio to other tax revenue; BMb: the ratio of the “economy-wide” average individual income tax rate to the top statutory individual income tax rate (average of 1974, 1979, 1984, and 1989). For some countries, *GFS* averages exclude years with missing data. The GDP per capita is measured in 1985 dollars from the Penn World Tables (Alan Heston, Robert Summers, & Bettina Aten, Penn World Table, Version 6.1 (Univ. Pennsylvania, Ctr. Int’l Comparisons 2002)). For political institution measures, pres = presidential dummy, democ = 1970–90 average POLITY democracy index (on 0–1 scale), dist = log standardized average district magnitude.

most of our *GFS* sample. Two other measures are, by design, available only for democratic countries, so we use them only in our OECD samples. One is a dummy for countries with a presidential rather than parliamentary democratic political system, which Torsten Persson, Gerard Roland, and Guido Tabellini claim to predict the size of government. Column 5 of our table reports estimates of a government revenue regression including this presidential dummy, and the dummy's coefficient is insignificant, although it should be noted that in an OECD sample like ours, this political institution variable is just a dummy for the United States and Switzerland.⁶² We therefore borrow another democratic institutions variable from the recent study by Gian-Maria Milesi-Ferretti, Massimo Rostagno, and Roberto Perotti,⁶³ which is a continuous measure of the proportionality of electoral systems—their “log of standardized average district magnitude”—which they claim to predict the size of government. Two of our 22 OECD countries are missing from the Milesi-Ferretti study.

A personal income tax, holding constant the amount of revenue it raises, is generally more efficient when it is “flatter”—has fewer deductions and a single marginal tax rate.⁶⁴ One measure of the flatness of a country's personal income tax is the ratio of its “economy-wide” average individual income tax rate to the top statutory individual income tax rate, where the economy-wide average rate is the ratio of personal income tax revenue to GDP. This measure would be one with a truly flat tax—one with no deductions (or cheating) and a single tax rate. Our measure b ⁶⁵ would be low with the kinds of taxes Robert Hall and Alvin Rabushka contrast with a flat tax, because the various deductions and exemptions would reduce revenue and the marginal tax rates would be high.

Before we consider the correlation between measure b and the size of government, consider each of the components of our measure. If we regress the top rate⁶⁶ on the average rate in our OECD cross section of countries, we find a coefficient of .32 with standard error .38, so we have some confidence that the coefficient is less than 1 and that countries obtain more

⁶² Furthermore, the Swiss observation drives the result shown in the table, and there is doubt as to whether Switzerland should be coded 0 or 1, as noted by Torsten Persson, Gerard Roland, & Guido Tabellini, *Comparative Politics and Public Finance*, 108 *J. Pol. Econ.* 1151 (2000).

⁶³ Gian Maria Milesi-Ferretti, Massimo Rostagno, & Roberto Perotti, *Electoral Systems and Public Spending*, 117 *Q. J. Econ.* 609 (2002).

⁶⁴ See Hall & Rabushka, *supra* note 3, for one persuasive statement of this point.

⁶⁵ Measure b for each country is the ratio of its time-averaged income tax rate to its time-averaged top rate.

⁶⁶ The top rate is taken from James D. Gwartney, Robert A. Lawson, & Walter E. Block, *Economic Freedom of the World* (1996), for the years 1974, 1979, 1984, and 1989 and then averaged for each country.

income tax revenue without proportionally higher top marginal tax rates.⁶⁷ If we regress non-income-tax revenue on the income tax's top rate and its average rate (namely, the ratio of income tax revenue to GDP), the coefficient point estimates are positive and negative, respectively. This is consistent with our hypothesis that inefficient income taxes are associated with more taxation by other means and higher top rates.

Column 6 of Table 1 shows the estimates of a regression of total tax revenue on measure b , log GDP per capita, the fraction elderly, openness, and the democracy index using the *GFS* sample.⁶⁸ Unlike our measure a , measure b is a good predictor of total tax revenue even when these other variables are held constant. The democracy index is not informative within the OECD, so the next column examines the relation between measure b and total revenue in the OECD sample without the democracy index; coefficient estimates are similar.

The presidential dummy helps predict government revenue, as shown in column 8, although we remind the reader how in our sample the presidential dummy is also a Swiss or United States dummy. The final two columns of the table reproduce columns 7 and 8 except that they use the standardized district magnitude measure. Comparing columns 7 and 9, we see that dropping the two countries without log of standardized average district magnitude does not affect the results. The final column regresses tax revenue on our measure b , the fraction elderly, openness, and log of standardized average district magnitude. Our estimated coefficients on measure b and fraction elderly are statistically significant, while the estimated coefficients on openness and political institutions are not. Perhaps this suggests that tax efficiency can help explain why some governments tax more than others, but we cannot claim much from Table 1 because there is the question of reverse causality (see below) and the fact that income tax revenue over GDP is used to construct both our dependent variable and our measure b .⁶⁹

Our theory distinguishes between the amount of DWC for a given government size and the equilibrium DWC. Both our measures a and b are

⁶⁷ We might expect a variety of political and economic forces aside from DWCs to prevent marginal tax rates from exceeding 100 percent, and in principle this "ceiling" on tax rates would mean that at some point the income tax would have to flatten as income taxation increased. However, the 100 percent ceiling does not seem binding in our data, because 87 percent (Sweden 1979) is the maximum top statutory rate among the 88 OECD country-years we sample, although our calculation does not consider how the personal income tax may be combined with other tax and expenditure programs to produce rates closer to 100 percent.

⁶⁸ Results for measure a do not change when the sample is reduced from 91 to 55 (36 of the 91 countries are missing the top statutory rate data).

⁶⁹ We point out that (total tax revenue/top income tax rate) does not predict total tax revenue conditional on openness and population age, so maybe the use of income tax revenue in our construction of measure b does not drive the results shown in the table. We have also used defense spending/GDP as an instrument for our measure b (this specification is not reported in the table), but it is weakly correlated with measure b , and the effect of doing so is to increase both measure b 's coefficient point estimate and standard error.

designed to capture mainly the former. Robert Inman and Michael Fitt's U.S. time-series study of government spending also points out that DWCs should be measured in this way.⁷⁰ Our measure *a* of tax efficiency is particularly in the spirit of their tax-cost variable, which for each year is a weighted average of the shares of revenue from customs, excise, and income taxes, where the weights reflect the different DWCs of those kinds of taxes. They interact their tax-cost variable with political variables and find those variables to explain some of the government spending trends and fluctuations—with higher tax costs associated with less spending.

C. *Reverse Causation*

Our model of political competition suggests that efficiency and the size of government are correlated because governments grow larger when taxes are more efficient. An alternative view is that more efficient tax systems are adopted in countries with larger governments.⁷¹ There are a couple of ways this alternative view might be modeled. One has a social planner trading off tax efficiency with some cost of the efficient tax system (the cost might be "fairness" or administrative overhead costs). Since the efficiency gain of moving from an inefficient tax system to an efficient tax system is greater when there is more revenue to be raised, the planner may respond to an exogenous increase in spending by taxing more efficiently. Perhaps the constitutional economics approach could be used to build a second model. Namely, the type of tax system (chosen during the authoring or amending of the constitution) and the size of government for a given tax system (chosen after the constitution is in place) are determined by the relative political power of the Taxpayers and Beneficiaries in each stage. An exogenous increase in the political power of Beneficiaries in both stages will increase the efficiency of taxes permitted by the constitution and increase the size of government realized under a given constitution. Both of these models imply that government does indeed grow in response to an exogenous increase in tax efficiency, but also that the observed correlation between tax efficiency and government size overstates this response.⁷²

James Kau and Paul Rubin's instrumental variables technique is one method of sorting out causation.⁷³ We also examine (1) the effects of a

⁷⁰ Robert P. Inman & Michael A. Fitts, *Political Institutions and Fiscal Policy: Evidence from the U.S. Historical Record*, 6 *J. L. Econ. & Org.* 79 (1990).

⁷¹ See Libor Dusek, *Do Governments Grow When They Become More Efficient? Evidence from Tax Withholding* (unpublished Ph.D. dissertation, Univ. Chicago 2003), for an application of the alternative view to the adoption of income tax withholding by U.S. states.

⁷² Our Section III offers another approach in which taxes become less efficient, at least according to the tax efficiency measures used in the literature, in response to an exogenous spending increase. In other words, the observed correlation between tax efficiency and government size may understate the response of spending to an exogenous increase in tax efficiency.

⁷³ Kau & Rubin, *supra* note 45.

wartime “budget shock” on the composition of spending, (2) changes in spending by “oil governments” during the 1970s, and (3) government responses to grants and aid. Each is a test of the hypothesis that government grows in response to more “easily available” revenue and has the advantage that the source of variation for the availability of tax revenue is exogenous to the determinants of spending.

Tests 1–3 derive from proposition 4 in Section II, which states that tax efficiency and government “budget shocks” have similar effects on the endogenous component of spending. According to our model, an exogenous increase (decrease) in spending—such as the 1940s military expenditures in the United States—should decrease (increase) endogenous spending (non-defense spending in the WWII example). An increase in exogenous government revenue—such as the extraordinary revenue enjoyed by the governments of oil countries after 1973—should increase government spending and decrease other revenues.

D. Budget Shocks and the Composition of Spending: Wartime

Government spending on the military increased sharply during WWII. In real terms,⁷⁴ government expenditure grew 352 percent from 1940 to 1944, while government receipts grew 131 percent. Even as a percentage of GDP, government expenditure grew 165 percent, while government receipts grew 37 percent.⁷⁵ The heightened level of government spending lasted more than 4 years. Government debt was 40 percent of GDP before the war and rose to more than 100 percent of GDP after the war, so wartime taxation lasted much longer than the 4–5 years of wartime spending.⁷⁶

Figures 2 and 3 display the composition of general government spending from 1934 to 1950 at 2-year intervals. General government spending is divided into three categories: defense, nondefense federal (excluding grants to state and local governments), and state and local. Defense spending is particularly large in 1942, 1944, and 1946. As a fraction of actual GDP, both nondefense federal and state and local spending are unusually small during the years 1942–46. Since GDP increased dramatically during the war years, it is not clear how government spending should be adjusted to obtain an appropriate test of the model. One attempt is displayed in Figure 3, which

⁷⁴ Wartime price controls in the United States clearly bias official inflation statistics (see Hugh Rockoff, *Indirect Price Increases and Real Wages during World War II*, 15 *Explorations Econ. Hist.* 407 (1978), for some convincing evidence). Our analysis assumes that inflation was uniform during the years 1941–46 rather than concentrated in 1946—the year when price controls were removed—as reported in the official statistics. See Casey B. Mulligan, *Pecuniary Incentives to Work in the United States during World War II* (Working Paper No. 6326, Nat’l Bur. Econ. Res. 1997), for further discussion.

⁷⁵ United States Council of Economic Advisers, *Economic Report of the President* (various issues).

⁷⁶ Robert J. Barro, *Macroeconomics* (1987).

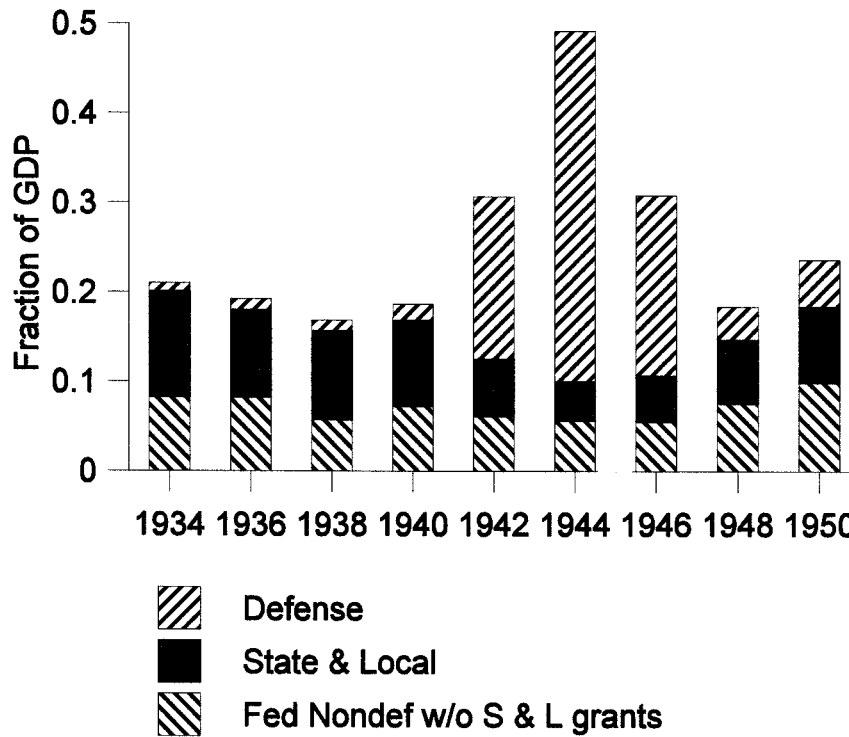


FIGURE 2.—Composition of government spending, 1934–50 (fraction of actual GDP)

measures government spending as a fraction of “trend GDP,” computed by linearly interpolating log real GDP using 1940 and 1948 as base years. With the adjustments, state and local spending is still abnormally small during 1942–46, although it is less clear for federal nondefense spending.⁷⁷

E. Budget Shocks and the Size of Government: Oil Shocks

The sharp increase in oil prices during the 1970s provided governments of oil-producing countries with extraordinary revenues.⁷⁸ Our analysis predicts that government spending would grow in these countries, although by

⁷⁷ Because of a lack of data, state and local government spending were estimated by different methods in the 1930s than in the 1940s (John Wallis, personal communications, August 1999, February 2000). However, we see no reason why state and local spending would be substantially overestimated in the 1930s relative to the 1940s.

⁷⁸ Alan H. Gelb, *Oil Windfalls: Blessing or Curse?* (1988).

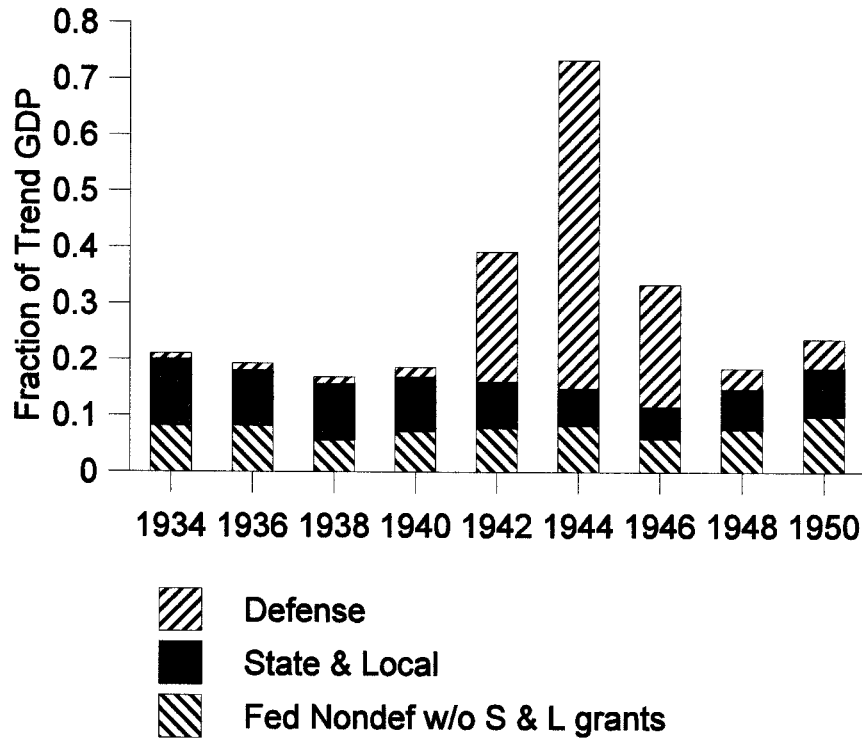


FIGURE 3.—Composition of government spending, 1934–50 (fraction of trend GDP)

less than the increases in revenue,⁷⁹ and that this growth in spending is analytically similar to the spending growth in response to a tax reform.

Luis Videgaray confirms this prediction in a sample of 13 net-oil-exporting countries (Canada, Columbia, Ecuador, Egypt, Indonesia, Malaysia, Mexico, Norway, Oman, Trinidad, Tunisia, the United Kingdom, and Venezuela) for the period 1970–95.⁸⁰ Videgaray finds that not all of the additional revenue is used to increase government spending, since some of it is used to cut taxes.

Our Figure 4 displays 1972–80 government spending/trend GDP for four Organization of Petroleum Exporting Countries (OPEC) and three non-OPEC

⁷⁹ For another model of this effect, see Philip R. Lane & Aaron Tornell, Power, Growth, and the Voracity Effect, 1 J. Econ. Growth 213 (1996), which argues that government spending should increase by more than the shock to government revenue.

⁸⁰ Luis Videgaray, The Fiscal Response to Oil Shocks (unpublished manuscript, Massachusetts Inst. Tech. 1997).

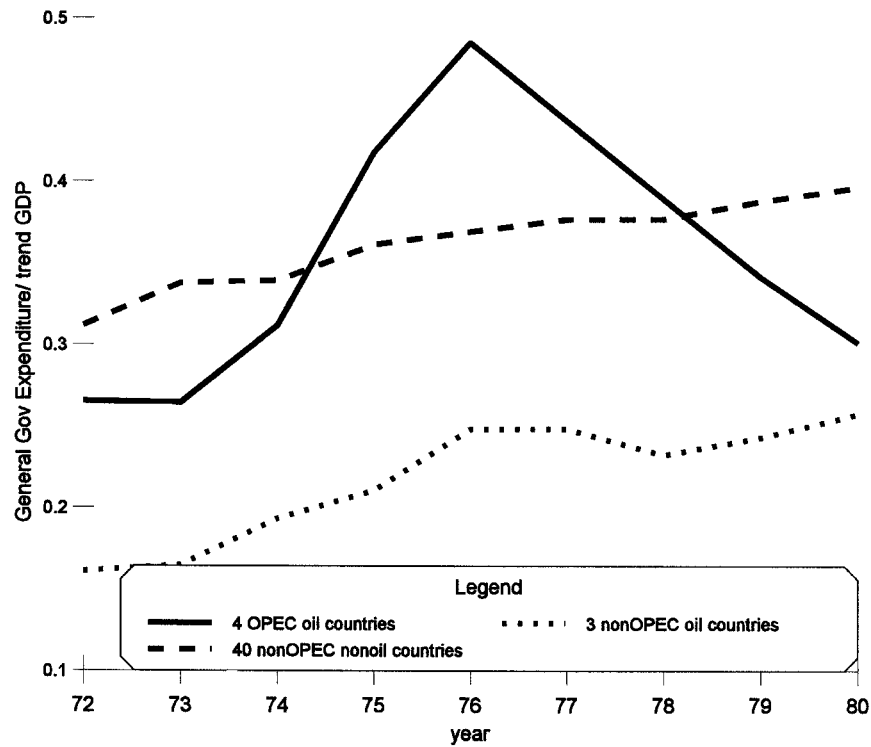


FIGURE 4.—The 1970s government spending in oil and nonoil countries (fractions of trend GDP).

oil countries.⁸¹ The figures also display as a benchmark the average size of government in 40 nonoil countries.⁸² We see significant increases—between 5 and 20 percent of trend GDP—in government spending for most of the oil countries during the 1970s.

⁸¹ Since GDP is also affected by the oil shocks, government spending is displayed as a ratio to trend GDP, which is computed by linearly interpolating log real GDP using 1970–71 and 1980–83 as base years. Unlike Videgaray, we do not exclude social security expenditures. The seven oil countries for which we found government spending data in International Monetary Fund, Government Finance Statistics Yearbook (various issues), are Gabon, Guatemala, Indonesia, Iran, Mexico, Morocco, and Venezuela. We linearly interpolated missing OPEC country data for 1978 and 1979 and corrected the 1972 OPEC average because Gabon data were missing.

⁸² The 40 “nonoil” countries with available data for the years 1972–80 are Australia, Austria, Barbados, Belgium, Chile, Colombia, Costa Rica, Cyprus, Denmark, Dominican Republic, Ethiopia, Finland, France, Germany, West, Greece, Guyana, Iceland, Ireland, Israel, South Korea, Luxembourg, Malaysia, Nepal, Nicaragua, Norway, Paraguay, Singapore, South Africa, Spain, Sweden, Switzerland, Tanzania, Thailand, Tunisia, Turkey, United Kingdom, United States, Yugoslavia, Zaire, and Zambia.

*F. Budget Shocks and the Composition of Spending:
Grants to Government*

Hines and Thaler suggest that federal grants to state and local government can be used to estimate what they call the flypaper effect, which is dT/dE in our notation.⁸³ Their table 1 surveys 10 studies with estimates of dT/dE that average .64 and range from .25 to 1.06. They also mention a few other cases of shocks to federal grants and claim that the receiving government's spending appears to increase nearly dollar for dollar.

Hines and Thaler suggest that dT/dE being so much larger than zero is surprising and inconsistent with a rational agent model of public decisions. Our Appendix A derives an expression for dT/dE , as predicted by our model, in terms of the derivatives of the influence and DWC functions. A particularly important determinant of the magnitude of the flypaper effect is the relative convexity of tax and spending DWCs Δ''/Γ'' . With more convexity on the tax side, nontax revenue can lead to nearly dollar-for-dollar spending growth. If it did not, then tax revenue would fall dramatically and so would marginal DWCs of taxation. But with low marginal DWCs, there would be very little reason for Taxpayers to resist spending growth. At the same time, the marginal DWCs of spending are relatively unchanged, so those subsidized continue to fight as hard as ever. Hence, Nash equilibrium requires a sizeable expansion in spending so that the reduced incentive to those taxed to fight balances the reduced incentive of those subsidized.

Since the three budget shock tests suggest that government spending does respond to the availability of government revenue, it is likely that some of the cross-country correlation between tax efficiency and the size of government indicates a response of government spending to tax efficiency. Appendix C derives quantitative implications of these spending responses to budget shocks for the effect of tax reform on spending.

V. ARE TAXES TOO EFFICIENT?

Our theoretical analysis shows that reducing the DWC of taxes or spending may, but need not, reduce total DWCs. The magnitude of the observed cross-country relationship between tax efficiency and the size of government can help resolve this ambiguity.

Most evidence suggests that few monetary resources are spent on political pressure, consistent with our model of free riding with multiple taxed and subsidized groups, although this evidence neglects time and other nonmo-

⁸³ Hines & Thaler, *supra* note 32.

TABLE 2
ARE TAXES TOO EFFICIENT? SOME CALCULATIONS

ASSUMPTIONS		$d(\text{Total DWC})$			
$(\Delta' + \Gamma')$	$d\delta/(\Delta' + \Gamma')$	$dT = 0$	$dT = .05$	$dT = .10$	$dT = .15$
.5	-.1	-.02	.00	.03	.05
1	-.1	-.05	.00 ^a	.06 ^a	.11
1.5	-.1	-.07	.01 ^a	.08 ^a	.16
2	-.1	-.09	.01	.11	.21
.5	-.3	-.07	-.04	-.02	.01
1	-.3	-.14	-.09 ^a	-.03 ^a	.01
1.5	-.3	-.20	-.13 ^a	-.05 ^a	.02
2	-.3	-.27	-.17	-.07	.03
.5	-.5	-.11	-.09	-.06	-.04
1	-.5	-.23	-.18	-.13	-.08
1.5	-.5	-.34	-.26	-.19	-.11
2	-.5	-.45	-.35	-.25	-.15

NOTE.— T and “total DWC” are measured as fractions of GDP. It is assumed that $T = .45$.

^a Entries are consistent with the calibration exercise reported in Appendix C.

netary inputs.⁸⁴ If the changes in pressure resources can be ignored to a first approximation,⁸⁵ then the change in total DWC from a change in the DWC of taxes is

$$d(\text{total DWC}) = (\Delta' + \Gamma')dT + Td\delta. \quad (3)$$

Equation (3) can help determine the effect on the size of government of changing the U.S. tax system. Table 2 displays some assumptions about DWCs of spending and taxes per dollar of revenue and their implications for total DWC. The first two columns of the table display four values for $(\Delta' + \Gamma')$, ranging from \$.50 per dollar of revenue to \$2 per dollar of revenue, and three values for the reduction in the DWC of taxes as a fraction of the marginal DWC term $(\Delta' + \Gamma')$. The last four columns show the effects on total DWC with various assumptions about changes in the size of government. The first of those four columns is the standard analysis, with no change in the size of government ($dT = 0$).

Consider a reform that renders the U.S. tax system as efficient as those

⁸⁴ Gordon Tullock, *The Economics of Special Privilege and Rent Seeking* (1989), has a more extensive discussion of this point. More recently, in *Interest Groups Pay out \$1 Billion to Lobby Congress*, Wash. Times, July 8, 1998, interest groups were reported to have spent about \$1 billion during 1997 to lobby Congress, the White House, and federal bureaucrats, which seems small when compared with the amount the federal government spent in that year (\$1.6 trillion; United States Council of Economic Advisers, *supra* note 75, table B-78) or with effects of federal regulation. See also Stephen Ansolabehere, John M. de Figueiredo, & James M. Snyder, Jr., *Why Is There So Little Money in U.S. Politics?* 17 *J. Econ. Persp.* 105 (2003).

⁸⁵ Ignoring political resources is appropriate in the planner model because, by definition, there are none.

in Western Europe. In order to find the table entry that best approximates a move from the U.S. system to a Western European system representative in terms of its size and tax efficiency, we need estimates of Δ' , Γ' , $d\delta$, and dT . Our Appendix C suggests how marginal excess burdens might be calibrated from the public finance literature and dT from cross-country correlation of government size and tax efficiency or from the budget shocks analyzed above. The various methods give similar estimates of dT , which range from .03 to .12. Therefore, our preferred table entries are the middle two columns, which assume that U.S. tax collections would increase by 5 or 10 GDP percentage points in response to a Western European tax system. On the basis of studies measuring excess burden, our preferred rows are the middle two of the top and middle of Table 2. The eight corresponding entries for $d(\text{total DWC})$ range from -13 percent to 8 percent of GDP (indicated by superscripts in Table 2), which indicates that tax reform does not substantially reduce DWCs and may even increase costs! Notice that for our preferred rows in the table, the computation of the gains according to the standard analysis ($dT = 0$) are similar to those computed by Hall and Rabushka and others for related tax reforms—between 5 and 20 percent of GDP.

A careful computation of the marginal excess burdens of various American and European taxes is beyond the scope of our paper, so our Table 2 offers some sensitivity analysis. In all of the rows, the growth of government means that reducing the DWC of taxes has a much more modest effect on total DWC or even increases total DWCs.

Several studies in the public finance literature are concerned with estimating the total and marginal DWC of taxes,⁸⁶ which often implies that greater DWC increases the case for “tax reform” by reducing total and marginal DWCs. This is also true in our analysis if average DWCs are reduced without changing marginal DWCs. But larger estimates of Δ' may indicate large efficiency losses of tax reform when $dT > 0$ because a growing government has a bigger impact on DWCs when marginal DWCs are large. To see this, factor equation (3):

$$d(\text{total DWC}) = (\Delta' + \Gamma')[dT + Td\delta/(\Delta' + \Gamma')].$$

Holding fixed a tax reform’s percentage change in the marginal DWCs of taxes and spending (that is, holding fixed $d\delta/(\Delta' + \Gamma') < 0$), a larger Δ' increases the magnitude of the change in total DWCs—making it more negative if $d(\text{total DWC}) < 0$ and more positive if $d(\text{total DWC}) > 0$. The former case includes the usual analysis, since $dT = 0$ is sufficient to guarantee $d(\text{total DWC}) < 0$. But the efficiency losses of tax reform are also aggravated by a larger Δ' in the latter case.

⁸⁶ Ballard, Shoven, & Whalley, Total Welfare, *supra* note 56; Ballard, Shoven, & Whalley, General Equilibrium, *supra* note 56; and Feldstein, *supra* note 43.

Because these calculations ignore expenditure on political pressure and planner models have no political pressure, the calculations are fully applicable to planner models. It may seem surprising that a planner may create more total DWCs in response to a more efficient tax system, but remember that the planner's objective is to maximize "social welfare," which typically is different than total DWCs.

VI. CONCLUSIONS AND EXTENSIONS

We use a model of political competition among interest groups to show that more efficient tax and spending policies generally promote the growth of government. We also derive several other implications of the basic analysis, including the effects of spending efficiency and spending shocks on the size of government, the equivalence between budget shocks and increases in tax efficiency, and conditions when greater tax efficiency would actually increase aggregate DWCs.

Although we characterize political competition as a conflict over government budgets, the same analysis applies to regulatory activities that are not part of government budgets. If T denotes an index of regulation harming Taxpayers and favoring Beneficiaries, Taxpayers expend resources A' to reduce T , while Beneficiaries expend resources B' to increase T ; both A' and B' determine the amount of regulation according to the influence function F' . Deadweight cost functions would allow for the possibility that regulations do not harm Taxpayers by the same amount that they help Beneficiaries and that the difference between Beneficiaries' gain and Taxpayers' loss depends on the amount of regulation.

Since T measures the quantity of government regulation, propositions 1 and 2 can be adjusted to imply that higher regulatory deadweight costs (that is, a greater gap between what the Beneficiaries gain and Taxpayers lose) decrease the amount of regulatory activity. Higher deadweight costs of regulation might arise, for example, from technological changes that render government regulations obsolete or from increased market participation of agents, such as foreigners or small business firms, who are more difficult to regulate. Indeed, Peltzman argues that growing inefficiencies of airline, trucking, and other regulations produced the wave of U.S. federal deregulation in the late 1970s and early 1980s.⁸⁷

Among the several important differences between the "utilitarian" or social planner approach and our approach to taxes and government spending is that the social planner approach cannot explain why tax and spending programs are often less efficient than is technologically feasible. But we show that the two approaches have similar implications for the relation between deadweight

⁸⁷ Sam Peltzman, Michael E. Levine, & Roger G. Noll, *The Economic Theory of Regulation after a Decade of Deregulation*, Brookings Papers & Econ. Activity: Microecon. 1 (1989).

costs and the quantity of redistribution when marginal government activities are redistributive. However, more research is required to identify those public behaviors that differ in interest group, planner, median voter, and other approaches to modeling the public sector. Still, it is noteworthy how many implications come out of our simple analysis of interest group competition.

APPENDIX A

COMPARATIVE STATICS OF THE BASIC MODEL

The two first-order conditions (one for each group) are

$$-F_a(A, B)[1 + \tilde{\Delta}''(F(A, B) - E) + \delta] = 1$$

and

$$F_b(A, B)[1 - \tilde{\Gamma}''(F(A, B) - D) - \gamma] = 1,$$

where the DWC functions are $\Delta(T; \delta, \alpha) = \tilde{\Delta}(T) + \delta T + \alpha$ and $\Gamma(G; \gamma, \beta) = \tilde{\Gamma}(G) + \gamma G + \beta$. The comparative statics of the model can be derived by totally differentiating the first-order conditions:

$$dF = \frac{J_a(F_a^2 F_b)(\Delta'' dE - d\delta) + J_b(-F_a F_b^2)(\Gamma'' dD - d\gamma)}{\Lambda},$$

$$\Lambda = J_a(F_a^2 F_b)\Delta'' + (F_{ab}^2 - F_{aa}F_{bb}) + J_b(-F_a F_b^2)\Gamma'',$$

$$J_a = \frac{F_a F_{bb}}{F_b} - F_{ab} > 0, \quad J_b = \frac{F_{aa} F_b}{-F_a} + F_{ab} > 0.$$

The expression for dF illustrates the determinants of public spending as we describe them in the propositions. The reader may also notice that total spending $F = G + D$ increases with exogenous government revenue E and with exogenous government spending D , but the sum of the two effects is less than 1. This means, for example, that exogenous government spending that occurred coincidentally with a revenue windfall in exactly the amount needed to finance that spending would nevertheless decrease endogenous government spending G . This derives from our specification of the influence function, and its concavity, and therefore would not occur in the planner model (see below). However, this result is not intrinsic to interest group models, because alternative formulations would retain the qualitative results shown in the text but imply that $d(G + D)/dD + d(G + D)/dE \geq 1$. For example, instead of assuming that, holding constant political pressures A and B , D reduces G and E reduces T one-for-one (remember that the budget equation is $G + D = F(A, B) = T + E$), we could have assumed that D increases T and E increases G ($G - E = F(A, B) = T - D$), in which case the effect of simultaneous and equivalent increases in D and E is to increase endogenous government spending G . Three other specifications— $G + D - E = F(A, B) = T$, $G = F(A, B) = T + E - D$, and $G + (D - E)/2 = F(A, B) = T + (E - D)/2$ —imply that simultaneous and equivalent increases in D and E have no effect on endogenous government spending G —exactly as in the planner model.

APPENDIX B

“SOCIALLY OPTIMAL” SPENDING AS A LIMITING CASE OF
INTEREST GROUP COMPETITION

Consider the spending, taxes, and lobbying that would be optimal from a social point of view, where we allow “social welfare” to put (perhaps) different weights on the surplus of Taxpayers ($-C_A$) and Beneficiaries (S_B) and take the DWC schedules as given

$$\max_{G,A,B} \theta S_B - C_A$$

$$\text{subject to } A, B \geq 0, S_B = G - \Gamma(G) - B,$$

$$C_A = [G + D - E + \Delta(G + D - E) + A],$$

where the relative social value $\theta \geq 1$ is, for simplicity, a constant. Notice how this planner is benevolent but not all-powerful, because he still faces the DWCs of redistribution embodied in the functions Δ and Γ .

Obviously, the planner sets $A = B = 0$ because lobbying is socially wasteful, and this is a departure from our interest group approach. But the more interesting question is whether and how the planner might choose taxes and spending differently than the taxes and spending that equilibrate the political competition and how the planner’s choices might react differently to D , E , $\Delta(\cdot)$, and $\Gamma(\cdot)$. The comparative statics for socially optimal government spending ($G + D$) are calculated by totally differentiating the planner’s first-order condition

$$d(G + D) = \frac{-(d\delta + \theta d\gamma) + \Delta'' dE + \theta \Gamma'' dD}{\Delta'' + \theta \Gamma''}.$$

Notice the similarity between these comparative statics and those reported in Appendix A. In particular, both cases have the slope and convexity of the DWC schedules as important factors.⁸⁸ The similarity is more striking when we limit our attention to a family of influence functions parameterized by the positive constant ϕ and the same constant θ from the planner model:

$$F(A, B) = \lambda(1 + \phi)[(\theta B)^{-1/(1+\phi)} - A^{-1/(1+\phi)}],$$

where $\lambda \in (1/\theta, 1)$ is a parameter dictating the size of potential effect of political pressure of either group.⁸⁹ The inequality $\theta > 1$ has very much the same interpretation it does in the planner model: it determines the relative influence of Beneficiaries and Taxpayers.

This influence function satisfies the assumed properties $F_a < 0$, $F_b > 0$, $F_{bb} < 0$, $F_{aa} < 0$, and, since this function is additively separable, the “strategic separability” condition. With strictly convex DWCs, the Nash equilibrium conditions imply, among other things,

$$\frac{1}{\theta} \left(\frac{\theta B}{A} \right)^{\phi(1+\phi)} = \frac{1 - \Gamma'(G)}{1 + \Delta'(G + D - E)}.$$

With the exception of the term $(\theta B/A)$, this is exactly the planner’s first-order con-

⁸⁸ Remember that $F_a = -1/(1 + \Delta')$ and $F_b = 1/(1 - \Gamma')$.

⁸⁹ We limit the size of λ so that equilibrium solutions are interior for both interest groups.

dition. The $(\theta B/A)$ term disappears as $\phi \rightarrow 0$, so the equilibrium level of government spending $G + D$ approaches the level that would have been chosen by a social planner.

APPENDIX C

CALIBRATION OF THE MODEL FROM THE PUBLIC FINANCE LITERATURE

We assume that Γ' (the marginal excess burden of spending) is of similar magnitude as Δ' (the marginal excess burden of taxes) and that the European $(\Delta' + \Gamma')$ is at least as large as the American $(\Delta' + \Gamma')$. Charles Ballard, John Shoven, and John Whalley estimate the “marginal excess burden” of the U.S. tax system to be between .17 and .56, and they find the marginal excess burden of the U.S. individual income tax (IIT) to be fairly representative of all U.S. taxes.⁹⁰ Martin Feldstein shows that these calculations and others in the literature ignore important forms of tax avoidance. He reestimates a marginal excess burden near unity for the IIT.⁹¹ Therefore, a somewhat conservative estimate of $(\Delta' + \Gamma')$ is between 1 and 1.5.

Ballard and his colleagues also report estimates of the marginal excess burden separately for capital, payroll, sales, excise, personal income, and output taxes.⁹² We estimate $d\delta/(\Delta' + \Gamma')$ by computing a weighted average of these marginal excess burdens (as a fraction of a Ballard-based estimate of $\Delta' + \Gamma'$) using two sets of weights: U.S. and European shares of these taxes in total revenue. We use the shares .20, .25, .11, .06, .24, and 0 for the United States and .12, .57, 0, .06, .25, and 0 for Europe⁹³ and find that $d\delta/(\Delta' + \Gamma') = -.1$.

The variable dT can be calibrated in three ways. First, we can assume that all of the difference in government revenue’s share of GDP between the United States and Europe is due to different tax efficiency and read a difference of $dT = .12$ in the government budgets of those countries, such as those reported by the International Monetary Fund.⁹⁴ Second, the finding of Summers and his colleagues that the majority of the differences in government size among their sample of 17 developed countries can be explained from differences in tax efficiency implies $dT = .10$.⁹⁵

Third, budget shocks can be used to estimate $dT/d\delta$. Proposition 4 implies

$$-\frac{dT}{d\delta}\Delta'' = \frac{dT}{dE}, \quad -\frac{dT}{d\gamma}\Gamma'' = \frac{dT}{dD}.$$

Recall that, given estimates of dT/dE and dT/dD from wartime, oil shocks, and other budget shocks, we need to estimate of Δ'' and Γ'' in order to compute the derivatives, $dT/d\delta$ and $dT/d\gamma$. We are unaware of direct estimates of Δ'' and Γ'' from the public finance literature but, assuming DWCs are approximately quadratic, $\Delta'(0) = 0$, Δ'' can be inferred from estimates of Δ' : $\Delta'' = \Delta'/T$. Using this relation, the percentage change in T from either a tax reform of magnitude $d\delta$ or a spending reform of magnitude $d\gamma$ is

$$\text{tax reform} \quad dT = T(d\delta/\Delta')(dT/dE),$$

⁹⁰ Ballard, Shoven, & Whalley, General Equilibrium, *supra* note 56.

⁹¹ Feldstein, *supra* note 43.

⁹² Ballard, Shoven, & Whalley, General Equilibrium, *supra* note 56.

⁹³ We assume that changing from American sales taxes to a VAT or a flat personal income tax is, in terms of efficiency, similar to changing from American sales to payroll taxes and thus assume a zero sales tax share for our example of tax reform.

⁹⁴ International Monetary Fund, Government Finance Statistics Yearbook (various issues).

⁹⁵ Summers, Gruber, & Vergara, *supra* note 51.

spending reform $dT = T(d\gamma/\Gamma')(dT/dD)$.

The formula $dT = T(d\delta/\Delta')(dT/dE)$ takes as inputs T , $(d\delta/\Delta')$, and (dT/dE) . The European-American average of government revenue/GDP is $T = .45$. Above we have calibrated values for $(d\delta/\Delta')$ of between $-.1$ and $-.3$. With $dT/dE = .64$,⁹⁶ the predicted changes in government/GDP ratios from the tax reform range from $dT = .03$ ($d\delta/\Delta' = -.1$) to $dT = .09$ ($d\delta/\Delta' = -.3$).

APPENDIX D

SUMMARY STATISTICS FOR THE CROSS-COUNTRY SAMPLES

The 91 countries in the *GFS* sample are Argentina, Australia, Austria, Bahamas,* Bahrain,* Barbados,* Belgium, Benin,* Bhutan,* Bolivia, Brazil, Burkina Faso,* Burundi,* Cameroon, Canada, Chile, Colombia, Congo,* Costa Rica, Cyprus, Denmark, Dominica,* Dominican Republic, Egypt, Ethiopia,* Finland, France, Gabon,* Gambia,* Germany, Greece, Guatemala, Guyana,* Haiti,* Hungary,* Iceland,* India, Indonesia, Iran, Ireland, Israel, Italy, Jamaica, Korea, Lesotho,* Liberia,* Luxembourg,* Malaysia, Malta,* Mauritius, Mexico, Morocco, Myanmar,* Nepal,* Netherlands, Nicaragua, Niger,* Norway, Pakistan, Panama, Paraguay, Poland,* Portugal, Romania,* Rwanda,* Senegal, Seychelles,* Singapore,* South Africa, Spain, Sri Lanka, St. Kitts&Nevis,* St. Lucia,* Suriname,* Sweden, Switzerland, Syria,* Tanzania, Thailand, Togo,* Tunisia, Turkey, U.K., United States, Uruguay,* Vanuatu,* Venezuela, Yugoslavia,* Zaire, Zambia, and Zimbabwe, where the asterisks indicate those excluded from the 55-country sample. Our 24-country OECD sample is all countries who were members since 1973. The 22-country OECD sample drops Iceland and Luxembourg (missing measure *b*), and the 20-country sample further drops New Zealand and Turkey (missing log standardized district magnitude). Sample characteristics are shown in Table D1.

⁹⁶ The value .64 is an average across the 10 studies surveyed in Hines & Thaler, *supra* note 32, at table 1.

TABLE D1
SAMPLE CHARACTERISTICS

	91-COUNTRY <i>GFS</i> SAMPLE			
	Mean	SD	Min	Max
Total government revenue/GDP, 1973–90 average	.30	.12	.10	.61
Measure <i>a</i> : revenue raised from social security, payroll, and sales taxes as a ratio to other revenue, 1973–90 average	.35	.37	.01	2.06
Log GDP per capita, 1985 \$, 1972–89 average	7.97	1.02	5.70	9.64
Fraction elderly	.07	.04	.02	.16
Openness = $\log((\text{exp} + \text{imp})/\text{GDP})$	-.52	.61	-1.97	1.19
	55-COUNTRY <i>GFS</i> SAMPLE			
	Mean	SD	Min	Max
Total government revenue/GDP, 1973–90 average	.30	.12	.10	.59
Measure <i>a</i>	.38	.20	.01	1.38
Measure <i>b</i>	.09	.09	.00	.36
Log GDP per capita	8.24	.93	6.18	9.64
Fraction elderly	.07	.04	.02	.16
Openness = $\log((\text{exp} + \text{imp})/\text{GDP})$	-.68	.50	-1.97	.24
Democracy index	.56	.40	0	1
	20-COUNTRY OECD SAMPLE			
	Mean	SD	Min	Max
Total tax revenue/GDP, 1970–90 average	.35	.07	.25	.48
Measure <i>a</i>	.76	.41	.14	1.85
Measure <i>b</i>	.18	.08	.05	.35
Log GDP per capita	9.25	.30	8.51	9.64
Fraction elderly	.13	.02	.09	.16
Openness = $\log((\text{exp} + \text{imp})/\text{GDP})$	-.63	.49	-1.74	.24
Presidential dummy	.10	.31	0	1
Log standardized average district magnitude	1.84	1.39	0	5.00

NOTE.—GDP = gross domestic product; *GFS* = International Monetary Fund's *Government Finance Statistics Yearbook*; exp = exports, imp = imports; OECD = Organisation for Economic Co-operation and Development's *Revenue Statistics*.

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