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# 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 and show that tax system or spending program which is suboptimal from a Ramsey point of view can improve taxpayer welfare because the system creates additional political pressure for suppressing the growth of government. Relevant examples include the use of inflation taxes capital taxes, excise taxes, deficit financing, and income taxes with many "loopholes." We also demonstrate the similarity of the political responses to revenue shocks, spending shocks, changes in program efficiency. In a broad sample of countries for the years 1973 - 90, we show that "more efficient" tax systems -- systems which rely on broad-based taxes with fairly flat rate structures -- are associated with larger governments. An analysis of defense spending -- especially wartime spending -- oil shocks, intergovernmental grants, and other flypaper effects suggests that the cause and effect is not from spending to tax structures.

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Once, long centuries past, con-sentients with a psychological compulsion to "do good" had captured the government. Unaware of the writhing complexities, the mingled guilts and self-punishments, beneath their compulsion, they had eliminated virtually all delays and red tape from government. The great machine with its blundering power over sentient life had slipped into high gear, had moved faster and faster. Laws had been conceived and passed in the same hour. Appropriations had flashed into being and were spent in a fortnight. New bureaus for the most improbable purposes had leaped into existence and proliferated like some insane fungus.

Government had become a great destructive wheel without a governor, whirling with such frantic speed that it spread chaos wherever it touched.

In desperation, a handful of sentients had conceived the Sabotage Corps to slow that wheel.

science fiction by Frank Herbert, *Whipping Star*, 1969.

## I. Introduction

The case for raising taxes in as efficient a way as possible has seemed to most economists to be rather obvious. A proof is straightforward if government expenditures are given. Given total government spending, the dead weight cost (dwc) of financing these expenditures is minimized if taxes are raised as efficiently as is possible. For example, with lump-sum taxes -- those favored by economists -- there is no dead weight cost of financing government spending.

Many economists approved of a flat tax because it is a more efficient way to raise a given amount of taxes than a progressive tax structure with many "loopholes" (this argument is criticized by Mulligan, 1996). But since government spending affects behavior, and the amount of spending depends on the tax system used to raise revenue, an efficient tax system may not minimize the total dead weight costs of government activities.

Sections II and III adapt the political competition model of Becker (1983) to address this issue. We show that more efficient taxes increase the political equilibrium size of government, whereas more efficient spending increases the size of government and thereby decreases taxpayer welfare. Section IV examines the size of government in different countries, showing that "more efficient" tax systems - systems which rely on broad-based taxes with fairly flat rate structures - are associated with larger governments.

In section V we use information on defense expenditures - especially during wartime - and oil shocks to show that causality from tax structure to the size of government is important for generating the reduced form correlation in section IV. This analysis of "government budget shocks" exploits a relationship between tax reforms and budget shocks derived from our theoretical model.

Although a welfare analysis of tax reforms is an interesting and timely application of our

approach, the vast majority of our paper is concerned with positive economics: predictions about the relationship between the tax-spending system and the size of government programs. The brief normative analysis shows how our positive theory of government might have normative implications.

## II. The Size of Government and Political Competition

### II.A. Dead-weight costs and the Equilibrium Size of Government

Consider a simple model of competition for political power between two interest groups, A and B (this is an application of the political competition model developed by Becker, 1983). Assume that the government has a balanced budget, and the political competition results in group A being taxed T, to finance equal subsidies G to group B. Group A spends resources, A, on lobbying legislators, influencing voters, etc. to persuade them to vote to keep taxes relatively low. Similarly, B spends resources, B, also trying to influence legislators and the electorate to raise the transfers to them.

Much of the political science literature tries, not very successfully, to model formally the process of government decision-making. That could be the goal of a complete analysis of the political process, but we have not tried to incorporate such a model into the analysis of interest group competition. We merely assume a reduced form function that is the end result of what may be a very 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 A and B on gaining political influence:

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

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

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 pressure 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 (also see Becker, 1983) many

important implications from minimal restrictions on properties of the pressure function.

One additional assumption is that a few interest groups overcome incentives to free ride by its members-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. Becker (1983) discusses more systematically the cost of overcoming free riding in the context of this model of interest group competition.

We assume a Nash one period 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 group case, the taxed group A minimizes the sum of its political spending and the cost to members of its group of the taxes assessed against it, given the spending by the subsidized group, B. The cost of the taxes equals the sum of tax revenue and $\Delta$, the dead weight cost of taxes. So A minimizes

$$A + T + \Delta(T) = C_A,$$
$$\Delta'' \geq 0$$

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

Similarly, B maximizes the difference between the value to members of B of the subsidies it receives and the amount it spends on political activity, given the spending by Group A. The value of the subsidy equals the difference between the amount received from the government and $\Sigma$, the dead weight cost of subsidies. So B maximizes

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

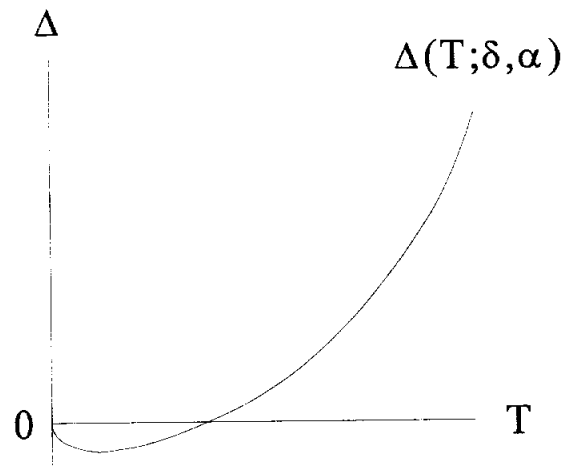
Subsidies also have a dwc because in many cases members of group B change their behavior in order to obtain the subsidy. $\Sigma$ depends on the amount subsidized G and we assume $\Sigma$ is nonconcave. $\Sigma$ is typically positive, although we do not rule out the possibility $\Sigma < 0$ which occurs, for example, when the behavioral changes induced by subsidies delivers a Pareto-improving allocation. If this also occurred for marginal subsidies, then $\Sigma' < 0$.

The first order conditions for each group with respect to A and B in a Nash Equilibrium are:[1]

$$dT/dA\{1+\Delta'\} = F_a\{1+\Delta'\} = -1$$
$$dG/dB\{1-\Sigma'\} = F_b\{1-\Sigma'\} = +1$$

The top equation implies a reaction function $A(B;\alpha,\delta)$ and the bottom equation a reaction function $B(A;\beta,\sigma)$. 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 dead weight costs of taxes and subsidies, $\Delta(T)$ and $\Sigma(T)$. 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 $\Sigma(T)$.

As we allow dwc's to change with the amount taxed, we distinguish three concepts of the dwc or "inefficiency" of the tax system: (i) average dwc, $\Delta(T)/T$, (ii) total dwc, $\Delta(T)$, and (iii) marginal dwc, $\Delta'(T)$. For the usual reasons, we expect total dwc to be a convex function of revenue collected so that all three measures vary with the size of government. It is important to distinguish tax systems whose dwc's differ for a given size of government from tax systems whose dwc's differ merely because different amounts of revenue are raised. In other words, the distinction is between a movement along and a shift of the function $\Delta(T)$, shown in the following graph.




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

We introduce exogenous parameters $\delta$ and $\alpha$ that shift $\Delta(T)$. $\alpha$ increases the function $\Delta(T)$ without changing its slope; a larger $\alpha$ corresponds to a parallel upward shift of the curve in the diagram. $\delta$ increases the slope of the function $\Delta(T)$ by the same amount at all levels of T; a larger $\delta$ corresponds to a counterclockwise twist of the curve in the diagram. Similarly, we introduce the parameters $\beta$ and $\sigma$ to shift and twist the function $\Sigma(T)$.

In our notation, movements *along* the curve $\Delta(T)$ involve changes in dwc and the size of government, but are not changes in the "efficiency" of the tax *system*. Changes in $\alpha$ or $\delta$ which reduce average or marginal dwcs *for a given T* are increases in the "efficiency" of the tax system.

Notice that T = G is the *net* transfer from A to B. It may be that A members, members of the net taxed group, receive some subsidies and B members pay some taxes. To the extent this "cross-hauling" occurs, it will typically be the case that greater dead-weight losses are suffered per dollar of net transfer than would be imposed in the absence of cross-hauling. Thus a downward shift of the $\Delta(T)$ function may be due to a reduction in the amount of gross taxes paid by Group A per dollar of net taxes paid by Group A. Similarly, a reduction in the amount of gross taxes paid by Group B per dollar of net subsidy received by Group B would produce a downward shift of the function $\Sigma(T)$.

The comparative statics of this system of FOC's are easily derived. Consider an increase in $\delta$. Then

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

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

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

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

When the dwc of the tax system increases and A'B' < 1, those taxed 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 $\Sigma$. If $F_{ab}$ were far enough from zero, B could increase enough so that government grew. We rule out by assumption such extreme equilibrium values for $F_{ab}$:

$$-F_bF_{aa}/(-F_a) < F_{ab} < F_aF_{bb}/F_b \qquad (2)$$

We refer to this restriction as "strategic separability" since it means that an exogenous increase in A's pressure, or an exogenous decrease in B's pressure, decreases equilibrium taxes and subsidies.[2] It is clear from the equations for A' and B' that, together with our assumed diminishing returns to pressure and convex dwcs, strategic separability implies $A'B' < 1$.

We immediately have an important

**Proposition I**: A shift to a tax system with higher marginal dwc (a higher $\delta$) 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 II**: A shift to a system of subsidies with higher marginal dwc (a higher $\sigma$) 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 $F_{ab} = 0$) we still have, with nonzero $\Delta''$ and $\Sigma''$, changes in pressure by A affecting pressure by B and vice versa. But when B reacts to changes in A's pressure - perhaps due to increased tax efficiency - (or A reacts to changes in B's pressure), the net result must be more government spending since B (or A) changes pressure only *in response to* a change in A (or B).

Some tax and subsidy systems may just differ according to additive terms $\alpha$ or $\beta$. Compliance and information costs may be "fixed" deadweight costs which, if reduced, would lower dwc's without affecting the marginal dwc functions. Since each lobby's marginal condition depends only the tax system only through the marginal dwc functions, an increase in the dwc of the tax system that does not affect marginal dwc's (an increase in $\alpha$ holding $\delta$ fixed) does not change the equilibrium size of government or pressure by either group. Similarly, an increase in the dwc of the subsidy system not affecting marginal dwc's (an increase in $\beta$ holding $\sigma$ fixed) does not change the equilibrium size of government or pressure by either group.

It should be noted, however, that a "marginal" dwc in our analysis is the change in the dwc with the marginal *political* decision - not necessarily with a marginal change in private behavior. Compliance

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[2]If F were either additively separable or homogeneous of degree zero, then any Nash equilibrium would be "strategically separable."

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

Propositions I and II are important because they show that the typical economic analysis, which takes government spending as given when analyzing the effects of changes in the tax system, ignores politically induced responses of tax rates, and hence of government spending, to changes in the efficiency of the tax system. In particular, the government sector tends to grow when it raises more efficient taxes.

One application of Proposition I is to recent discussions of the advantages 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 generally 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. While such a flat tax would be more efficient than the current system in raising each tax dollar, Proposition I implies that political reactions to such an improvement in efficiency would expand of tax collections and government spending.

Some economists have argued that the problem with VAT's and some other taxes on private spending is that they are hidden from consumers. Their invisibility is supposed to make them easier to increase over time.[3] European VAT tax rates have indeed grown significantly over time. However, Proposition I suggests a different reason why flat tax VAT's increase over time: they are more efficient ways to raise government revenue.

A good comparison is with social security taxes, which have also grown greatly over time. Like VAT's they are essentially flat taxes, but they are not hidden from consumers to the same extent since they are partly deducted explicitly from earnings -- the same way income taxes are.[4] The rapid growth is social security taxes suggests that the growth over time in VAT's is not entirely explained by the way they are collected.

While economic analyses of tax efficiency have often ignored the effects of tax systems on the size of government, lobbyists and politicians have not. Without working out the implications of a

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[3]The idea is sometimes referred to as the "fiscal illusion" hypothesis (eg., Goetz 1977, Buchanan and Wagner 1977). It dates back at least to John Stuart Mill (1970); Oates (1991) is a recent survey of the literature.

[4]Mulligan and Sala-i-Martin (1997b) show that, in a cross-section of countries, the larger social security programs actually tend to rely relatively *more* heavily on "employee" contributions even though these are more visible to workers than the "employer" contributions.

growing government, Hall and Rabushka (1995, p. 48) point out that advocates of larger government are frequently supporters of their Flat Tax. Lobbyists for Civil War veteran pension programs were keenly aware that their success depended on efficient sources of revenue (Costa 1998, chapter 8). Jean Baptiste Colbert, Louis XIV's finance minister described public finances as the art of "plucking the goose ... while provoking the smallest possible amount of hissing." (*Forbes Magazine* 2/15/1972, p. 22).

Our application of Proposition I to the movement away from a cumbersome, complicated, and progressive individual income tax system to a flat income tax, VAT, or payroll tax presumes that such a move actually increases the efficiency of the tax system without substantially affecting the efficiency of the subsidy system (or at least not making subsidies much less efficient). This is also the presumption of Hall and Rabushka (1995) and others advocating flat taxes and related tax reforms. But the "base broadening" that occurs with tax reform reduces the efficiency of the subsidy system to the extent that Group B members were among those previously enjoying tax loopholes. Under a broad-based tax - one paid by the B's as well as the A's - the B's suffer a greater dwc per dollar of *net* transfer to them. If this effect is large enough, a broader-based tax may decrease the political equilibrium *net* transfer, and may decrease gross tax collections too.

Although we characterize political competition as a conflict over government budgets, our analysis also applies to regulatory activities which are not recorded in government budgets. In this case, T denotes an index of regulation harming group A and favoring group B.[5] Higher regulatory deadweight costs (ie, a greater gap between what the B's gain and A's lose) decrease the amount of regulatory activity. Indeed, it has been argued (eg., Peltzman (1989)) that growing inefficiencies of airline, trucking, and other regulations produced the wave of U.S. Federal deregulation in the late 1970's and early 1980's.

II.B. "Budget Shocks" and "Tax Efficiency"

Since government spending and taxes may also change for "exogenous" reasons, we now generalize the government budget equation to:

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

D measures government spending, such as spending on the military to conduct or prevent a war, that are "exogenous" to political pressure. E measures government revenue, such as the oil revenue enjoyed by the governments of oil producing countries and perhaps aid or reparations from the governments of other

[5]Becker and Mulligan (1998) analyze this case more carefully; they also study how budget battles affect regulation, and vice versa.

nations, that are also exogenous to pressure. As before, T measures taxes levied on group A, and G subsidies enjoyed by group B due to political pressure.

The economic relevance of the distinction between D and E is that, holding constant the pressure applied by the two groups, more D means fewer subsidies (G) enjoyed by group B. Similarly, E is "exogenous taxes" in the sense that, holding constant the pressure applied by the two groups, more E means fewer taxes levied on group A. It is straightforward to prove:

**Proposition III**: 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.

Proposition III is a version of the "flypaper effect," so called by Hines and Thaler (1995) and others. Hines and Thaler suggest that irrational behavior is required to produce this behavior, but we have deduced the effect in a rational model of interest group behavior (see also Videgaray (1997)).

Propositions I-III require the "strategic separability" restrictions on the cross-derivative of the pressure function F(A,B). Although these are weak restrictions, there is, regardless of the sign and magnitude of $F_{ab}$, a close relation between changes in the exogenous government revenue, exogenous government spending, and tax system efficiency. In particular, greater tax efficiency (lower $\delta$) and more exogenous government revenue (higher E) have the same qualitative effects on pressure by A and B, and on total government spending F(A,B) for all values of $F_{ab}$. Similarly, greater spending efficiency (lower $\sigma$) and more exogenous government spending (higher D) have the same qualitative effects on pressure A, B, and F(A,B). Comparing the *quantitative* effects of $\delta$, $\sigma$, D, and E, we have the Proposition IV (see the proof in Appendix II):

**Proposition IV** Even if $F_{ab}$ violates assumption (2), the magnitude of the effects of $\delta$ and E on A, B, and F(A,B) differ only by the factor $\Delta''$. Similarly, the magnitude of the effects of $\sigma$ and D on A, B, and F(A,B) differ only by the factor $\Sigma''$.

Given two basic assumptions (a) the size of government is constrained by pressure from taxpayers, and (b) the dwcs of taxes and spending are increasing convex functions of revenue collected, there is a close relationship between anything easing the political pressure applied by taxpayers to restrain

the growth of programs subsidizing group B. The relationship can be used to derive additional empirical tests of our claim that more efficient tax and spending programs (ie, decreases in $\delta$ and $\sigma$) lead to the growth of government. Even without empirically identifying exogenous changes in $\delta$, our analysis implies the effects of efficient spending and taxes on the size of government should be related to the effects of exogenous changes in D or E. Two examples are the "peace dividend" at the end of a war (ie, a decrease in D), and the extraordinary oil revenue enjoyed by oil producing governments during the "oil shock" period of the 1970's (ie, an increase in E).

II.C. Welfare Analysis

Economists have typically preferred lump-sum taxes because they have no effect on efficiency, or effects confined to fertility and mortality. But the political economy effects of different kinds of taxes is usually ignored. 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 kind of taxes or transfers, even when individuals fully know what they pay in taxes.

Since $\delta$, the measure of the marginal dwcs of taxes, does not affect group B's surplus directly and a reduction in $\delta$ reduces pressure applied by group A, group B must be better off from a more efficient tax system. However, the analysis is not symmetric for more efficient spending systems. Although $\sigma$, the measure of the marginal dwc of subsidies, does not directly affect group A's net income, a lower $\sigma$ *increases* pressure applied by group B, so that more efficient spending makes taxpayers worse off.

Economists, journalists, and others have often pointed out the inefficiencies in many government spending programs - including farm price supports, the government administration of schools, and other "in kind transfers" - and argue that taxpayers deserve to see them eliminated. Why not write checks to farmers or print schooling vouchers for students? But taxpayers may be better off with inefficient spending programs since there is less political pressure by those subsidized to expand an inefficient program.[6] Cash transfers make taxpayers worse off even though the in-kind transfers are inferior uses of each tax dollar. The "pilot programs" popularized by Ross Perot are an attempt to make subsidy programs more efficient, which taxpayers might rationally oppose for the same reason.

While those subsidized benefit from greater tax efficiency, we cannot sign the effect of lower marginal dwcs of taxes (lower $\delta$) on the Nash equilibrium group A net income. Holding A constant,

[6]Subsidized groups may also oppose proposals to enhance spending efficiency, especially if these relax "barriers to entry" into the subsidized group (Stigler 1971).

lower $\delta$ decreases the dwc and increases the net income of Group A. This group further increases their net income by reducing their pressure to equate costs and benefits (where they compute costs and benefits holding B fixed). If B's did not react to less group A pressure by increasing their own pressure (ie, if $B' \geq 0$), then any reaction by group B would further increase group A net income, and taxpayers would be better off from more efficient taxes. Indeed, the convexity of $\Sigma$ tends to generate a positively sloped reaction function for the B's so the more likely result (but not a result guaranteed by our various second derivative restrictions - see equation (1)) is that taxpayer are better off with a lower $\delta$. A reduction in averge dwcs of taxes (lower $\alpha$), on the other hand, unambiguously enhances group A's welfare because it involves no change in equilibrium pressures.

Similar reasoning shows that lower average dwcs of subsidies (lower $\beta$) makes group B better off. But lower $\sigma$ might make B's worse off. Holding B constant, a lower $\sigma$ decreases their dwc and increases their net income. Group B further increases their surplus by increasing their pressure to equate costs and benefits (where they compute costs and benefits holding A fixed). If $A' \leq 0$, so that A's did not react to more group B pressure by increasing their own pressure, then any reaction by group A would further increase group B surplus. However, the convexity of $\Delta$ tends to generate a positively sloped reaction function for the A's (see equation (1)), so it is likely that A's respond to lower $\sigma$ with more pressure. The additional pressure by group A would hurt group B, and may dominate the effect of $\sigma$ and greater pressure B on B's net income. Hence, the effect of $\sigma$ on the equilibrium welfare of those subsidized cannot be signed without further restrictions on $F_{ab}$.

When B' is not too negative, taxpayers prefer more efficient taxes despite the induced growth in government because government expands *as a result of* the taxpaying group's *collective decision* to cut resistance. The next section shows that, when taxpaying groups do not apply political pressure collectively, this relationship between program efficiency and the size of government still obtains but, because of the free riding, unorganized taxpayers have another reason to oppose efficient taxes. Free-riding among subsidy groups, on the other hand, strengthens the gain to those subsidized of more efficient subsidies.

The determinants of the marginal dwc schedules, which have been taken as exogenous, vary over time or across countries. For example, technological constraints have limited the kinds of taxes available to governments. Peltzman (1980, pp. 221, 257) discusses the technological constraints, but suggests they are currently relevant for undeveloped economies. Constitutions sometimes also limit the kinds of taxes

available to governments, as in the United States before the passage of the 16th Amendment in 1913.[7] The marginal dwc of taxes is also partly determined by special interests who lobby for tax exemptions and thereby narrow the income tax base. Differing degrees of political power affect the number and type of tax exemptions, and therefore the marginal dwc of the income tax.

Hence government redistribution in this approach might be viewed as a two staged "game." In the first stage, tax and subsidy 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 propositions regarding the properties of the second stage game - such as those we have derived in this paper - are a necessary part of that fuller analysis.

Still, our conclusion that efficient spending programs receive less political support than efficient tax systems suggests that that actual tax systems are more efficient than actual subsidy programs. For example, our analysis implies that "cross-hauling" - one form of inefficiency of taxes and spending - should be more common on the spending side. This prediction is consistent with the observation that subsidies typically (although not exclusively) are explicit payments rather than the forgiveness of income, payroll, sales, property, and other taxes paid by those who are net subsidy recipients.

## III. Interactions within Political Groups

### III.A. Free-riding within the Taxpaying and Subsidy Groups

The above welfare analysis assumes that taxpayers act collectively and that those subsidized act collectively. A more realistic analysis has some taxpayers and some subsidy recipients acting collectively, but other groups who are taxed and subsidized unable to act collectively because of free riding on a collective political good (see Olson 1965). One way to introduce free riding within our framework is to assume pressure spending by different taxpayer (or subsidy) groups, are substitutes in the pressure function. For example, certain taxpayers may fight for a reduction in tax rates that ultimately creates a political climate that benefits all taxpayers, or unions may push for restrictions on immigration which also benefit some nonunion workers.

Consider M taxpaying and N subsidy groups and the extreme case that the size of government depends on the *sum* of the expenditure by all groups:

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[7]The experience with the 16th 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.

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

$A_j$ minimizes $A_j + a_j F(\Sigma_1^M A_i , \Sigma_1^N B_i ) + \Delta_j(a_j F)$ s.t. $A_j \geq 0, \Sigma_1^M a_i = 1$

$B_j$ maximizes $b_j F(\Sigma_1^M A_i , \Sigma_1^N B_i ) - \Sigma_j(b_j F) - B_j$ s.t. $B_j \geq 0, \Sigma_1^N b_i = 1$

It is easy to show from the FOCs that no more than the taxpaying group with highest marginal cost $a_j(1+\Delta_j')$, and the subsidy group with the greatest marginal surplus $b_j(1-\Sigma_j')$, apply political pressure. These two groups may be "active," but all other groups would free ride on pressure by the 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 only receive the fractions $a_i$ and $b_j$ of the total benefits generated by their pressure. *No* groups may be active, even though $F(0,0) >> 0$, and pressure by taxpayers could greatly reduce the tax burden, and pressure by subsidy recipients could greatly increase subsidies.

As in section II, an increase in the dwc of taxes or a decrease in the dwc of spending of the active groups increase the size of government. Taxpayers are still hurt by more efficient spending. However, inactive subsidy recipients - and perhaps also the politically active subsidy group - unambiguously prefer 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 the 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 resist "reforms" of the tax system when reform means lowering the marginal dwc of taxation. On the other hand, the possibility of free-riding among those subsidized is yet another reason for them to favor efficient spending programs.

III.B. Endogenous Tax Efficiency

The multigroup framework also makes easy to endogenize the choice of a tax system. Consider two types of taxes, each of which harms one of two equally powerful and equally sized taxed groups, but these taxes differ according to the marginal dwc incurred for a given tax revenue. Since we have shown that the group harmed by the relatively inefficient tax applies more pressure, the efficient tax is utilized more heavily (this is Proposition 4 of Becker (1983)). But since the average dwc of each tax increases with the amount of revenue raised, exogenous increases in the size of government raise the marginal and

average dwc of the efficient tax, shifting the political equilibrium to include also the less efficient tax. The greater reliance on less efficient taxes by exogenously larger governments is consistent with the empirical findings, to which we now turn.

## IV. Efficient Taxes and the Size of Government in a Cross-Section of Countries

### IV.A. Cross-country Evidence: Results from the Literature

In a study of fiscal policy and economic growth in a broad cross-section of countries for the period 1970-88, Easterly and Rebelo (1993) find a nation's population and per capita income to be associated with greater reliance on income rather than trade taxes, which in turn are positively correlated with the size of government. They obtain similar results in a 118 year panel of 28 countries. Theirs are an interesting contrast with the findings of Borcherding and Deacon (1972) and Bergstrom and Goodman (1973) across states and municipalities that neither population nor per capita income are correlated with the size of government. Our model can reconcile these findings if the tax system is the direct cause of bigger governments. All U.S. states already have an income tax, and all municipalities a property tax, and - regardless of population and income - they do not have to rely on inefficient trade taxes to finance expenditure. Population and income are good predictors of the use of income rather than trade taxes in a broad cross-section of countries, and so are good predictors of the size of government.

Peltzman (1980) 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. 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 the size of government.[8]

Our analysis collapses all of the political details into the pressure function F, and focuses on "deadweight losses" and other economic variables. A little evidence supporting our approach is that - holding constant just a few economic variables - the cross-country regressions of both Easterly and Rebelo (1993) and Peltzman (1980) exhibit no correlation between democracy indicators and the size of government, suggesting that large differences in "political details" have a smaller effect on the size of

[8]Among his other regressors, only inequality has much explanatory power, where countries with more equality have bigger governments. See our section IV.B for a description of the modernization measure.

government than differences in a few economic variables.[9] Indeed, Easterly and Rebelo (1993, p. 436) admit that considerable search revealed only one fiscal variable to be different for democracies and nondemocracies - the amount of aid received from foreign governments!

Summers et al (1993) and Olson (1982) point to another source of cross-country differences in tax efficiency: "corporatism." Summers et al explain (pp. 385-86) that corporatist economies might make labor supply decisions collectively, and collective labor supply decisions reduce the marginal deadweight cost of labor income taxes.[10] Consistent with our model, they find a strong positive correlation between corporatism and labor income tax revenue in their sample of 17 countries for the period 1980-84 and 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.[11] 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.

IV.B. Additional Measures of the Efficiency of Tax Systems

The equilibrium dwc of taxes in our model depends on two factors: (1) movements along the $\Delta(T)$ schedule due to other determinants of the size of government and (2) shifts and twists of the $\Delta(T)$ schedule such as those parameterized by $\alpha$ and $\delta$ in our model. Therefore, we classify a tax system as "efficient" if it has a low marginal dwc for a *given* size of government. The equilibrium average, marginal, and total dwc's of taxes can be positively or negatively correlated with the size of government in our model, depending how the parameters $\alpha$, $\beta$, D, E and the first and second derivatives of the

[9]However, a few studies of local governments (Pommerehne and Schneider 1982, Santerre 1986, Schneider 1986) suggest that political institutions are an important predictor of the size of government. On the other hand, for a cross-section of 43 countries, Oates (1985) constructs one of the institutional measures - fiscal centralization - from the local government literature, and holding constant only a few economic variables, does not find a correlation between fiscal centralization and the size of government.

[10]Mancur Olson (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.

[11]That political motives are affecting both corporatism and the size of government is consistent with Mulligan and Sala-i-Martin's (1998) finding that the fraction of the population aged 65+ explains some (but not all) of the correlation between corporatism and the size of government in the Summers et al 17 country sample.

functions $\Delta(T)$ and $\Sigma(T)$ vary across countries. We use proxies for the efficiency of taxes proposed in the literature, as well as three new measures constructed for a cross-section of countries. We show that all of the measures are positively correlated with the size of government across 92 countries for the years 1973-90.

Among the proxies for the efficiency of taxes found in the literature are: the fraction of the labor force in agriculture, population, the "modernization" of industry, and the administrative efficiency of government. Stigler (1986, p. 4) states that the prevalence of agriculture precludes efficient income and property taxation because "income is [then] ill defined and not a suitable object of taxation, so property becomes the only basis for taxation. However, it is difficult to tax property progressively because its ownership can often be subdivided." Following Stigler, we include in our cross-country data sets the fraction of the nation's labor force in agriculture.

Adelman and Morris (1971) construct two proxies for tax efficiency for middle income and less developed countries. One proxy (Adelman and Morris 1971, pp. 76-8) is an index of government administrative efficiency, which they believe represents the organization of administrative services by the government, and the government's ability to create favorable financial institutions and tax instruments. Their index is based on interviews with regional and country experts as well as information from country studies, and pertain to the period 1957-62. The degree of permanence and training of administrators, the extent to which corruption seriously hampered government function, and the extent to which "instability of policy at higher levels of administration promotes inefficiency," are among the main criteria used in making their index. A second proxy is an "indicator of the extent of modernization of production techniques in industry as of about 1961... composed of three principal elements: a rough quantitative estimate of the relative importance of indigenous modern power driven industrial activities compared with that of traditional handicraft production, the degree of modernity of machinery and organization in the modern industrial sector as indicated by the incidence of the most up-to-date large-scale and/or otherwise relatively efficient production methods, and a diversity and range of goods produced in the modern industrial sector" (p. 97). Their indicator is based on their examination of country studies, with doubtful cases resolved by interviews with region and country experts.

Easterly and Rebelo (1993) suggest that bigger countries rely more on income tax rather than trade taxes, and thus can have bigger governments - see their study for an analysis of the composition of trade vs. income taxes. We include each nation's population in our cross-country data set, but do not report regression results with population as an independent variable because the estimated coefficient is economically and statistically insignificant.

We construct three of our own measures of the efficiency of the tax system:

(i) share of total revenue raised from social security, payroll, and sales taxes

(ii) the ratio of the "economy-wide" average individual income tax rate to the top statutory individual income tax rate

(iii) number of years that a country has had a VAT tax

Our preferred measure is based on the presumption that social security, payroll, and sales (especially VAT) taxes 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.[12] See Ballard et al (1985a,b), or Hall and Rabushka (1995) for a nontechnical discussion and further references to the public finance literature. See also our caveat to this result on page ? regarding "cross-hauling." 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[13], import, estate, use, poll, stamp, inflation and other taxes. We consider these taxes to be inefficient because of their narrow tax bases and/or because the same revenue could be raised more efficiently with a payroll or sales tax. 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

[12]"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 (i) regardless of the taxes they are "on top of". Our measure (i) 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.

[13]Excise taxes might also be included in the "efficient tax" category, although some (eg., Ballard et al (1985a)) argue that the variability of excise taxes across goods is particularly inefficient.

allocation of economic activity over time.[14]

Economists generally agree on the inefficiency of a sizable inflation tax relative to an income, consumption, or wage tax as a long-term source of substantial revenue. There is somewhat more debate about the efficiency of moderate rates of inflation. Woodford (1990) surveys several studies that support the "Friedman rule" - absolutely no inflation tax should be levied. All of the papers surveyed by Woodford (1990) assume that revenue raised with an inflation tax need not be raised with an alternative flat consumption or income tax. Feldstein (1996) points out the U.S. tax code discourages capital accumulation and, because of nominal provisions in the code, capital accumulation is most heavily distorted when there is inflation. He therefore argues that even moderate levels of inflation may not be optimal given the income tax system that is in place. Mulligan and Sala-i-Martin (1996), on the other hand, point out that the income tax in the U.S. and other countries feature marginal tax rates that rise with income, so that a effectively regressive inflation tax may be more efficient than the income tax, although not more efficient than a flat-rate tax, such as social security or VAT taxes. Given these results, we assume that the inflation tax is inefficient relative to the social security, sales, and payroll taxes in place in many countries.

IV.C. Cross-country Evidence: New Results

Figure 1 is a scatter diagram displaying the relationship between our tax efficiency measure (i) and the size of government. The horizontal axis measures general government social security, general government payroll, and federal sales taxes[15] as a fraction of total government revenue (including inflation taxes and capital revenue). The vertical axis measures total government revenue as a fraction of GDP. Government revenue is as reported by the International Monetary Fund, and includes the revenue from money creation.

[14]See Jones, Manuelli and Rossi (1993), Judd (1989), and Lucas and Stokey (1983) for arguments for the occasional use of capital levies, but against their long-term use.

[15]We do not have data on sales taxes by state and local governments. 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 et al (1985a) and others argue that state and local sales taxes are quite inefficient because their rates substantially vary across goods and regions.

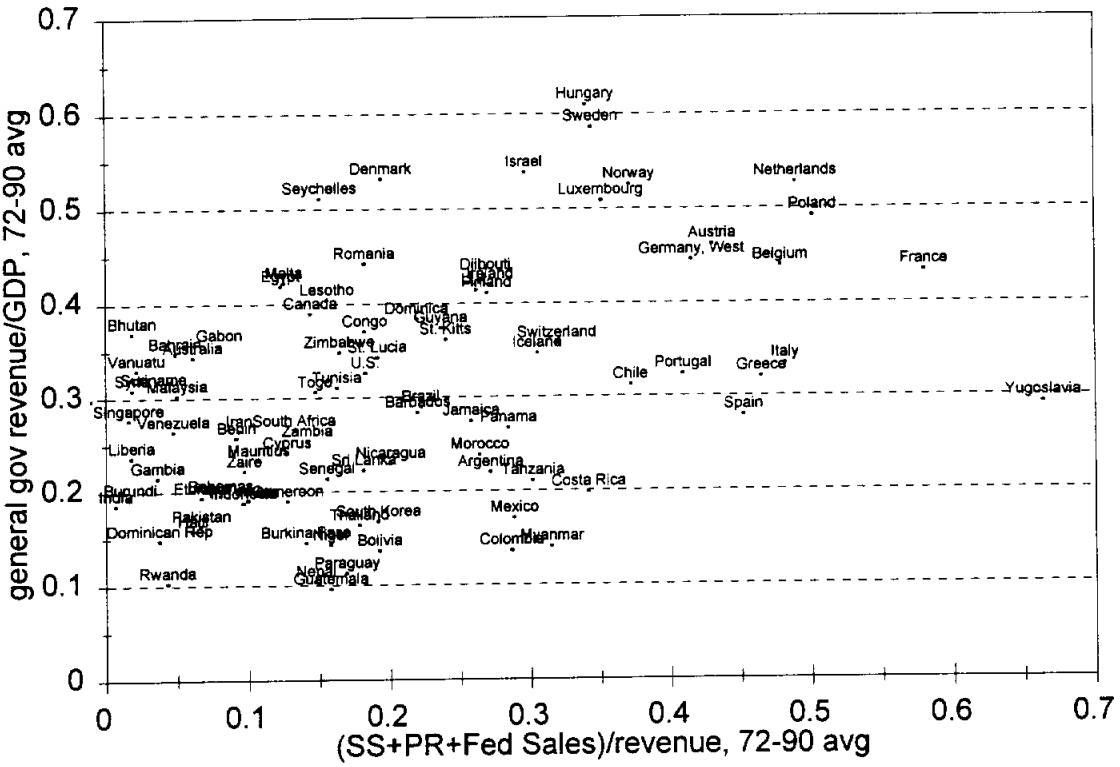


**Figure 1** Tax Efficiency Measure (i) vs Size of Government

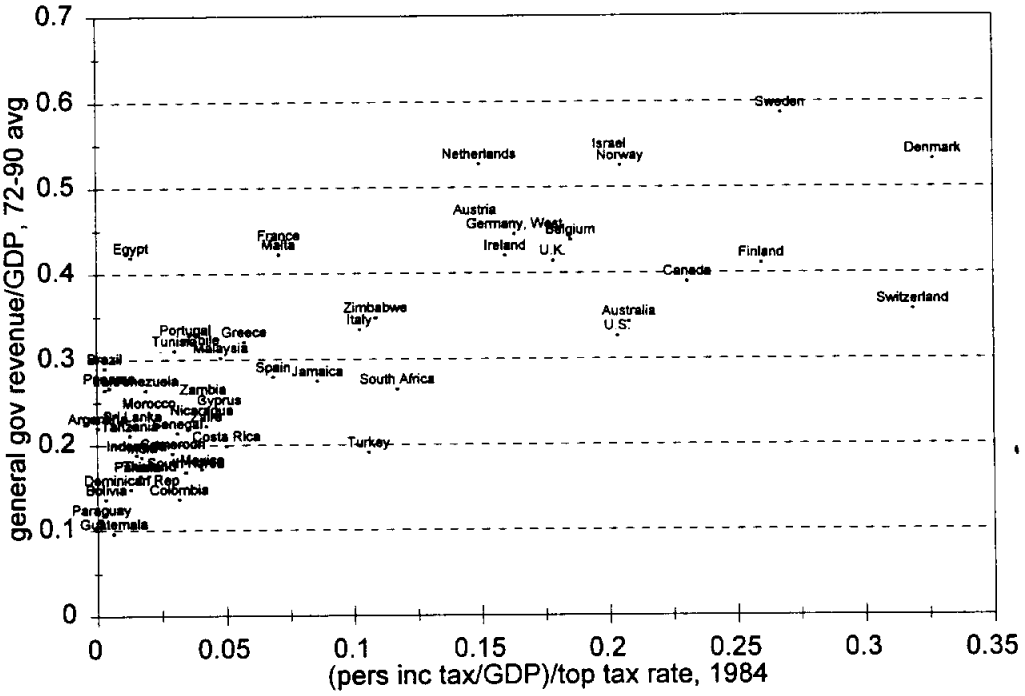


**Figure 2** Tax Efficiency Measure (ii) vs Size of Government

Table 1 shows some regression results relating to our tax efficiency measure (i) and the size of government. The first column displays results from a regression of total government revenue as a fraction of GDP on tax efficiency measure (i). The regression result confirms Figure 1: there is an important positive correlation between the two variables. The estimated magnitude of the coefficient is 0.31, but we believe this estimate is biased downward because total government revenue is measured with error. By construction, errors in this variable are positively correlated with the dependent variable in our regression, and negatively correlated with tax efficiency measure (i).

GDP per capita is an important variable in the literature for explaining the size of government. "Wagner's Law" states that GDP per capita is positively correlated with the size of government (see Borcherding (1977, p. 50) for a survey of alternative findings on this "law"). The estimates reported in the second column of Table 1 are consistent with these previous findings, although there is still an economically significant partial correlation with measure (i). However, the third column of the Table shows that most of our measure (i) findings are due to the differences between European and other countries rather than to differences within European and nonEuropean countries. Results are quite similar if five additional continent dummies are included in the regression. The Europe dummy is a better predictor of government size than is an OECD dummy.

Table 1: Regression Estimates of the Links between Tax Efficiency and the Size of Government

| independent variable | Dependent variable: Total Gov Revenue/GDP, 1973-90 avg | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **tax efficiency** | 0.31 (0.08) | 0.10 (0.07) | -0.02 (0.08) | 0.17 (0.08) | 0.65 (0.18) | 0.68 (0.18) | 1.31 (0.37) | 0.19 (0.05) | 0.17 (0.12) |
| measured as: | BMi | BMi | BMi | 1-(LF in agric.) | BMii | BMii | BMii | admin. eff | indus. modern |
| **other controls:** | | | | | | | | | |
| log(GDP per capita), 1972-89 avg | | 0.07 (0.01) | 0.05 (0.01) | 0.01 (0.02) | 0.03 (0.02) | 0.04 (0.02) | 0.05 (0.03) | 0.07 (0.02) | 0.01 (0.04) |
| democracy grade, 1975/94 | | | | | | -0.06 (0.06) | -0.11 (0.07) | -0.11 (0.07) | -0.08 (0.08) |
| Europe dummy | | | 0.11 (0.03) | 0.11 (0.03) | 0.05 (0.03) | 0.06 (0.03) | -0.03 (0.05) | -0.03 (0.05) | -0.01 (0.05) |
| N | 83 | 83 | 83 | 83 | 53 | 53 | 32 | 32 | 32 |
| $R^2$ | .15 | .43 | .51 | .54 | .65 | .64 | .41 | .42 | .20 |

Notes (1) Tax efficiency measures
BMi: share of total revenue raised from social security, payroll, and sales taxes (1973-90 avg)
BMii: the ratio of the "economy-wide" average individual income tax rate (1973-90 avg) to the top statutory individual income tax rate (1984)
LF in agric.: fraction of nation's labor force in agriculture (World Bank)
admin. eff.: government administrative efficiency grade (Adelman and Morris 1971, pp. 76-8, on 0 to 1 scale)
indus. modern: industry modernization grade (Adelman and Morris 1971, pp. 97-99, on 0 to 1 scale)
(2) For some countries, 1973-90 averages exclude years with missing data (see Appendix I)
(3) GDP per capita is measured in 1985 $ and is from the Penn World Tables
(4) Democracy grade an average of the two years 1975 and 1994 from Barro (1996, Table 8).
(5) 92 countries are displayed in Figure 1, but only 83 in the first column of the Table because 9 of the 92 countries are missing agricultural share data.

In a cross-country study, GNP may itself be a good proxy for the efficiency of taxes since less developed countries have larger agricultural and underground sectors which are difficult to tax. This interpretation of the per capita GNP coefficient is consistent with the findings of Borcherding and Deacon (1972) and Peltzman (1980) using cross-state data. Both authors fail to find a positive effect of GNP on government revenue/GNP, findings which may differ from cross-country findings because GNP is a good

proxy for the efficiency of tax collection only in the cross-country study.

Easterly and Rebelo (1993) suggest another reason why per capita GNP might proxy for tax efficiency in cross-country regressions. While the use of payroll and sales taxes rather than income taxes may be an indicator of tax efficiency among middle and high income countries, use of income taxes rather than tariffs may be an indicator of tax efficiency among low and middle income countries. And in such a sample, Easterly and Rebelo (1993) find the use of income taxes to be more likely in relatively richer countries.

The fourth column of the table introduces Stigler's proxy for tax efficiency - the fraction of the labor force in agriculture. Even when GDP per capita and a dummy for Europe are held constant, the partial correlation between the measure of tax efficiency and the size of government is economically and statistically significant.

Another measure of tax efficiency is the ratio of the "economy-wide" average individual income tax rate to the top 1984 statutory individual income tax rate.[16] The "economy-wide" average individual income tax rate is measured as the ratio of individual income tax collections to GDP, averaged for the years 1972-1990. All else constant, a more efficient income tax system collects a lot of revenue without high marginal tax rates. The fifth, sixth, and seventh columns of Table 1 (which use a smaller sample of 53 countries for which measure (ii) and democracy are available[17]) show that our second measure of tax efficiency is even more correlated with the size of government than our first measure.[18]

We verify and build on the cross-country results of Easterly and Rebelo (1993) and Peltzman (1980) by introducing a measure of democracy in equations explaining the size of government. One might expect such a measure to be correlated with the size of government if political institutions were an important determinant of the amount of government activity. We use the indicator of political rights

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[16]Results are very similar when we use the top 1974 statutory individual income tax rate for a smaller sample of countries for which we have the measure.

[17]Results for measure (i) do not change when the sample is reduced from 83 to 53.

[18]We would like to measure an average marginal tax rate for each country, but such a measure is hard to obtain. We know, for example, that the top marginal tax rate is only remotely related to an average marginal income tax rate when the income required to be in the top income tax bracket is much greater than average income in the country. We have tried specifications that interact our tax efficiency measure with the ratio of top bracket income to per capita GDP. As expected, we find the effect of measure (ii) on the size of government to be smaller when the top rate is applicable for only very high incomes. However, introducing the interaction term does not substantially affect our other regression coefficients.

compiled by Gastil and his followers - and supplemented, rescaled, and reported by Barro (1996) for 1975 and 1994 and for a sample of countries that is similar to the sample for which our measure (ii) is available. The indicator is based on the impressions of Gastil and others as to the degree to which citizens can participate in the political process and the degree to which minority parties have an influence on policy. The last four columns of Table 1 show the democracy variable is not strongly correlated with the size of government but rather a few economic variables explain most of the cross-country variation.

Income tax revenue appears in the numerator of our measure (ii), and general government revenue is by construction the sum of income tax revenue and nonincome tax revenue. We have tried instrumenting our measure (ii) with GDP per capita and/or our other tax efficiency measures, which are not positively correlated with government size as an artifact of construction. The resulting second stage regression coefficient (not shown in the Table) is statistically significant in the 53 country sample, except when GDP per capita is included as an additional second stage regressor, in which case none of the regressors have statistically significant coefficients. IV estimates of the partial correlation of measure (ii) with government size are statistically and economically significant in the 32 country sample when administrative efficiency instruments for measure (ii). As long as *either* GDP per capita or administrative efficiency is not correlated with the size of government when tax efficiency is held constant, the results we report for measure (ii) are not likely to be a statistical artifact.

Because it closely mimics a broad-based flat-rate consumption tax, the value-added tax is one of the most efficient taxes used. Figure 3 graphs our third measure of tax efficiency - number of years that a country had a VAT tax prior to 1992 - versus the size of government; again, tax efficiency and the size of government are positively correlated.

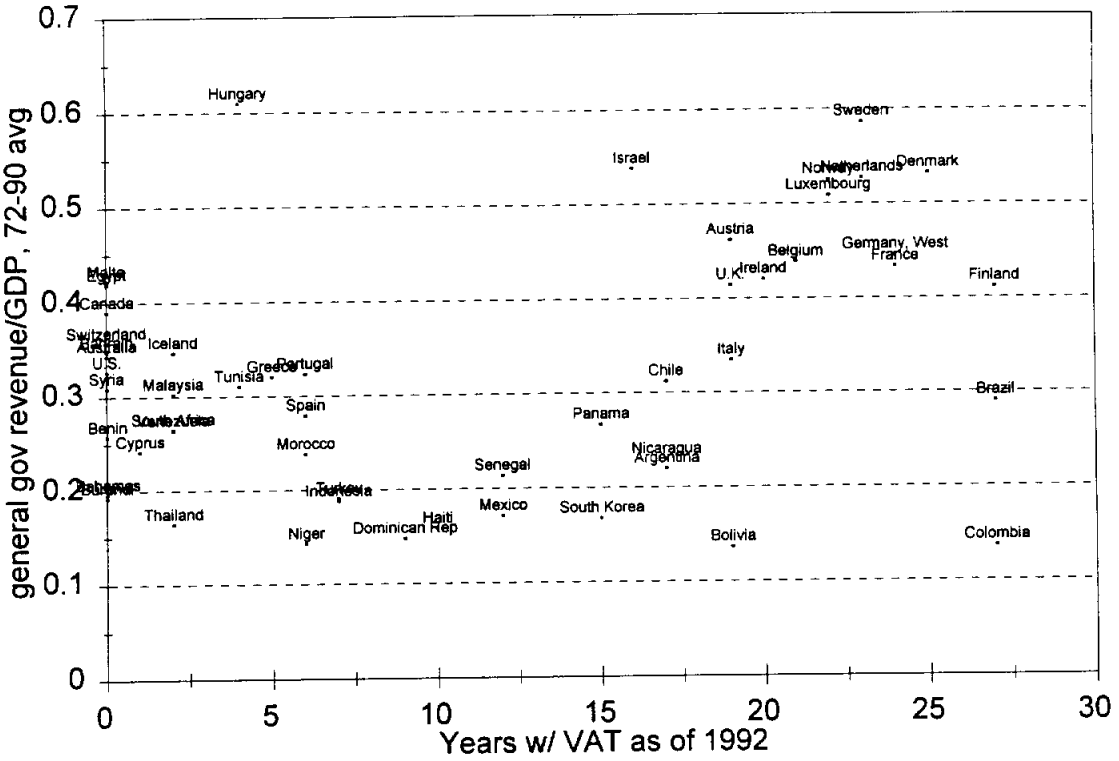


**Figure 3** Tax Efficiency Measure (iii) vs. Size of Government

IV.D. Are Taxes Too Efficient?

As long as government activity has positive marginal dwc (ie, $\Delta'+\Sigma'>0$), the usual analysis overstates the benefits of reducing the dwc of taxes because it does not consider the effect of the tax reform on the size of government. Our theoretical analysis shows that reducing the dwc of taxes or spending may but need not increase total dwc's. The *magnitude* of the observed cross-country relationship between tax efficiency and the size of government can help resolve this ambiguity.

Most evidence (eg., Tullock) suggests that few 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 various nonmonetary inputs. Still, the changes in pressure resources can be ignored to a first approximation. Then the evidence suggests that the change in total dwc from a change in the dwc of taxes is:

$$d(\text{total dwc}) = (\Delta' + \Sigma')\, dT + T\, d\delta \qquad (3)$$

Equation (3) can be used to determine the effect on the size of government of changing the U.S.

tax system. Table 2 displays some assumptions about dwc's 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 $(\Delta' + \Sigma')$, ranging from \$0.50 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 $(\Delta' + \Sigma')$. The last four columns show the effects on total dwc for 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 ($dT = 0$).

Table 2: Are Taxes Too Efficient?
Some Calculations

| Assumptions | | d(total dwc) | | | |
|---|---|---|---|---|---|
| $(\Delta' + \Sigma')$ | $d\delta/(\Delta' + \Sigma')$ | $dT = 0$ | $dT = 0.05$ | $dT = 0.10$ | $dT = 0.15$ |
| 0.5 | -0.1 | -0.02 | 0.00 | 0.03 | 0.05 |
| **1** | **-0.1** | -0.05 | 0.00 | **0.06** | 0.11 |
| **1.5** | **-0.1** | -0.07 | 0.01 | **0.08** | 0.16 |
| 2 | -0.1 | -0.09 | 0.01 | 0.11 | 0.21 |
| 0.5 | -0.3 | -0.07 | -0.04 | -0.02 | 0.01 |
| **1** | **-0.3** | -0.14 | -0.09 | **-0.03** | 0.01 |
| **1.5** | **-0.3** | -0.20 | -0.13 | **-0.05** | 0.02 |
| 2 | -0.3 | -0.27 | -0.17 | -0.07 | 0.03 |
| 0.5 | -0.5 | -0.11 | -0.09 | -0.06 | -0.04 |
| 1 | -0.5 | -0.23 | -0.18 | -0.13 | -0.08 |
| 1.5 | -0.5 | -0.34 | -0.26 | -0.19 | -0.11 |
| 2 | -0.5 | -0.45 | -0.35 | -0.25 | -0.15 |

Note: (1) T and "total dwc" are measured as fractions of GDP.
(2) It is assumed that T = 0.45

In order to find the entry that best approximates a move from the U.S. system to a Western European government representative in terms of its size and our three measures of tax efficiency, we need estimates of $\Delta'$, $\Sigma'$, $d\delta$, and $dT$. The Mean Value Theorem and the convexity of dwcs imply that the correct value for $(\Delta' + \Sigma')$ is some average of its values for the U.S. and for Europe. We conservatively assume that $\Sigma'$ is of similar magnitude as $\Delta'$, and that the European $(\Delta'+\Sigma')$ is at least as large as American $(\Delta'+\Sigma')$.

Ballard et al (1985b) estimate the "marginal excess burden" of the U.S. tax system ($\Delta'$ in our model) to be between 0.17 and 0.56, and they find the marginal excess burden of the U.S. individual

income tax (IIT) to be fairly representative of all U.S. taxes. Feldstein (1995) 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. Therefore, a somewhat conservative estimate of $(\Delta'+\Sigma')$ is between 1 and 1.5.

Ballard et al (1985b) also report estimates of the marginal excess burden separately for capital, payroll, sales, excise, personal income, and output taxes. We estimate $d\delta/(\Delta'+\Sigma')$ by computing a weighted average of these marginal excess burdens (as a fraction of a Ballard-based estimate of $\Delta'+\Sigma'$) using two sets of weights: U.S. and European shares of these taxes in total revenue. We use the shares 0.20, 0.25, 0.11, 0.06, 0.24, 0 for the U.S. and 0.12, 0.57, 0, 0.06, 0.25, 0 for Europe[19] and find $d\delta/(\Delta'+\Sigma') = -0.1$.

dT can be calibrated in four ways. First, we can assume that all of the difference between the U.S. and Europe is due to different tax efficiency and read from Figures 1-3 a difference of $dT = 0.12$ in the American and European government shares of GDP. Second, the difference between our European and American measures of tax efficiency can be multiplied by the appropriate multiple regression coefficient from Table 1, which produces an estimate of roughly $dT = 0.05$. Third, Summers et al (1993) finding 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 $dT = 0.10$. Fourth, budget shocks can be used to estimate $dT/d\delta$, whidch yield an estimate of $dT=0.05$, the details of which we discuss in Section V.H below.

For these and other reasons, our preferred estimates are the $dT = 0.10$ column and middle two rows of the top and middle panel of Table 2. The four corresponding entries for d(total dwc) are 6%, 8%, -3%, and -5% of GDP (set in bold font in the Table), 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 (1995) and others for related tax reforms - between 5 and 25% of GDP.

A careful computation of the marginal excess burdens of various American and European taxes are beyond the scope of our paper, so our Table 1 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.

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[19]We assume 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.

Several studies in the public finance literature are concerned with estimating the total and marginal dwc of taxes (eg., Ballard et al (1985b), Feldstein (1995)), often implying 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. That larger values of $\Delta'$ increase the welfare gains of tax reform can be reversed when $dT>0$ because a growing government has a bigger impact on dwcs when marginal dwcs are large. To see this, factor equation (3):

$$d(\text{total dwc}) = (\Delta' + \Sigma') [\, dT + T\, d\delta/(\Delta' + \Sigma') \,]$$

Holding fixed a tax reform's percentage change in the marginal dwc's of taxes and spending (ie, holding fixed $d\delta/(\Delta' + \Sigma') < 0$), a larger $\Delta'$ 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 welfare losses of tax reform are aggravated by a larger $\Delta'$ in the latter case.

## V. What is the Direction of Causality?

### V.A. 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 because the efficiency gain of moving from an inefficient tax system to an efficient tax system is increasing in the amount of revenue to be raised.

Our model of political competition can explain this reverse causation because increases in the size of government cause politically active taxpayers to press harder for more efficient tax systems. But that is not necessary in our analysis since the discussion of many groups in Section III explains how exogenous increases in the size of government can lead to *less* efficient system as measured by our (i), (ii), and (iii).

In order to determine whether the size of government responds to the efficiency of taxes, we empirically examine (1) the effects of a wartime "budget shock" on the composition of spending, (2) changes in spending by "oil governments" during the 1970's, (3) government responses to grants and aid,

(4) the effects of WWII on U.S. tax efficiency, and (5) the relationship between defense spending and tax efficiency across countries. (1)-(3) indirectly test the hypothesis that government grows in response to greater tax efficiency, while (4)-(5) test directly the claim that bigger government leads to more efficient taxes.

Tests (1)-(3) derive from Proposition IV 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 1940's military expenditures in the U.S. - should decrease (increase) endogenous spending (nondefense 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.

If the entire cross-country correlation between tax efficiency and the size of government were due to reverse causality, then the *composition of government spending* should not be related to the magnitude of the cross-country correlation. According to this view, the *total quantity* of revenue to be raised determines the efficiency of the tax system. In particular, government large for "exogenous" reasons should not be outliers in our Figures 1-3. In contrast, our multi-group analysis predicts that exogenously larger governments rely *more* heavily on inefficient taxes. This is the motivation for tests (4)-(5).

V.B. Budget Shocks and the Composition of Spending: Wartime

Government spending on the military increased sharply during WWII. In real terms[20], government expenditure grew 152% from 1940 to 1944, while government receipts grew 92%. Even as a percentage of GDP, government expenditure grew from 19% to 57%, while government receipts grew from 18% to 24%.[21] The war was not permanent, but the heightened level of government spending lasted more than four years. Government debt was 40% of GDP before the war, and and rose to more than 100% of GDP after the war, so wartime taxation lasted much longer than the 4-5 years of wartime spending (see Barro 1987).

[20]Wartime price controls in the U.S. clearly bias official inflation statistics (see Rockoff (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 Mulligan (1997) for further discussion.

[21]U.S. Council of Economic Advisors (1988).

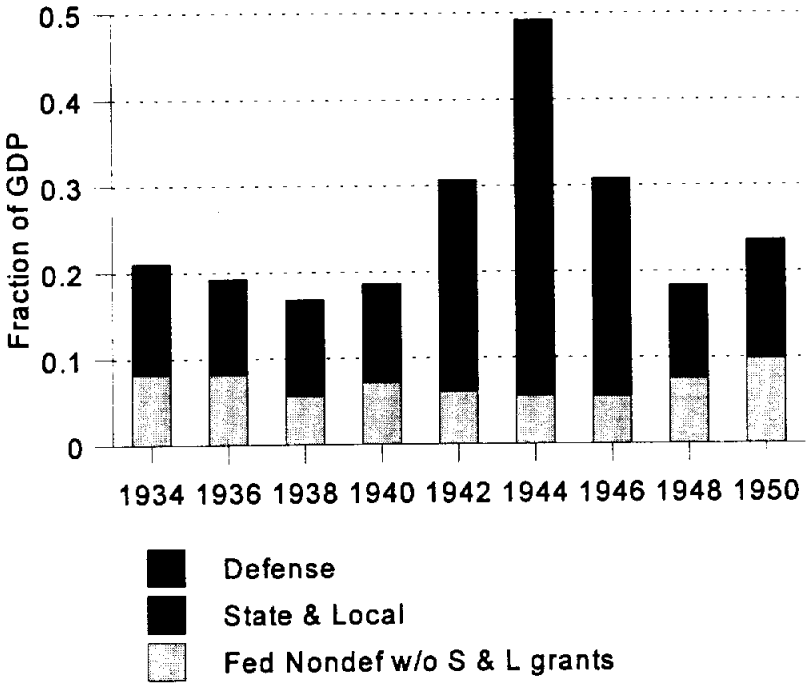


**Figure 4a** Composition of Government Spending, 1934-50 (fraction of actual GDP)

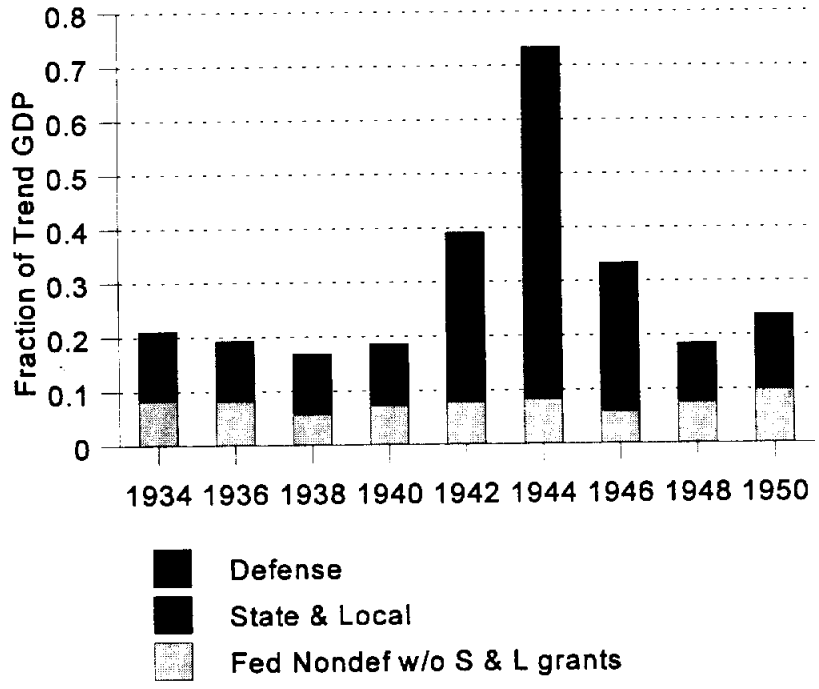


**Figure 4b** Composition of Government Spending, 1934-50 (fraction of trend GDP)

Figures 4a and 4b display the composition of general government spending from 1934-1950 at two 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 4b, which 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.

V.C. Budget Shocks and the Size of Government: Oil Shocks

The sharp increase in oil prices during the 1970's provided governments of oil producing countries with extraordinary revenues (Gelb, 1988). Our analysis predicts that government spending would grow in these countries, by less than the amount of the revenue increase,[22] and that this growth in spending is indicative of the growth in response to a tax reform.

A recent study of non-Social-Security government spending by Videgaray (1997) 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. Videgaray (1997) also finds that most of the additional revenue is used to increase government spending rather than to cut taxes.

Our Figures 5 and 6 display 1972-80 government spending/trend GDP for four OPEC and four nonOPEC oil countries.[23] The figures also display as a benchmark the average size of government in 40 non-oil countries.[24] We see significant increases - between 5 and 15% of trend GDP - in government

[22]For another model of this affect, see Lane and Tornell (1996) who argue that government spending should increase by *more* than the shock to government revenue.

[23]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.

[24]The 40 "nonoil" countries with available data for the years 1972-80 are Australia, Austria, Barbados, Belgium, Chile, Colombia, Costa Rica, Cyprus, Denmark, Dominican Rep, Ethiopia, Finland, France, Germany, West, Greece, Guyana, Iceland, Ireland, Israel, South Korea, Luxembourg,

spending for most of the eight countries during the 1970's.[25]

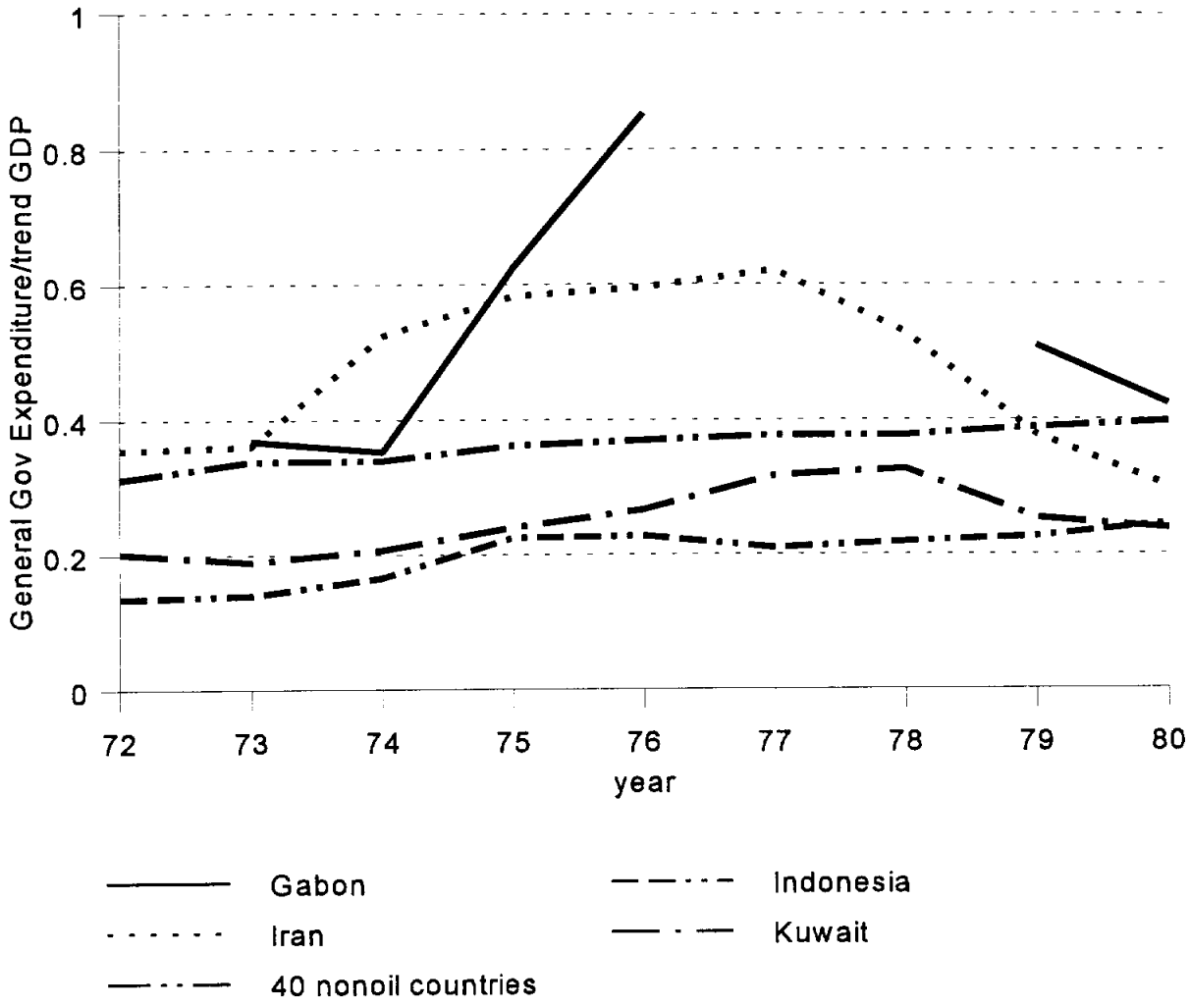


**Figure 5** 1970's Government Spending in 4 OPEC countries (vs. trend GDP)

Malaysia, Nepal, Nicaragua, Norway, Paraguay, Singapore, South Africa, Spain, Sweden, Switzerland, Tanzania, Thailand, Tunisia, Turkey, U.K., U.S., Yugoslavia, Zaire, and Zambia.

[25]Some additional government spending in OPEC countries is associated with the oil industry. Since OPEC countries were supposed to be pumping *less* oil, it is not clear that such spending was "optimal" (Videgaray (1997) separates oil-related government spending from the rest of the budget).

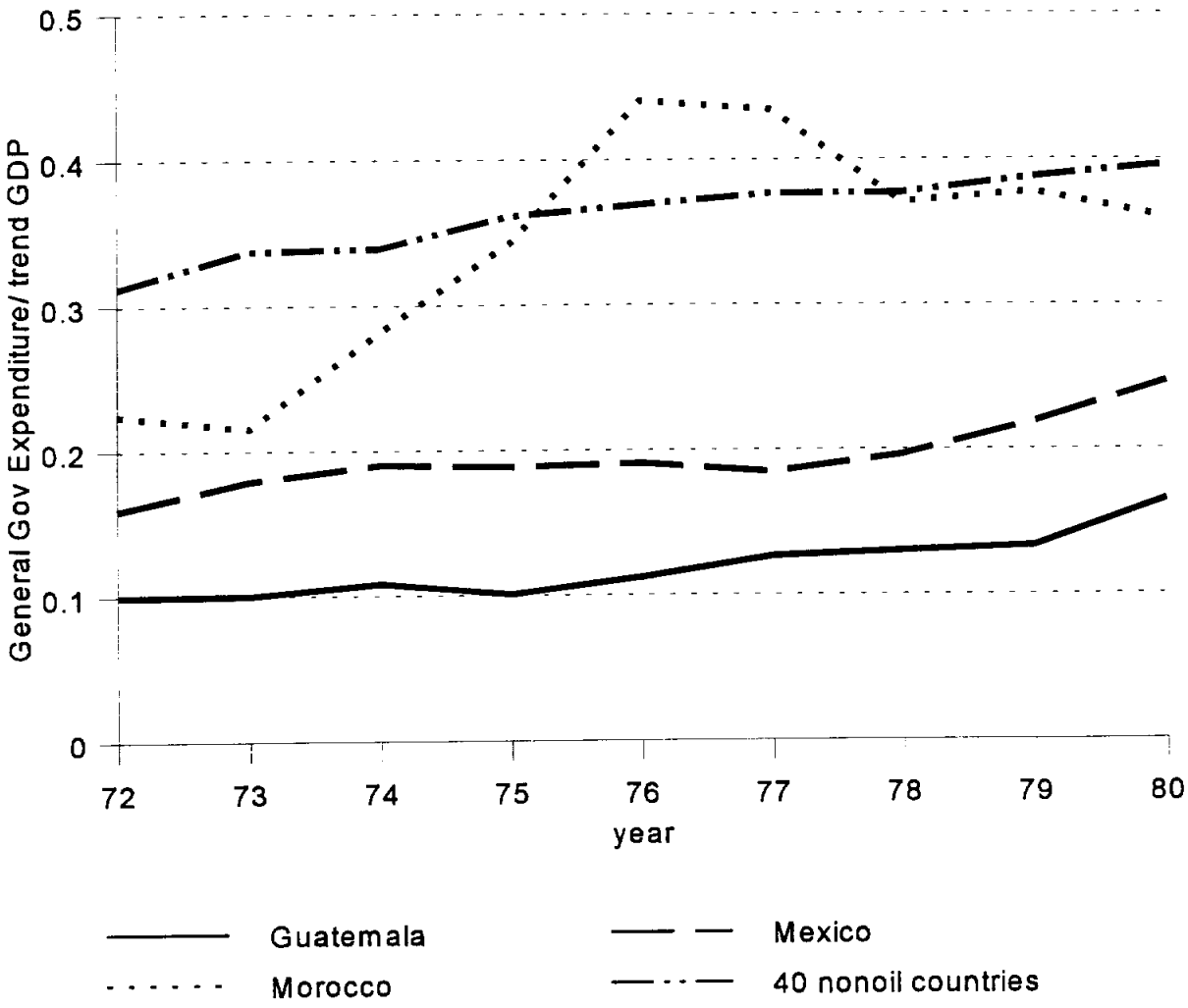


**Figure 6** 1970's Government Spending in 3 nonOPEC oil countries (vs. trend GDP)

V.D. Budget Shocks and the Composition of Spending: Grants to Government

Hines and Thaler (1995) suggest that Federal grants to state and local government can be used to estimate of what they call "the flypaper effect," which is dT/dE in our notation. Their Table 1 surveys ten studies with estimates of dT/dE averaging 0.64 and ranging from 0.25 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.

Another instance of substantial nontax revenue is the aid Israel has received from foreign governments, individuals, and organizations, for that government receives almost 10% of GNP in private and public foreign aid.

Cogan's (1998) study is also related to the "flypaper effect." He finds that, regardless of Social

Security's long-run actuarial position, legislators raise Social Security benefits during times of high short-run Social Security surpluses.

V.E. Tax Efficiency During WWII in the U.S.

Figure 7 illustrates the composition of general U.S. government tax receipts before, during, and after the war. The two relatively efficient tax categories are social insurance and sales taxes. Revenue from both fell as a fraction of total revenue between 1938-40 and 1942-44, and then was fairly stable between 1942-44 and 1946-48. Individual income taxes behaved quite differently: they grew in importance in both periods by even more than social insurance and sales taxes fell. Since individual income taxes are generally considered less efficient than social insurance and sales taxes, these movements away from the latter and toward the former during and after WWII are inconsistent with claims that greater government spending causes governments to move toward relatively efficient taxes.

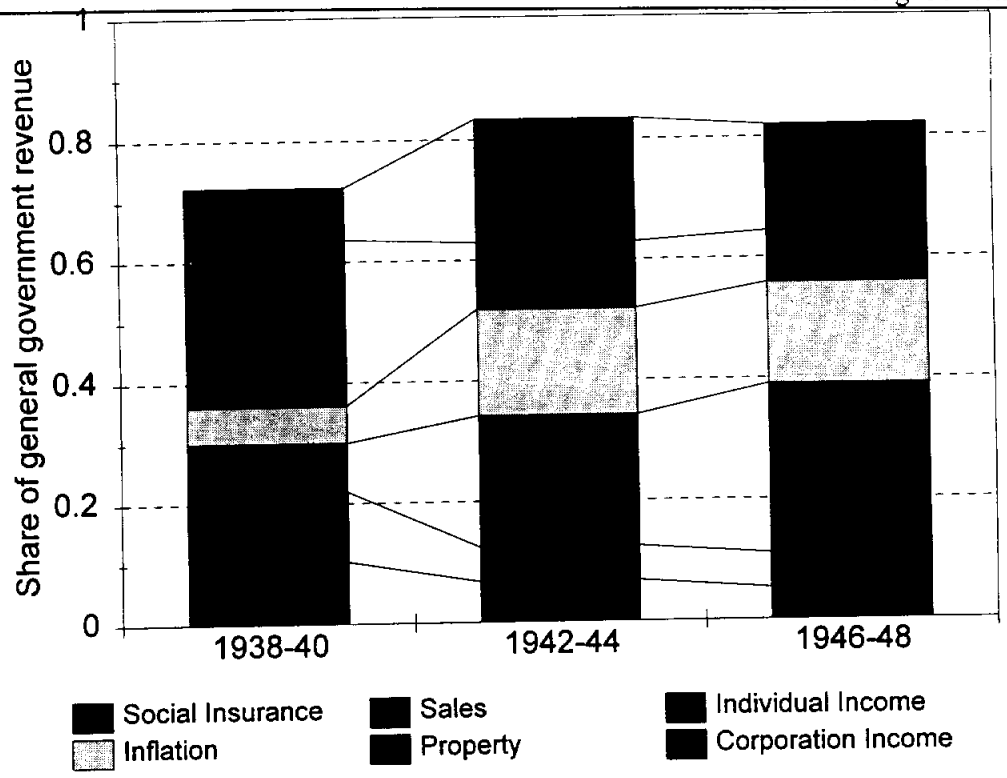


**Figure 7** Composition of Tax Revenue Surrounding WWII

Table 3 constructs measures of tax efficiency, and shows that wartime income taxes were much less efficient than wartime social security (SS) taxes. SS tax rates were very low throughout the 1940's and marginal federal individual income tax (IIT) rates were higher. Yet in 1940, SS taxes brought in twice as much revenue as the federal IIT. Because social security taxes were regressive with few deductions while the Federal IIT was highly progressive with many deductions, this strongly suggests that SS taxes were the more efficient way to raise revenue. Note that the relative wartime decline in the importance of SS taxes was not due to legislative "inertia" since the 1937 Social Security legislation provided for large increases in these tax rates during the 1940's (Miron and Weil, 1997).

Table 3: Efficiency of the Social Security and Federal Individual Income Taxes During the 1940's

| | 1940 | | 1944 | | 1948 | |
|---|---|---|---|---|---|---|
| | SS | IIT | SS | IIT | SS | IIT |
| MTR range | 0-0.02 | 0-0.77 | 0-0.02 | 0-0.91 | 0-0.02 | 0-0.82 |
| average MTR | 0.019 | 0.056 | 0.012 | 0.252 | 0.012 | 0.18 |
| revenue/potential tax base | 0.015 | 0.009 | 0.016 | 0.093 | 0.018 | 0.074 |
| efficiency rating | 0.8 | 0.2 | 1.3 | 0.4 | 1.6 | 0.4 |

Notes: (1) MTR = "marginal tax rate"; SS = "Social Security Taxes (old age only)"; IIT = "Federal Individual Income Tax"
(2) average IIT MTR is income weighted and reported by Barro and Sahasakul (1986)
(3) average SS MTR is income weighted and is computed based on the fraction of AGI that is wages and salaries and the fraction of AGI that is covered by social security and reported to be below the social security cap by Barro and Sahasakul (1986)
(4) "potential tax base" is labor compensation for SS and GNP for IIT.
(5) "efficiency rating" = (revenue/potential tax base)/(average MTR)

Wartime increases in the IIT law did not improve its efficiency very much, as can be seen from the efficiency ratings in Table 3. To compute these ratings, we first take the ratio of actual tax revenue to the "potential" tax base, which we take to be GDP in the case of the IIT, and aggregate wages and salaries in the case of social security taxes. The efficiency ratings divide these ratios by the average marginal tax rate. The most efficient tax - a lump sum tax - would have a rating of $\infty$ because a positive amount of revenue is raised while marginal tax rates are zero. A perfectly "flat tax" with a single rate and absolutely no deductions would have a rating of 1 because (revenue/potential tax base) would equal the MTR. A tax with many "loopholes" and/or a progressive rate structure would earn a rating less than one because (revenue/potential tax base) would be less than the typical MTR. Efficiency ratings increase during the 1940s' for each of the taxes, but the increases are much less than the efficiency gap between the two taxes.

Corporate income and inflation taxes were also used more heavily during and after the war than in the pre-war years. Although a long-term reliance on capital taxes, inflation taxes, and other "capital levies" is highly inefficient, Lucas and Stokey (1983), Judd (1989), and Jones, Manuelli, and Rossi (1993) show that surprise capital levies would be used in an efficient tax system when there are shocks to the government's budget. Wartime inflation might also be efficient since some more income went underground because of price controls and higher income taxes, although much of the underground

economy was a *result* of the use of inefficient taxes. An increase in revenue between 1938-40 and 1942-44 from taxes that seem like capital levies may therefore be efficient and might be the outcome of the political competition in our model. But the wartime reliance on corporate income and inflation taxes also after the war, contradicts the "optimal" capital levy approach.

To summarize, the view that larger government leads to more efficient taxes cannot readily explain why the wartime U.S. raised its personal and corporate income taxes relative to payroll and sales taxes. If bigger governments turn to more efficient taxes, then why, rather than adding "surtaxes," "victory taxes," and "defense taxes" to the personal income tax, didn't the U.S. take the technologically trivial step of adding another line in the withholding section of each worker's paycheck increasing the rate of payroll taxation?

V.F. Tax Efficiency and Defense Spending Across Countries

If causation is from government size to tax efficiency, the *composition* of government spending should not be related to tax efficiency. In our model, however, the relationship between the level of government spending and tax efficiency is weaker when government spending is determined by "exogenous factors," that is, factors other than tax efficiency. We have used defense spending during World War II as one example of exogenous spending; a cross-country analysis provides other good examples.

It seems clear that the extraordinary government spending in Israel (to the extent it exceeds exogenous sources of revenue), for example, results from factors other than tax efficiency. In our view, this means that Israel should be an outlier in our Figures 1-3. According to the alternative view, Israel should not be such an outlier. Although Israel has a very large government, its tax efficiency is pretty average. Israel relies on social security, payroll, and sales taxes for only 22% of its revenue. Israel's tax efficiency measure (ii) is only 0.20, which is smaller than 10 of the other 29 countries we study. Israel has had a VAT tax only since 1976.

The correlation across countries between defense spending and each of our three measures of tax efficiency is negative and very near zero. Also, multiple regressions with tax efficiency (either measure (i), measure (ii), or administrative efficiency) as the dependent variable produce a positive partial correlation with nondefense government spending's share of GDP, but a negative and/or statistically insignifcant partial correlation with defense spending's share. These results offer little support for the view that larger government mainly induce more efficient tax systems, and is more supportive of causation from tax efficiency to government spending.

V.G. Implications of the Empirical Findings for Tax Reform

The first three tests show that government spending does respond to the availability of government revenue, which suggests that some of the cross-country correlation between tax efficiency and the size of government indicates a response of government spending to tax efficiency. The last three tests indicate that exogenous increases in the size of government often do not result in greater tax efficiency, so apparently little of the cross-country correlation reflects a response of tax efficiency to the size of government.

Our analysis of budget shocks can be used to predict the consequences of tax reform for the size of government. Proposition IV implies:

$$-\frac{dT}{d\delta}\Delta'' = \frac{dT}{dE} \quad , \quad -\frac{dT}{d\sigma}\Sigma'' = \frac{dT}{dD}$$

Given estimates of dT/dE and dT/dD from wartime, oil shocks, and other exogenous effects, we need to estimate of $\Delta''$ and $\Sigma''$ in order to compute the derivatives, dT/dδ and dT/dσ, measuring the consequences of tax reform for the size of government. We are unaware of direct estimates of $\Delta''$ and $\Sigma''$ from the public finance literature but, assuming dwcs are approximately quadratic, and that $\Delta'(0) = 0$, $\Delta''$ can be inferred from estimates of $\Delta'$: $\Delta'' = \Delta'/T$. Using this relation, the percentage change in T from either a tax reform of magnitude dδ or a spending reform of magnitude dσ is:

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

$$\underline{\text{spending reform}}\ dT = T(d\sigma/\Sigma')(dT/dD)$$

Section IV.D shows that making the U.S. tax system as efficient as Europe's implies $d\delta/\Delta' = -0.1$. We also point out in that section that $d\delta/\Delta' = -0.2$ or $-0.3$ is consistent with Hall and Rabushka's (1995) description of the benefits of a flat tax. Combined with a European-American average of about T=0.45 and dT/dE = 0.64 (an average across the ten studies surveyed in Hines and Thaler's (1995) Table 1), the predicted changes in government/GDP ratios from the tax reform range from dT = 0.03 ($d\delta/\Delta' = -0.1$) to dT = 0.09 ($d\delta/\Delta' = -0.3$).

## VI. Conclusions and Extensions

VI.A. Relations with Existing Literatures

We argue that efficient tax and spending policies promote the growth of government. Related

arguments appear in the work of Brennan and Buchanan (1980), Buchanan and Lee (1982), Cukierman (1994), Fischer and Summers (1989), Krusell et al (1996), and others. Our analytical framework indicates the conditions under which more efficient tax and spending programs (a) encourage the growth of government and (b) increase the total dwc of government activity. Buchanan and Lee provide an analytical framework using the "leviathan" model of government. But that leviathan model has the unrealistic prediction that governments are "at the top of their Laffer curves." Cukierman (1994) argues that the use of inflation taxes rather than more efficient taxes sometimes reflects an attempt to restrain the growth of government, an effect which we analyze more extensively, and apply to other taxes as well. Fischer and Summers (1989) provide a model implying that a more efficient inflation tax can decrease welfare, and suggest that the basic idea applies to other taxes as well. However, because their analysis does not apply to payroll, VAT and other important taxes. The Fischer and Summers analysis also assumes that policy-makers are not self-interested. Peltzman (1980) and North (1985, p. 391) assign some responsibility for the growth of government to declining tax collection costs, but do not distinguish between average and marginal costs of tax collection; only the later affects the size of government in our model.

We derive several other implications of the basic reasoning that tax efficiency affects the size of government. These additional results include, but are not limited to, 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 can actually increase aggregate dwcs.

Empirically, we show that tax efficiency appears to be related to the size of government in a cross-section of countries. Moreover, we provide some evidence that an important direction of causality is from tax and spending efficiency to the size of government. Other empirical studies in the public choice literature have linked the tax structure to the size of government, although the hypotheses are somewhat different from ours (see Becker and Mulligan 1998 for a review and discussion).

J.A. Stockfisch (1985) studied the growth of government in 12 OECD countries before and after the adoption of VAT taxes, and compares these estimates with the growth of government in 12 OECD countries without VAT taxes over the same time period. As compared to non-VAT countries, government grows slightly faster after the adoption of a VAT, although the estimated effect is small and sensitive to the countries included in the sample. Our model does not necessarily predict that the effects should be large because in most cases VAT taxes replaced other rather efficient taxes such as federal sales or payroll taxes (Aaron, 1981). It takes time for tax efficiency to affect the size of government, which is why the introduction of a VAT should have a larger effect over a decade or two than over the few years

studied by Stockfisch.

VI.B. Utility of Standard Public Finance Analyses of Tax and Spending Programs

In the standard "public interest" analyses of government tax and spending programs, only efficient taxes are used and only spending that is efficient is considered. We show that this analysis overstates the benefits of increasing program efficiency, because of the reaction of the political system. Increasing the efficiency of a tax or spending program can actually decrease the overall efficiency of government activity!

The standard "public interest" analysis can in principle be used to endogenize the size of government, although this is rarely done in the evaluation of tax reforms. There are important differences between the "public interest" and our approach to government spending, although more research is required to derive an exhaustive list of their competing predictions. When the two approaches coincide, our model shows how efficient allocations may be implemented even though "winners" do not compensate "losers."

Our analysis helps to interpret some of the empirical public finance literature. That literature (see, for example, MaCurdy (1992) and the studies surveyed by Hausman (1985)), uses policy "experiments" to estimate the behavioral effects of taxes and subsidies and often concludes that those behavioral effects are small. Since our analysis implies that efficient taxes will be targeted toward groups with the smallest behavioral responses rather than the "representative" groups, we are not surprised that studies exploiting policy variations have found smaller responses to prices then have other studies.

VI.C. Extensions

More work needs to be done to determine the generality of our results from special assumptions about the pressure function F(A,B). We believe that F(A,B) can be derived from voter models, although these models would have to endogenize preferences, where special interests would spend resources to affect "preferences" of the electorate. Further analysis along these lines should help to gain deeper insights into the political process. A lot of politics are hidden by the pressure function, but similar profit and utility functions have been useful in production and household analyses, even though these functions hide considerable engineering, management, and psychological principles. Profit and utility functions have been "opened up" in recent years to principal-agent conflicts, altruistic behavior, and other micro characteristics of households and firms, and eventually that will happen with the political pressure function if it gives enough insights into political decisions. We have tried to show in this paper the variety, importance, and novelty of these insights.

## VII. Appendix I: Cross-Country Sample Characteristics

Table 2: Sample Characteristics

| | 83 country sample | | | |
|---|---|---|---|---|
| | Mean | Std. Dev. | Min. | Max. |
| Total Gov Revenue/GDP, 1973-90 average | 0.297 | 0.124 | 0.096 | 0.610 |
| Measure (i): share of total revenue raised from social security, payroll, and sales taxes, 1973-90 average | 0.226 | 0.159 | 0.007 | 0.673 |
| Log GDP per capita, 1985 $, 1972-89 average | 8.01 | 1.04 | 5.70 | 9.64 |
| | 53 country sample | | | |
| | Mean | Std. Dev. | Min. | Max. |
| Total Gov Revenue/GDP, 1973-90 average | 0.298 | 0.124 | 0.096 | 0.590 |
| Measure (i) | 0.247 | 0.145 | 0.007 | 0.579 |
| Measure (ii) | 0.087 | 0.090 | 0.000 | 0.328 |
| Log GDP per capit | 8.27 | 0.930 | 6.18 | 9.64 |
| Democracy index | 0.676 | 0.296 | 0 | 1 |
| | 32 country sample | | | |
| | Mean | Std. Dev. | Min. | Max. |
| Total Gov Revenue/GDP, 1973-90 average | 0.232 | 0.091 | 0.096 | 0.554 |
| Measure (i) | 0.207 | 0.124 | 0.007 | 0.469 |
| Measure (ii) | 0.036 | 0.042 | 0.000 | 0.201 |
| Log GDP per capita | 7.77 | 0.651 | 6.18 | 8.93 |
| Democracy index | 0.536 | 0.243 | 0.165 | 1 |
| Administrative efficiency | 0.569 | 0.284 | 0.1 | 0.9 |
| Modernization of industry | 0.556 | 0.296 | 0.1 | 0.9 |

| | Years for computing: | | part of sample? | | |
|---|---|---|---|---|---|
| Country | Gov rev/GDP | avg log real Heston-Summers GDP | N = 83 | N = 53 | N = 32 |
| Argentina | 1983-88 | 1972-89 | 1 | 1 | 1 |
| Australia | 1973-90 | 1972-89 | 1 | 1 | 0 |
| Austria | 1973-90 | 1972-89 | 1 | 1 | 0 |
| Bahamas | 1973-82 | 1977-87 | 0 | 0 | 0 |
| Bahrain | 1975-90 | 1985-88 | 1 | 0 | 0 |
| Barbados | 1973-89 | 1972-89 | 1 | 0 | 0 |
| Belgium | 1973-90 | 1972-89 | 1 | 1 | 0 |
| Benin | 1977-79 | 1972-89 | 1 | 0 | 0 |
| Bhutan | 1982-86,88-90 | 1985-85 | 0 | 0 | 0 |
| Bolivia | 1984-90 | 1972-89 | 1 | 1 | 1 |
| Brazil | 1974-87 | 1972-89 | 1 | 1 | 1 |
| Burkina Faso | 1973-86 | 1972-89 | 1 | 0 | 0 |
| Burundi | 1973-81 | 1972-89 | 1 | 0 | 0 |
| Cameroon | 1975-84,86-88 | 1972-89 | 1 | 1 | 1 |
| Canada | 1974-89 | 1972-89 | 1 | 1 | 0 |
| Chile | 1973-88 | 1972-89 | 1 | 1 | 1 |
| Colombia | 1973-89 | 1972-89 | 1 | 1 | 1 |
| Congo | 1973-76,80-83 | 1972-89 | 1 | 0 | 0 |
| Costa Rica | 1973-90 | 1972-89 | 1 | 1 | 1 |
| Cyprus | 1973-90 | 1972-89 | 1 | 1 | 1 |
| Denmark | 1973-90 | 1972-89 | 1 | 1 | 0 |
| Djibouti | 1979-83 | 1972-87 | 0 | 0 | 0 |
| Dominica | 1976-79 | 1985-85 | 0 | 0 | 0 |
| Dominican Rep. | 1973-90 | 1972-89 | 1 | 1 | 1 |
| Egypt | 1975-79,81-89 | 1972-89 | 1 | 1 | 1 |
| Ethiopia | 1973-88 | 1972-86 | 1 | 0 | 0 |
| Finland | 1973-90 | 1972-89 | 1 | 1 | 0 |
| France | 1973-90 | 1972-89 | 1 | 1 | 0 |
| Gabon | 1973-85 | 1972-89 | 1 | 0 | 0 |
| Gambia | 1972-82,90 | 1972-89 | 1 | 0 | 0 |
| Germany | 1973-90 | 1972-89 | 1 | 1 | 0 |
| Greece | 1973-89 | 1972-89 | 1 | 1 | 1 |
| Guatemala | 1973-89 | 1972-89 | 1 | 1 | 1 |
| Guyana | 1972-83,85 | 1972-89 | 1 | 0 | 0 |
| Haiti | 1979-80,82-86 | 1972-89 | 1 | 0 | 0 |
| Hungary | 1981-90 | 1972-89 | 1 | 0 | 0 |
| Iceland | 1973-87 | 1972-89 | 1 | 0 | 0 |
| India | 1974-90 | 1972-89 | 1 | 1 | 1 |

| | | | | | |
|---|---|---|---|---|---|
| Indonesia | 1973-90 | 1972-89 | 1 | 1 | 1 |
| Iran | 1973-90 | 1972-89 | 1 | 1 | 1 |
| Ireland | 1973-90 | 1972-89 | 1 | 1 | 0 |
| Israel | 1973-90 | 1972-89 | 1 | 1 | 1 |
| Italy | 1973-90 | 1972-89 | 1 | 1 | 0 |
| Jamaica | 1975-85 | 1972-89 | 1 | 1 | 1 |
| Korea | 1973-90 | 1972-89 | 1 | 1 | 1 |
| Lesotho | 1973-77,84,86-90 | 1972-89 | 1 | 0 | 0 |
| Liberia | 1974-88 | 1972-86 | 1 | 0 | 0 |
| Luxembourg | 1973-90 | 1972-89 | 1 | 0 | 0 |
| Malaysia | 1973-90 | 1972-89 | 1 | 1 | 0 |
| Malta | 1972-78,80-90 | 1972-89 | 1 | 0 | 0 |
| Mauritius | 1973-90 | 1972-89 | 1 | 1 | 0 |
| Mexico | 1973-89 | 1972-89 | 1 | 1 | 1 |
| Morocco | 1973-87 | 1972-89 | 1 | 0 | 0 |
| Myanmar | 1973-88 | 1972-89 | 1 | 0 | 0 |
| Nepal | 1973-90 | 1972-86 | 1 | 0 | 0 |
| Netherlands | 1973-90 | 1972-89 | 1 | 1 | 0 |
| Nicaragua | 1973-86,88-90 | 1972-87 | 1 | 1 | 1 |
| Niger | 1976-80 | 1972-89 | 1 | 0 | 0 |
| Norway | 1973-90 | 1972-89 | 1 | 1 | 0 |
| Pakistan | 1973-90 | 1972-89 | 1 | 1 | 1 |
| Panama | 1973-90 | 1972-89 | 1 | 1 | 1 |
| Paraguay | 1973-90 | 1972-89 | 1 | 1 | 1 |
| Poland | 1984-88 | 1972-89 | 1 | 0 | 0 |
| Portugal | 1975-89 | 1972-89 | 1 | 1 | 0 |
| Romania | 1980-90 | 1985-85 | 1 | 0 | 0 |
| Rwanda | 1973-80 | 1972-89 | 1 | 0 | 0 |
| Senegal | 1973,75,77-84 | 1972-89 | 1 | 1 | 1 |
| Seychelles | 1985-89 | 1972-89 | 0 | 0 | 0 |
| Singapore | 1973-90 | 1972-89 | 1 | 0 | 0 |
| South Africa | 1973-89 | 1972-89 | 1 | 1 | 1 |
| Spain | 1973-89 | 1972-89 | 1 | 1 | 0 |
| Sri Lanka | 1973-90 | 1972-89 | 1 | 1 | 1 |
| St. Kitts&Nevis | 1985-90 | * | 0 | 0 | 0 |
| St. Lucia | 1978-83,85 | 1985-85 | 0 | 0 | 0 |
| Suriname | 1973-76,84-86 | 1972-89 | 1 | 0 | 0 |
| Sweden | 1973-90 | 1972-89 | 1 | 1 | 0 |
| Switzerland | 1973-84 | 1972-89 | 1 | 1 | 0 |
| Syrian Arab Rep. | 1973-81,86-90 | 1972-89 | 1 | 0 | 0 |
| Tanzania | 1973-81,85 | 1972-88 | 1 | 1 | 1 |
| Thailand | 1973-90 | 1972-89 | 1 | 1 | 1 |

| | | | | | |
|---|---|---|---|---|---|
| Togo | 1977-87 | 1972-89 | 1 | 0 | 0 |
| Tunisia | 1973-90 | 1972-89 | 1 | 1 | 1 |
| Turkey | 1973-81,83-90 | 1972-89 | 1 | 1 | 1 |
| U.K. | 1973-90 | 1972-89 | 1 | 1 | 0 |
| U.S.A. | 1973-90 | 1972-89 | 1 | 1 | 0 |
| Uruguay | 1973-90 | 1972-89 | 1 | 0 | 0 |
| Vanuatu | 1982-89 | 1983-89 | 0 | 0 | 0 |
| Venezuela | 1973-90 | 1972-89 | 1 | 1 | 1 |
| Yugoslavia | 1973-89 | 1972-89 | 1 | 0 | 0 |
| Zaire | 1973-82 | 1972-89 | 1 | 1 | 0 |
| Zambia | 1973-88 | 1972-89 | 1 | 1 | 1 |
| Zimbabwe | 1976-87 | 1972-89 | 0 | 0 | 0 |

*Computed from IMF nominal GDP and converted to $ with IMF exchange rate

## VIII. Appendix II: Comparative Statics of the Basic Model

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

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

$$F_b(A,B)\left[1 - \breve{\Sigma}''\left(F(A,B) - D\right) - \sigma\right] = 1$$

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

$$dF = \frac{J_a(F_a^2 F_b)(\Delta'' dE - d\delta) + J_b(-F_a F_b^2)(\Sigma'' dD - d\sigma)}{D}$$

$$D \equiv J_a(F_a^2 F_b)\Delta'' + (F_{ab}^2 - F_{aa}F_{bb}) + J_b(-F_a F_b^2)\Sigma''$$

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

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