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The political economy of government size

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Abstract

We contribute to the political economy of public-sector growth by integrating the analysis of three essential elements (i) the 'demand' for government stemming from attempts to coercively redistribute as well as from the usual demand for public services, often analyzed in a median voter framework; (ii) the 'supply' of taxable activities emphasized in Leviathan and other models of taxation; and (iii) the distribution of 'political influence' when influence and economic welfare are distinct. We combine these elements in a spatial voting framework, and use the comparative static properties of the integrative model to shed light on the existing literature with emphasis on empirical research.

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1. Introduction

A systematic account of the size of government in democratic countries includes at least three elements. First, there is the 'demand' for government stemming from attempts to use the fiscal system to coercively redistribute as well as from the usual demand for public services. Second, it is necessary to investigate the role of the 'supply' of activities on which taxation may be levied. A third key aspect is the distribution and role of political influence, as distinct from the economic welfare of individual voters.

The first two of these elements have been combined in empirical studies of the growth of government by Ferris and West (1996) and Kau and Rubin (1981, 2002). Estimates of the effect of unequal political influence have been made by Mueller and Stratmann (2003) using a framework that also pays some attention to demand and supply.[1] In this paper, we combine all three factors in an spatial probabilistic voting model. We provide a closed form solution for government size in this integrative framework, and we use the comparative static properties of the model to shed light on the existing literature, especially the empirical side of this large body of work. A comparison of the size of government in the integrative model with less realistic median-voter and Leviathan frameworks helps to outline the contribution of the broader view that we develop.

We begin in section 2 with a selective review of recent literature on the size of government in the light of the demand-supply collective-choice framework, acknowledging other important aspects that are not studied here. The integrative model is developed and solved in section 3. The building blocks of the model are as follows. 'Demand' for government originates from voters with unequal incomes and 'political influence' who want public goods and who also attempt to use the fiscal system to coercively redistribute in their favour. The 'supply' of taxable activities originates with citizens who pay taxes on their market activities only, and who also engage in valuable non-market actions. Thus in addition to the deadweight loss from taxation, political parties take into account the fact that tax revenues vary with the choices that individuals make between market and non-market activities.

Political equilibrium is modelled using a probabilistic spatial voting framework. Here the influence and economic welfare of each voter is distinct, and no single voter or group of

[1] Mueller and Stratmann focus mainly on political influence. Our discussion of their paper assumes that participation in elections and political influence are closely related. See also Bassett, Burkett and Putterman (1999), who identify income with influence in different ways, and consider the effect of influence so defined on transfer payments.

voters is decisive. In section 4 the comparative statics of government size in the integrative model are analyzed and used to comment on selected aspects of the literature. (The progressivity of the equilibrium tax system is examined in an Appendix.) The integrative model is compared with its distinguished predecessors in section 5, and section 6 concludes.

2. A selective review of literature

Early research on the 'demand' for government, including Wagner (1958), Peacock and Wiseman (1967) and Bird (1970), emphasized the role of income, urbanization, and war as determinants of the demand for public services. Income and factors like urbanization lie behind the longest standing theory of the growth of government known as 'Wagner's Law': that the income elasticity of the demand for publicly provided goods and services is greater than one. A large number of differing estimates of this elasticity have appeared over the years, including those by Ram (1987), Gemmel (1990), Tridimas (1992), Kristov and Lindert (1992), Courakis, Moura-Roque and Tridimas (1993) and Borcherding, Ferris and Garzoni (2001), and evidence of an inconclusive nature continues to accumulate.[2]

Following the seminal work of Stigler (1971), Romer (1975), Roberts (1977), and Meltzer and Richard (1981), empirical as well as theoretical research on the demand for government shifted to the analysis of income inequality as a determinant of coercive redistribution. If individual preferences are single-peaked and the issue space over which voting occurs is uni-dimensional, the median voter sets the tax rate, the size of public expenditure (via the government budget restraint) and hence the degree of redistribution, and is usually limited in these respects only by the behavioural responses of the rich to taxation.[3] An increase in the ratio of mean to median income in this framework leads to expansion of the public sector, a result confirmed empirically by Meltzer and Richard (1983)[4]. Expansion of the franchise

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[2] For further discussion, see the surveys on growth of government by Holsey and Borcherding (1997), Peacock and Scott (2000), and Mueller (2003, chapter 21).

[3] Other factors that might limit the degree of coercive redistribution in addition to the disincentive effects of taxation include: whether the median or another percentage of the income distribution is decisive, the exact objectives of the winning coalition, the nature of their political behavior, and the institutions which constrain such policies. See Harms and Zink (2003) and Hillman (2003, Chapter 3) In this paper we focus on the limits to coercive redistribution that result from the disincentive effects of taxation and from the nature of political behavior, as discussed below.

[4] See, however, Peltzman (1980) for a model in which *increasing equality* of incomes, by giving more bargaining strength to members of all political coalitions, leads politicians to promise and deliver more redistribution.

down the income scale has the same effect, as shown in studies by Husted and Kenny (1997) and Lott and Kenny (1999).

In contrast to the median voter framework, Baumol (1967, 1993), Brennan and Buchanan (1980), and Kau and Rubin (1981, 2002) focus on supply issues while downplaying the role of electoral institutions. Several subsequent empirical studies of the size of government or of tax structure, including Ferris and West (1996), Becker and Mulligan (2003), Kenny and Winer (2001) and Kau and Rubin (2002), have investigated the role of the capacity to raise tax revenue as a determinant of the size and structure of the public sector.

As a group, these studies appear to indicate that taxation and the size of government depends on the structure of the economy including, for example, the extent of oil reserves and female labour force participation. Expansion of potential tax bases allows reductions in the full economic cost of raising a given amount of revenue, and also attenuates political opposition by reducing tax burdens relative to the costs of political organization.[5] Kau and Rubin (2002) go so far as to suggest that the major determinant of the growth of government spending in the United States since 1930 is the increased participation of women in the labour force, where they can be taxed, accounting for over 50% of the total change in government revenue.

The role of the distribution of political influence, the third of the key elements that we explore in this paper, has not often been considered directly in the empirical literature on government size.[6] Recently, Bassett, Burkett and Putterman (1999) investigate the relationship between income and the size of transfer payments in a cross section of countries, assuming that political influence and income is positively correlated in various ways. Perhaps their most robust conclusion is that the evidence they consider is consistent with a complicated pattern of political influence rather than with the existence of a decisive median voter.[7]

[5] Political opposition is not of concern to a Leviathan. It does play a role in other models of tax structure such as Kenny and Winer (2001).

[6] It may be noted that it has long been argued in the analytical literature that special interest groups may have a disproportionate effect on the size and growth of the public sector. See, for example, Downs (1957) and Demsetz (1982) among many others. Reviews of this substantial body of work on special interests are provided by Austen-Smith (1997), Grossman and Helpman (2001), Hillman (2003, chapter 9) and Mueller (2003, chapter 20).

[7] Bassett, Burkett and Putterman (1999, p. 216). One should note that some other recent empirical studies have also cast doubt on the ability of a median-voter model to explain the size of government. Using fiscal redistribution data for an international sample of democratic countries, Milanovic (2000)

Mueller and Stratmann (2003) use an international panel data set to show that more political participation - implying that poorer voters take a more active interest in politics - leads to more redistribution and a larger public sector in countries with well-entrenched democratic institutions. They also show that in weak democracies, greater participation does not lead to bigger government, suggesting that politically privileged interest groups can block redistributive policies.[8]

Most of the theoretical and empirical work discussed above is based on frameworks that are incomplete in the following sense. Work on the 'supply' side has, on our reading, downplayed the role of the demand for coercive redistribution, while the literature on coercive redistribution has been hamstrung by the assumption that the fiscal system is essentially uni-dimensional.[9] Moreover, as in all median voter models, no distinction is made between the economic welfare and the political influence of various groups, since one voter is decisive. This is a serious drawback because welfare and influence can evolve in different ways for various reasons as discussed, for example, by Downs (1957). Hinich (1977), Coughlin and Nitzan (1981), Hinich and Munger (1997), Hettich and Winer (1999), Tridimas (2001) and others use the probabilistic spatial voting model to relax both these conditions. However, the details of coercive redistribution and its relation to the size of government have usually been suppressed in such models in the pursuit of other matters. Finally, one may note that despite its success in moving toward a broader perspective, the recent empirical work on the role of political participation is not founded on a well-explored analytical model that includes all of the three elements emphasized here.

There are other important determinants of the size of government besides those acknowledged above, including the nature of the institutions that set the terms within which political competition occurs.[10] Three such arrangements have attracted attention. First, the electoral rule; that is, whether a majoritarian or a proportional representation rule applies (Milesi-Ferreti, Perotti and Rostagno, 2002; Persson, Roland and Tabellini, 2000; Austen-Smith, 2000). Second is the structure of executive–legislative relations including whether

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fails to support the median voter hypothesis concerning the ratio of mean to median income. So too do Gouveia and Masia (1998) in their panel data study of government size in U.S. states.

[8] Weak democracies are defined by Mueller and Stratmann as those that score less than one in the Freedom House evaluation of a country's political rights.

[9] Extension of the median voter model to deal with two dimensions is possible using single-crossing restrictions on individual preferences. This is far from an adequate representation of the complexity of real fiscal systems. See Boadway and Keen (2000) for review of this literature.

[10] See Kirchgaessner (2002) for a review of the empirical literature on the role of institutions.

budgetary decisions are made in a presidential regime characterised by separation of powers, or in a parliamentary regime characterised by dependence on a confidence vote (see, for example, Breton 1996, Persson and Tabellini 1999, and Persson, Roland and Tabellini 2000). A third branch of the literature focuses on the common pool problem that arises when legislators try to deliver benefits to their supporters at the expense of the general taxpayer (e.g., Shepsle, Weingast and Johnson 1981; Inman and Rubinfeld 1996; Baqir 2002; Persson, Roland and Tabellini 2002; and Buchanan and Yoon 2004).

In this paper, we use a spatial voting framework to consider the analytical and empirical implications for the size of the public sector of the interaction of 'demand', 'supply' and 'political influence'. This mixture of elements and of theoretical and empirical work proves to be sufficiently complex on its own, and we leave the incorporation of detailed aspects of governance for further research.

3. Analytical framework

We suppose that individuals vote and make choices regarding market and non-market activity in two interrelated stages. In the first, every individual participates in a political process that results in the level of a pure public good and individualized tax rates. In a second stage, each household takes the fiscal system as given, and chooses among work (market goods), leisure and home production. Decisions at both stages must be consistent with each other in the political equilibrium.

Before beginning as usual with the second stage, it should be noted that the assumption that each voter faces a separate tax rate acknowledges that actual tax systems are complex. Real tax systems differentiate in many ways among taxpayers: multiple tax bases, separate rates for each base, and numerous special provisions such as credits, deductions and exemptions selectively alter the effective rates of tax for many different types of taxpayers. Hettich and Winer (1999) show how this sort of tax structure will emerge in a model of the kind used here when there are administration and information costs that place a wedge between the collection of tax revenues and the provision of public services.

We capture this complex differentiation among taxpayers in a straightforward manner by assuming there is one (distortionary, proportional) tax rate that can be directed towards each individual. This formulation is more realistic than a model, often employed in the literature, where the tax system consists of a linear income tax or a nonlinear tax governed by, say, two parameters as in Cukierman and Meltzer (1991). To incorporate fully the formation of a complete tax structure in the present context - where the emphasis is on the deriving closed form solutions - would complicate the analysis substantially.[11]

3.1 The individual voter/home-producer

Each person *i*, who is a voter, a taxpayer and a home-producer, is assumed to maximise a quasi-linear utility function defined over a private consumption good Z_i, leisure L_i and a publicly provided good G[12]:

$$U_i = Z_i + \beta lnL_i + \gamma lnG. \qquad (1)$$

To account for the possibility of shifts in the taxable capacity of the economy originating from changes in home production (or from informal labour employment), as suggested by Kau and Rubin (1981, 2002), we divide labour supply into two components; formal work in the market place, denoted as a fraction of the day by N_i, which yields an income subject to taxation; and informal work for home production, denoted as fraction of the day by H_i, which is left untaxed. The time endowment constraint requires that

$$N_i + H_i + L_i = 1. \qquad (2)$$

Private consumption goods and services Z_i can either be bought in the market or produced at home. Let Q be the quantity bought in the market at a price P. Home production takes place by using time as the only input under a logarithmic technology. Formally, home production is αlnH, where α is a positive coefficient measuring household productivity. Writing $Z_i = Q_i + \alpha lnH_i$ and using (1), the utility function for person i can be written:

$$U_i = Q_i + \alpha lnH_i + \beta lnL_i + \gamma lnG. \qquad (1')$$

[11] We therefore omit self-selection constraints that arise because of information costs. Including self-selection constraints introduces intractable polynomials in what follows. For a model in which the tax skeleton emerges explicitly in equilibrium in the face of information and other costs, see Hettich and Winer (1999, chapter 4).
[12] The assumption of quasi-linearity simplifies the algebra that follows as it implies that the marginal utility of income is independent of income and only private consumption is subject to the income effect. It has been widely used in recent literature. See, for example, Persson, Roland and Tabellini (2000).

The parameters of utility functions are assumed to be identical for all individuals. Voters do, however, differ in their productivities and, thus, incomes.[13] Denoting the wage rate of voter i by W_i, his or her income is $Y_i = W_i N_i$. Assuming that each voter- home-producer pays a proportional income tax rate t_i , the budget constraint is

$$PQ_i = (1\text{-}t_i)W_i(1\text{-}L_i\text{-}H_i). \tag{3}$$

Maximizing the utility function (1′) subject to (3) yields individual demand functions for market purchases, home production and leisure respectively:

$$Q_i = [(1\text{-}t_i)W_i \text{-}(\alpha+\beta)P]/P, \qquad H_i = \alpha P/(1\text{-}t_i)W_i \qquad \text{and} \qquad L_i = \beta P/(1\text{-}t_i)W_i.$$

Household income and the indirect utility function can then be written respectively as:

$$Y_i = W_i - [(\alpha+\beta)P/(1\text{-}t_i)]. \tag{4a}$$

$$V_i = [(1\text{-}t_i)W_i /P] - (\alpha+\beta) + (\alpha+\beta)lnP + \alpha ln\alpha + \beta ln\beta - (\alpha+\beta)ln(1\text{-}t_i)W_i + \gamma lnG. \tag{4b}$$

For later use, we note that on differentiating the latter two equations with respect to tax rates and the level of public provision, we have that:

$$\partial Y_i /\partial t_i = -(\alpha+\beta)P/(1\text{-}t_i)^2 \quad \text{and} \quad \partial V_i /\partial t_i = -Y_i /P \tag{4c}$$

$$\partial Y_i /\partial G = 0 \quad \text{and} \quad \partial V_i /\partial G = \gamma /G. \tag{4d}$$

From the above expression for Y_i, we see that for $W_i \le W_0 \equiv (\alpha+\beta)P/(1\text{-}t_i)$, the household does not work and, therefore, Y_i=0. Note that as t_i rises so does W_0. Individuals with earning ability below or equal to W_0 will not make any market purchases (Q_i=0) and rely on home production only for their consumption. For ease of exposition in what follows, we assume that $Y_i > 0$ for all taxpayers i, i=1,2,…,I although for some, income may be very low.

[13] Hence when political influence is uniformly distributed, differences in income are politically the most salient characteristic. Generalizing the model to allow for distributions of tastes substantially complicates the framework, and we must leave such generalizations for further research. For an initial attempt to deal with distributions of taste when influence and economic welfare are not distinguished, see Usher (1977).

3.2 Collective choice

There are two parties labelled 1 and 2. Each voter supports one of these parties based on an assessment of which policy platform promises the greater expected utility.

As in Lindbeck and Weibull (1987), Coughlin, Mueller and Murrell (1990a,b) and others, we assume that from a party's perspective, the expected utility of voter *i*, EU_i, is the sum of two factors: the utility generated by its proposed platform, V_i, and the voter's evaluation of the non-policy characteristics of the party, ξ^I which is stochastic.[14] The latter may include an assessment of candidate personalities, of party competency or of the party's reputation for carrying out promises.

Define the non-policy *bias* of *i* in favour of party 1 as $\phi_i^1 = \xi_i^1 - \xi_i^2$.Then from the perspective of party 2, individual *i* will vote for it rather than party 1 if $[V_i(2) - V_i(1)] > \phi^1_i$. In other words, to get a voter on side, party 2 must deliver enough policy-related welfare to overcome the non-policy bias of the voter in favour of the opposition.

If we also assume that the non-policy bias of a voter is thought to be uniformly distributed over the interval $(\phi^j_{min}, \phi^j_{max})$, the probability that individual *i* will vote for party 2 is equal to the probability that φ_i^1 is less than (the deterministic part of) the utility differential generated by the other party:

$$F_i[V_i(2) - V_i(1)] = \theta'_i \cdot \{V_i(2) - V_i(1) - \phi^j_{min}\}, \qquad (5)$$

where F_i is the cumulative distribution function of φ_i and where $\theta'_i = \partial F_i / \partial V_i = 1/(\phi^j_{max} - \phi^j_{min})$ is the sensitivity of the voting probability to a change in individual welfare. In the present framework, it will become clear that θ'_i represents an index of the political influence of voter i on the equilibrium outcome.

The expected number of votes that party 2 maximizes is $EV_2 = \sum F_i$, and EV_1 is equal to $I - EV_2$. Assuming that $V_i(2) - V_i(1)$ lies everywhere within the interval on which φ_i is defined ensures that parties believe that every voter has some positive probability of voting for it, even if that probability may be small. Consequently, no party will com-

[14] Uncertainty can apply at this individual level, or at the level of total expected votes, as in Roemer (2001).

pletely ignore any voter of either type.[15] This last assumption plus the probabilistic nature of voting makes the expected vote function of each party globally continuous in its policy instruments.

Denoting the unit cost of producing the public good by C, the budget constraint facing each party is

$$CG = \sum_i t_i Y_i, \quad i=1,...,I, \tag{6}$$

where t_i is the individualized tax rate.

Given the proposals of the opposition, each party maximizes expected votes EV subject to (6) which yields the following first order conditions for t_i and G, where μ denotes the relevant Lagrange multiplier and the party subscript is omitted for convenience:

$$(\partial F_i/\partial V_i)\,(\partial V_i/\partial t_i) = \mu\,[Y_i + t_i(\partial Y_i/\partial t_i)] \qquad \text{I equations} \tag{7.1}$$

$$\sum_i(\partial F_i/\partial V_i)\,(\partial V_i/\partial G) = \mu C. \tag{7.2}$$

Analogously for the opposition party. Note that in deriving (7.2) it is assumed that the public good does not affect the level of income.

A pure strategy Nash equilibrium in the electoral game, $\{[t_1^1,\ldots,t_I^1,G^1],[t_1^2,\ldots,t_I^2,G^2]\}$, defined by the first order-conditions for each party, exists if after the substitution of all relevant constraints on policy choices, both expected vote functions are strictly concave in each policy instrument for every platform chosen by the opposition. Since the indirect utility function V_i is strictly concave in each t_i and in G, such concavity of F_i in (5) and thus of the expected vote functions is assured.[16]

In this equilibrium policy platforms converge. Strict concavity of the expected vote functions and the fact that from (5), voting depends only on utility differences, means that

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[15] If this were not true, and the probability that some voters will support one of the parties falls to zero, the objective function of the parties will not be globally concave and a vote cycle may occur.

[16] Note that $\partial^2 V_i/\partial t_i^2 = -(\alpha+\beta)/(1-t_i)^2 < 0$ and $\partial^2 V_i/\partial G^2 = -\gamma/G^2 < 0$ and the cross-partial is zero. In more general spatial models, Lin, Enelow and Dorussen (1999) and Lindbeck and Weibull (1987) show that global concavity and hence existence of an equilibrium requires a certain minimum amount of uncertainty (or stochastic heterogeneity) in preferences. In this respect, our key assumption is that $[V_i(2) - V_i(1)]$ lies within the interval on which φ_i is defined. Assuming concavity is essentially the same as the reasonable assumption that each party can choose an optimal platform.

no party gains a lasting advantage by adopting a platform that differs from that of its opposition (see Enelow and Hinich 1989 for proof). Since platforms converge, we may drop the subscripts identifying the party and refer only to the incumbent party or government.[17]

3.3 Electoral equilibrium

A convenient and well-known feature of Nash equilibrium in the probabilistic voting framework is that policy choices can be represented or characterized by maximizing a political support function S (Coughlin and Nitzan 1981; Hettich and Winer 1999, chapter 4):

$$S = \sum_i \theta_i V_i\,, \tag{8}$$

subject to the same budget constraint that faces the political parties, where $\theta_i \equiv \theta'_i / \sum_i \theta'_i$ and $\theta'_i = \partial F_i / \partial V_i$ is the sensitivity of the probability of voting to a change in welfare. Note that $\sum_i \theta_i = 1$, so that $\bar{\theta} = 1/I$. It should be noted that the support function (8) is not a social welfare function: Its linear form and the weights are all determined within the model and not on the basis of an exogenous social norm.

The intuition for the representation theorem is straightforward: Since voters care about their economic welfare, a party that advocates a Pareto-improving platform will advance its electoral chances. Political competition forces the parties to seek out such policies and, in an equilibrium, no such platforms remain to be discovered.[18] This does not mean that all voters will be treated alike, hence the *weighted* sum of utilities in S. In moving towards the Pareto frontier, parties will find it advantageous to give special attention to the demands of voters who are relatively politically sensitive (i.e., whose θ_i is high)[19].

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[17] It will be interesting to revisit the present investigation using a model where parties do not converge, such as that of Schofield (2003).

[18] The efficiency property of the equilibrium can be relaxed by introducing various kinds of decision externalities. (See for example, Hettich and Winer 1999, chapter 6). We do not consider the implications of such inefficiency for the size of government in this paper.

[19] A related formulation of political influence involves dividing the electorate into a finite set of homogeneous groups whose political behavior differs, as in Coughlin, Mueller and Murrell (1990a). We do not engage in this type of aggregation in the present paper, nor do we investigate how the changing composition of interest groups affects the political equilibrium, leaving this for future work.

Using the representation theorem, the first order conditions (7.1) and (7.2) at a Nash equilibrium can be written using (8) as

$$\theta_i(\partial V_i / \partial t_i) \div [\, \partial(t_i Y_i) / \partial t_i] = \mu, \qquad i = 1,2,...,I$$

$$\Sigma_i \theta_i(\partial V_i / \partial G_i) \div C = \mu, \qquad i = 1,2,...,I .$$

The first equation represents the marginal political cost or loss in votes per dollar of tax revenue raised from each taxpayer. The second defines the marginal political benefit or gain in votes per dollar of public expenditure. In a political equilibrium, the marginal political loss will be the same across all taxpayers and equal to the marginal political benefit.

Using the indirect utility function (4b) and the derivatives (4c) and 4(d), the above conditions become:

$$\theta_i Y_i / P = \mu\, [Y_i - P(\alpha+\beta)t_i/(1-t_i)^2)] \qquad \text{I equations} \qquad (9.1)$$

$$\Sigma_i\, \theta_i\, \gamma = \mu C. \qquad (9.2)$$

After rearranging as a quadratic equation, (9.1) becomes $(\theta_i-\mu P)Y_i t_i^2-[(2Y_i(\theta_i-\mu P)-\mu(\alpha+\beta)P^2)\, t_i+(\theta_i-\mu P)Y_i = 0$ or, more compactly, $At_i^2-[(2A-B)]t_i+A = 0$. The solution for t_i is:

$$t_i = \{(2A-B)\pm\sqrt{[(2A-B)^2-4A^2]}\}\div(2A) = \{(2A-B)\pm\sqrt{[B^2-4AB]}\}\div(2A) \qquad \Rightarrow$$

$$t_i = \{(2A-B)\pm B\sqrt{[1-4(A/B)]}\}\div(2A).$$

Using the approximation $\sqrt{(1+px+qx^2)} \approx 1+(p/2)x+(1/2)[q-(p^2/4)]x^2$, with $p = -4$, $x = A/B$ and $q = 0$, we obtain $t_i \approx \{(2A-B)\pm[B-2A-(2A^2/B]\}\div(2A)$, which yields the roots
$t_{i1} = (\mu P-\theta_i)Y_i/\mu(\alpha+\beta)P^2$ and $t_{i2} = 2-[\mu(\alpha+\beta)P^2/(\theta_i-\mu P)Y_i]+[(\theta_i-\mu P)Y_i/\mu(\alpha+\beta)P^2]$ [20]

Before proceeding we check whether a unique economic solution can be obtained. Assuming that $0<t_{i1}<1$, t_{i2} can be a second acceptable solution if also $0<t_{i2}<1$. Noting that $t_{i2}=2+(1/t_{i1})-t_{i1}$, or equivalently, $t_{i2}=-(t_{i1}^2-2t_{i1}-1)/t_{i1}$, after the relevant manipulations we obtain that for $t_{i2}>0$ it must be $0<t_{i1}<1$, and that when $t_{i2}<1$, it must be that

[20] A similar problem of dealing with two roots arises in the work of Meltzer and Richard (1981) and Cukierman and Meltzer (1991)

$t_{i1}>(1+\sqrt{5})\div 2>1$. We can then be certain that when $0<t_{i1}<1$, t_{i2} is not an acceptable root. Therefore in what follows we focus on t_{i1}.

Noting that $\sum_i\theta_i=1$, using the budget constraint (6) and substituting in (9.2) we have that $\mu = \gamma/\sum_i t_i Y_i$. Inserting t_{i1} from the above in this and solving for μ we have that $\mu = [(\alpha+\beta)P^2\gamma+\sum_i\theta_i Y_i^2]/P\sum_i Y_i^2$.

To solve for t_{i1} and G, we then substitute into the expression for t_{i1}, and then use (6) to solve for G. Denoting $\sigma^2_{\theta Y} \equiv$ covariance(θ_i, Y_i^2), $\sigma^2_Y \equiv$ variance(Y_i) and $\bar{Y} \equiv \sum_i Y_i/I$ (the mean value of Y_i), and noting that $\sum_i\theta_i Y_i^2 = (I\,\sigma^2_{\theta Y} + \sigma^2_Y + \bar{Y}^2)$ and $\sum_i Y_i^2 = I(\sigma^2_Y + \bar{Y}^2)$, we have that:

$$t^*_i = \frac{(\alpha+\beta)\gamma P^2 + I\,\sigma^2_{\theta Y} + (\sigma^2_Y + \bar{Y}^2)I(\bar{\theta}-\theta_i)}{(\alpha+\beta)\gamma P^2 + I\,\sigma^2_{\theta Y} + \sigma^2_Y + \bar{Y}^2} \; \frac{Y_i}{(\alpha+\beta)P} \tag{10}$$

$$G^* = \frac{\gamma I\,(\sigma^2_Y + \bar{Y}^2)}{(\alpha+\beta)\gamma P^2 + I\,\sigma^2_{\theta Y} + \sigma^2_Y + \bar{Y}^2} \; \frac{P}{C}\,. \tag{11}$$

In the equilibrium, tax rates depend on: the size and distribution of income, represented respectively by $\bar{Y}$ and σ^2_Y; the number of voters taxpayers I; consumer tastes for leisure β (and therefore indirectly for private goods) and for the public good γ; household productivity in home production α; the political influence of the voter in comparison to the mean political influence, $\bar{\theta}-\theta_i$; the distribution of political influence in relation to the distribution of income, captured by $\sigma^2_{\theta Y}$; and the price of private consumption P.

The provision of the public good G also depends on the same set of factors except for the political weights by themselves θ_i. Given the structure of our model, where G is jointly and uniformly consumed by all voters and utility is separable in G, the political weights do not affect the equilibrium level of public expenditure by themselves - only their covariance with income, $\sigma^2_{\theta Y}$, does. In what follows, special attention is given to the role of the covariance of influence and income which does not enter the median voter analogue to the present model.

It is important to acknowledge that neither (10) nor (11) are reduced form equations since the level of income and its distribution, and the covariance of income and political influence, depend on tax rates and the public good. This aspect of the model must be taken into account in deriving comparative statics and in doing empirical research. Even in the present simplified framework, solving for equilibrium income and then substituting to derive a completely reduced form version of (12) requires dealing with third and higher order polynomials that cannot be solved analytically. The same difficulty applies, for example, to the model of Meltzer and Richard (1983). [21]

It is also interesting to note that, in the optimal tax literature, the analogue of $\sigma^2_{\theta Y}$ is referred to as the covariance of the "social valuation of income" and taxpayer income, and is determined by social justice criteria. In the present setting, $\sigma^2_{\theta Y}$ reflects how voter income and political influence vary in relation to each other, and is determined within the model by voting densities and the factors determining the distribution of income. We are aware that in an even more complex model, this covariance may depend on a variety of institutional and political factors.

4. The relative size of government and implications of the integrative model for empirical research

The relative size of the public sector in the integrative model may be defined as $s \equiv CG / I\bar{Y} = (1/I)(G/\bar{y})(C/P)$ where $\bar{y}$ is average real income. Substituting from (11) and rearranging gives:

$$s^* = \frac{\gamma P(\sigma^2_Y + \bar{Y}^2)}{[(\alpha+\beta)\gamma P^2 + I\,\sigma^2_{\theta Y} + \sigma^2_Y + \bar{Y}^2]\,\bar{Y}} . \qquad (12)$$

[21] Meltzer and Richard (1983, 408) write: "For given productivity and tastes, the decisive voter's choice of the income tax rate determines mean income and the mean-median income ratio and all other endogenous variables follow. When making his choice the decisive voter is aware that he cannot treat the [equilibrium equation] as a quadratic function in the tax rate. The reason is that the ratio of mean to median income and cut-off productivity level depend on the choice of the tax rate." (p. 408). Nevertheless, they solve the quadratic equation for the size of government, and proceed to estimate it using the distribution of income as an (exogenous) explanatory variable.

Here the main determinants of s^* are: consumer tastes; consumer productivity in home production; mean income; income inequality captured by the variance of the distribution of income, σ^2_Y; and political inequality in relation to income inequality as captured by the covariance, $\sigma^2_{\theta Y}$.

4.1 Comparative statics and empirical work

We can now investigate the comparative static properties of (12), as a way of understanding the model and as a basis for drawing out some of its implications for empirical work. Since the fiscal variables and incomes are simultaneously determined, we study the effects of exogenous shocks on the size of government by assuming that changes in mean income, its variance or in the covariance of influence and income leave the structural relations of the model unaffected, so that (12) applies before and after the shock. Such a structure-preserving change may arise from a change in wages (a proxy for skill levels) which are assumed to be exogenous.[22] We do not explicitly solve for the increase in the mean or variance of wages that has the effect of increasing mean income or its variance by given amounts. Doing so requires dealing with third and higher order polynomials which cannot be dealt with analytically.

Differentiating (12) with respect to mean income, we have that:

1. Sign $(\partial s^*/\partial \bar{Y})$ = Sign $\{ [P^2\gamma(\alpha+\beta) + I\sigma^2_{\theta Y})](\bar{Y}^2 - \sigma^2_Y) - (\sigma^2_Y + \bar{Y}^2)^2\} = ?$

The effect of a (structure-preserving) increase in mean income on the size of government is ambiguous: it depends on the relative strength of the taste, inequality and income factors identified here. This result stands in contrast to Wagner's law of increasing state activity: that as per capita income increases, the share of public expenditure in income increases too. The complexity of this comparative static result offers an explanation for the wide variety of often conflicting income elasticity estimates which have been reported in the empirical literature. It is possible that some of the variation arises from the difficulties of controlling for all of the factors that determine the effect of changes in

[22] It is clear from (4a) that given our assumptions about utility and work/leisure opportunities, the mean and variance of income in equilibrium will vary directly with the mean and variance of wages for given taxes.

average income and that play a role in determining the size of government in the present, more general, setting.

2. Sign $(\partial s^*/\partial\alpha)$ = Sign $\{ -\gamma P^2 s^*/ [(\alpha+\beta)\gamma P^2 + I\, \sigma^2_{\theta Y} + \sigma^2_Y + \bar{Y}^2)] \} < 0$

The less productive the household in home production, the larger the relative size of government. This result provides a formalization of the 'supply side' explanation of government growth, proposed in empirical studies by Kau and Rubin (1981, 2002). Technological progress in the formal market sector, which can be interpreted as a fall in α, causes household labour supply in the informal sector to fall and labour supply in the formal sector to increase. This in turn increases tax revenue and reduces the excess burden of taxation; as a result the income tax base available to finance public expenditure increases. One should note also that comparative static result (2), as well as result (3) below, show how redistribution will be limited by the disincentive effects of raising taxation on labour supply.

3. Sign $(\partial s^*/ \partial\beta)$ = Sign $\{ -\gamma P^2 s^* / [(\alpha+\beta)\gamma P^2 + I\sigma^2_{\theta Y} + \sigma^2_Y + \bar{Y}^2)]\} < 0$

That is, the stronger the preference for *leisure*, the smaller the relative size of government. The effect is exactly the same as that when α changes, and for the same reason. Thus if one estimates a non-linear regression equation based on (12), it will not be possible to distinguish whether the parameter on P^2 reflects the technological coefficient by which households “transform” time into output α, or the preference for leisure β. This raises the question of exactly what is captured in empirical studies, such as that of Kau and Rubin, which show that growth of government is strongly related to entry of women into the labour force.[23]

4. Sign $(\partial s^*/\partial\gamma)$ = Sign $\{I\sigma^2_{\theta Y} + \sigma_Y^2 + \bar{Y}^2 \} > 0$

The stronger the preferences for the public good, the larger the relative size of government, since $I\sigma^2_{\theta Y}+\sigma^2_Y+ \bar{Y}^2 = \sum_i \theta_i Y_i^2 > 0$. Hence an increase in the intensity of the taste for the public good will increase the relative size of the public sector, a result which accords well with the intuition of demand theory.

[23] A further difficulty is that working women may *demand* more public services as a substitute for their work at home, such as early child education.

5. Sign $(\partial s^*/\partial P)$ = Sign $\{I\sigma^2_{\theta Y} + \sigma^2_Y + \bar{Y}^2 - (\alpha+\beta)\gamma P^2)\}$ = ?

This result bears on Baumol's (1967, 1993) productivity effect and empirical work that has attempted to investigate its strength. Whether a decrease in the relative price of private consumption, as might follow productivity advance in the private sector that is faster than in the public sector, increases the relative size of government is ambiguous. Here the Baumol effect depends on the strength of political inequality, the variance of income, mean income, the strength of preferences for private and public goods and the productivity of home production.

It should be noted that the way the productivity effect is captured here differs from the standard approach in the literature. Studies of government expenditure growth typically specify an equation of the form $lnG = c_0 + e_P lnP_G + e_Y lnY + ...$ (e.g. Borcherding 1985; Mueller 2003). If the relative price of public services P_G rises (equivalently, P in our model falls) and demand is price inelastic ($-1 < e_P < 0$), then public expenditure grows in relative terms. If growth in income is also taken into account, the relative size of government output will increase when the income elasticity exceeds the absolute value of the price elasticity of demand for G. [24]

In contrast, here the equilibrium price elasticity of G is -1, which is the result of the log-linearity of the utility function (see equation 11), so the productivity effect, if it leads to a larger public sector, cannot work through this elasticity in the present model. Comparative statics result 5 postulates a more complicated relationship between the relative size of public expenditure and the productivity lag than that described in standard demand specifications.[25] Again, as for work on Wagner's Law, and in view of the difficulties of

[24] Assume that labour is the only input into both the private and the public sector and that labour productivity in the private sector rises by r while it does not rise at all in the public sector (that is, $Q_t = e^{rt}L_{Qt}$ and $G_t = L_{Gt}$, where e=the basis of natural logs and t=time). With $W = W_0 e^{rt}$, we have that $P_G = WL_{Gt}/G_t = W_0 e^{rt}$, which rises through time at the rate r, while the price of Q remains constant. Similarly, real income $Q + P_G G = e^{rt}L_{Qt} + e^{rt}L_{Gt}$ rises at the rate r. From $lnG = c_0 + e_P lnP_G + e_Y lnY$ we have that the rate of growth of G is $dlnG = (dG/G) = e_P(dP_G/P_G) + e_Y(dY/Y)$. Hence, $dG/G = (e_P + e_Y)\, r$ which is greater, smaller or equal to zero as the absolute value of e_Y is greater, smaller or equal to e_P. That is, if the income elasticity of demand for government sector output exceeds the absolute value of the price elasticity of demand for government output, the rate of growth of government output exceeds the rate of growth of income and, consequently, the relative size of government will be increasing as the economy grows.

[25] The ambiguity of the effect of a change in the price of public consumption on the size of government has been acknowledged before. Kenny (1978) shows that whether an increase in income will increase the growth of public consumption depends on the strength of the income elasticity of demand and the elasticity of substitution between private and public consumption. In his model, the increase in the price of public consumption is attributed to increasing voter income only, rather than to the broader set of changes in technology and costs identified here, which may occur independently of changes in income.

controlling for all of the factors that determine the effect of changes in relative prices, it is not surprising that empirical estimates of the Baumol effect will vary from study to study.

6. Sign $(\partial s^*/\partial\sigma^2_Y)$ = Sign $\{(\alpha+\beta)\gamma P^2 + I\sigma^2_{\theta Y}\}$ = ?

Whether a mean (and structure) preserving increase in income inequality, which might follow from an increase in wage inequality, increases the relative size of government depends on the relative strength of preferences and productivity in home production and on the covariance of political influence and income.

With $\sigma^2_{\theta Y} \geq 0$, so that influence is distributed in a pro-rich manner, $\partial s/\partial\sigma^2_Y > 0$. A related analytical result - which, however, omits the role of $\sigma^2_{\theta Y}$ - is found by Cukierman and Meltzer (1991) using a median voter model with a tax schedule that is quadratic ($T=-r+tY+aY^2$), and where all taxpayers face the same tax and transfer parameters. Both here and in the earlier model, this result occurs because the equilibrium tax structure is such that as the variance of income increases, the government gets more taxes from the rich than it loses from the poor following a mean preserving increase in income inequality. (This interpretation is supported by the comparison of models in section five).

For values of the covariance such that $\sigma^2_{\theta Y} < -(\alpha+\beta)\gamma P^2/I$, *then* $(\partial s^*/\partial\sigma^2_Y) < 0$. In this case, politically influential and now poorer voters use their influence to insure that the public sector does not divert income away from their consumption of desired privately supplied goods. Accordingly, as the condition above indicates, the stronger the taste for public goods (γ), the more pro-poor must the distribution of political influence be for this particular result to hold.

Cross-national regressions of the effect of inequality on size of government (see, for example, the regression in Bjorvatn and Cappelen (2003) for a sample of OECD countries) show that more inequality, as measured by the pre-tax income GINI coefficient, is associated with *smaller* government.[26] (Here one immediately thinks of the United States which has a relatively high GINI and also a relatively small *s*). The sign of the coefficient on the income GINI could be a reflection of the comparative static result

[26] In the model used here, the variance of incomes arises naturally as a measure of inequality, rather than the GINI coefficient, even though the latter is a better measure.

for σ^2_Y with sufficiently small $\sigma^2_{\theta Y}$. This explanation requires that all or most countries in the sample have similar pro-poor distributions of influence.

A quite different and perhaps more likely explanation for the regression result is that countries with more unequal income distributions also have more pro-rich distributions of political influence. In this case, the income GINI in a cross-section of countries may just be a proxy for the role of the covariance of income and influence, which is discussed immediately below.

7. Sign $(\partial s^*/\partial\sigma^2_{\theta Y}) =$ Sign $\{ -\gamma P(\sigma^2_Y + \bar{Y}^2)I \} < 0$

The more unequal the distribution of political influence *in relation to* the distribution of income, the higher the relative size of government.[27] This effect is stronger the greater is the variance of incomes because of the interaction of income inequality, tax structure and government size reflected in result 6. The role of the covariance of influence and income is not at all surprising, but it cannot be revealed in a median voter framework, where one voter is politically decisive, and it is useful to remember this when studying growth in government in situations where political influence is skewed or where its distribution is changing.

For example, let us compare two states. In the first state there is complete political equality, so that the distribution of political power is independent of the distribution of income and hence $\sigma^2_{\theta Y} = 0$. In the second the political arrangements have redistributed power in favour of the lower income groups, so that $\sigma^2_{\theta Y} < 0$. Our model predicts that the latter state will be characterised by a larger public sector as a result of the greater extent to which lower income voters use the fiscal system to coercively redistribute in their favour. Result 7 thus replicates analytically the empirical regularity documented in the work of Mueller and Stratmann (2003) that the size of government rises with political participation, assuming that such participation involves greater numbers of the poorer voters engaging in political activity. It is also consistent with the work of Husted and Kenny (1997) and Lott and Kenny (1999) on the effects of the extension of the franchise.

Despite its importance, empirical measurements of the relationship between income and political influence are not widely available. The use of political participation as proxy for

[27] The caveat concerning the structure-preserving nature of the change applies here too.

influence by Mueller and Stratmann (2003) represents one possible solution. Rutherford and Winer (1991) and Hotte and Winer (2001), who were among the first to focus on the problem of distinguishing between economic welfare and political influence in spatial voting models, measure influence by calibrating weights on different groups in a political support function. In this setting, measurement depends on the assumptions about how individuals are aggregated into interest groups. Despite the difficulties, dealing with the covariance between welfare and influence is something with which empirical research on the public sector has to cope.

Considering results 6 and 7 together suggests that empirical work, whether using cross-section, time series or pooled data should include both a measure of the distribution of income as well as a measure of the covariance of influence and income (or political participation) in the *same* regression for the size of government. To our knowledge, such work has not yet been attempted.

Finally, we turn to a complication in the analysis of comparative static results 6 and 7 that is not explicitly reflected in the present model. With the exception of the case where income and political influence are distributed independently, a structure-preserving change in income inequality within a country will also involve a change in $\sigma^2_{\theta Y}$.[28] Since the equilibrium size of government depends both on income inequality and on how income varies in relation to political influence, a change in the variance of income will thus affect the size of government through two routes: a direct route captured by result 6, and an indirect route operating through result 7.

It is instructive to trace the full effect of a change in income inequality allowing for this complication. Assuming first $\sigma^2_{\theta Y} > 0$, a mean preserving fall in σ^2_Y will decrease the size

[28] This can be seen from the relevant formulas for variance and covariance, $\sigma^2_Y = (\sum_i Y_i^2 / I) - \bar{Y}^2$ and $\sigma^2_{\theta Y} = (\sum_i \theta_i Y_i^2 / I) - (\sum_i \theta_i / I)(\sum_i Y_i^2 / I)$, where the political weights remain constant as the distribution of Y_i changes. It is probably best shown by using a numerical example. Let us suppose a three-voter economy, where the poor are more sensitive politically (this is the most complicated case). The incomes and respective political weights (Y_i, θ_i) of the three voters are assumed to be (5, 0.5); (8, 0.3) and (14, 0.2). The corresponding income variance and income – influence covariance are $\sigma^2_Y = 14$ and $\sigma^2_{\theta Y} = -8.05$. Consider a mean preserving increase in the variance of income, so that the income – influence pairs become (4, 0.5); (8, 0.3) and (15, 0.2). It is easily checked that the resulting income variance and income – influence covariance become $\sigma^2_Y = 20.66$ and $\sigma^2_{\theta Y} = -9.82$, so that the mean preserving increase in the variance of income is followed by a fall in the covariance of income and influence. Since the political weights are endogenous they may also change as the distribution of income varies, so that the final effect on the covariance may differ from that suggested by the numerical example. The latter, nevertheless, does not negate the predicted change in $\sigma^2_{\theta Y}$ following the change in σ^2_Y.

of government (the 'direct' effect, due to the connection between the variance of incomes and tax revenues). But the fall in the variance implies that the covariance of incomes and influence decreases as influence and income is reshuffled among the same voters, leading to an 'indirect effect': at each level of influence, people find their interests have now changed and the parties will respond accordingly by increasing government size.

Similarly, assuming a sufficiently negative covariance ($\sigma^2_{\theta Y} < -(\alpha+\beta)\gamma P^2/I$), a mean preserving fall in σ^2_Y will increase the size of government via interaction with tax structure and revenue, and will also reduce the absolute value of the covariance of influence and income which tends to decrease the size of government in this case. These combined effects of a change in income inequality on the equilibrium size of government under the different assumptions are summarised in Table 1.

Table 1. The effects of income inequality on the size of government

Assume	$\sigma^2_{\theta Y} > 0$					
Then as	$\sigma^2_Y \downarrow$	$\Rightarrow$		$\Rightarrow$	$s^*\downarrow$	(direct effect – result 6)
		$\Rightarrow$	$\sigma^2_{\theta Y}\downarrow$	$\Rightarrow$	$s^*\uparrow$	(indirect effect – result 7)
Assume	$\sigma^2_{\theta Y} < -(\alpha+\beta)\gamma P^2/I < 0$					
Then as	$\sigma^2_Y \downarrow$	$\Rightarrow$		$\Rightarrow$	$s^*\uparrow$	(direct effect – result 6)
		$\Rightarrow$	$\lvert\sigma^2_{\theta Y}\rvert\downarrow$	$\Rightarrow$	$s^*\downarrow$	(indirect effect – result 7)

In both cases the two effects oppose each other, and whether the final outcome will be an increase or decrease in the size of government becomes in practice an empirical issue.[29] The empirical consequences of the relationship between the distributions of income and of influence are not known.

5. Comparison with the median voter and Leviathan

To provide additional insight into the contribution of the integrative model, we compare it

[29] Basset, Burkett and Putterman (1999) have also considered these two effects informally in their empirical work. In terms of our model, their argument supposes a positive covariance between income and political influence and assumes that income equality increases. We can see from Table 1, that these assumptions imply that there are then two opposing factors in operation.

with two of its distinguished predecessors.

Since the present framework is one of multi-dimensional policy choices, the median voter theorem is not applicable. In order to get around this problem and compare the integrative model with the median voter and Leviathan, two of the most widely used models in the literature, we simplify the probabilistic framework by assuming that there is a single income tax rate and a single level of public expenditure so that we can apply the median voter theorem. This simplification rules out any relationship between the variance of incomes and tax revenues discussed earlier. As we shall see, it still leaves considerable differences in structure between the models.

With one tax rate, the budget constraint of the government is now

$$CG = \sum_i tY_i \,, \quad i=1,...,I \,. \qquad (5')$$

Here the tax rate t is also equal to the relative size of government; $t = CG/\sum Y_i$. In the probabilistic voting setting, the equilibrium can again be determined by maximizing $S=\sum_i \theta_i V_i$, subject to (5′). Working in a manner similar to the one described above, after the relevant manipulations, we obtain the simplified probabilistic voting equilibrium tax rate as

$$t^* = \frac{\gamma P \bar{Y}}{(\alpha+\beta)\gamma P^2 + I\sigma^2_{\theta Y} \bar{Y} + \bar{Y}^2} \,, \qquad (13)$$

where this time $\sigma^2_{\theta Y}$ is the covariance between θ_i and Y_i. Thus the politically optimum income tax rate, and thus the relative size of public expenditure, depends positively on the consumer tastes for the public good, and negatively on the parameters of taste for leisure, the productivity in home production and the covariance between income and political power. The latter implies that in electorates where the rich have more political influence than the poor, the income tax rate will tend to be lower and vice versa. Here the effect of an increase in mean income is ambiguous, since sign $(\partial t^*/\partial \bar{Y})$ = sign $(\gamma P[\gamma(\alpha+\beta)P^2 - \bar{Y}^2)$. All these results are identical to those obtained from equation (12).

In contrast to the multi-tax rate setting, however, the equilibrium tax rate here is independent of the variance of income σ^2_Y, since this variance cannot be taken into account in the setting of a single rate.

It is interesting to note that it is not possible to establish whether the size of government will be higher when the tax system discriminates among taxpayers, or when there is a single flat rate, except when there is no correlation between influence and income. Assuming that mean income is the same under the full and simplified versions of the probabilistic model[30], upon comparison of equations (12) and (13), we find that (where $v^2_{\theta Y}$ is the covariance between θ_i, and Y_i^2 from equation (12))

$$\text{sign}\,\{s^* - t^*\} = \text{sign}\,\{[(\alpha+\beta)\gamma P^2 + I\ \bar{Y}[\sigma^2_{\theta Y}(\sigma^2_Y + \bar{Y}^2) - \bar{Y}\, v^2_{\theta Y}\},$$

which cannot be signed unambiguously. If income and influence are independent, then a situation with the more complex tax system will clearly lead to a larger public sector. But this sort of independence would be unusual in democratic societies.

Now we derive the median voter analogue to (13). The Condorcet winner maximises the utility function of the median voter V^M, subject to the budget constraint (5′). In the present model, there is an one-to-one relationship between voter income and the tax rate that maximises voter utility: $t^i = \gamma P\ \bar{Y}/[(\alpha+\beta)\gamma P^2 + \bar{Y}Y^i]$.

If the median voter has median income, the median voter analogue to (13) is

$$t^M = \frac{\gamma\, P\ \bar{Y}}{(\alpha+\beta)\gamma P^2 + \bar{Y}Y^M}\,. \tag{14}$$

Although the variance of income does not enter as in (13), its skewness as represented by the ratio of mean to median income does matter. An increase in mean income relative to a given median leads the decisive voter to choose an increase in taxation and public expenditure in order to coercively redistribute in his or her favour. Moreover, and contrary to (13), the sign of $(\partial t^M/\partial\ \bar{Y})$ = sign $(\gamma^2(\alpha+\beta)P^3)$ is unambiguously positive as is required for Wagner’s law.

[30] Again we note that solving out for the tax rates in each case is not possible here, since doing so involves solving polynomials of third degree.

Assuming that mean income is the same under both the probabilistic – single tax rate equilibrium and the median voter equilibrium[31], by comparing (13) and (14) we see that

$$t^M \geq t^* \quad \text{when} \quad \gamma P\ \bar{Y}^2[(\bar{Y}-Y^M) + I\sigma^2_{\theta Y}] \geq 0 .$$

Since in practice the distribution of income is positively skewed, $\bar{Y} > Y^M$. Thus the above expression implies that when the rich have more political influence than the poor, or when income and political influence are distributed independently of each other ($\sigma^2_{\theta Y} \geq 0$), the median voter equilibrium involves a higher tax rate and a correspondingly larger public sector than in the comparable probabilistic spatial voting equilibrium. The reason is that when the rich wield relatively more political influence, they protect their wealth by securing a lower tax rate and government size than would have prevailed if the preferences of the (poorer) median voter were decisive. Once again we see the difference between a model where one voter is decisive, and one where political influence is effectively spread more widely in the electorate.

5.2 C*omparison with Leviathan*

To complete the comparative analysis, we derive the equilibrium tax rates that would prevail under a Leviathan-type government and compare this equilibrium with that of the probabilistic and median voter models. A Leviathan government is defined as one which sets tax rates (one for each person) at the levels which maximise revenue. The government is only constrained by consequences of taxation for the size of the tax base. Existence of an equilibrium is not an issue in this framework.

If Leviathan can discriminate perfectly between different taxpayers, its maximisation problem is formally expressed as choosing the t_i values which maximise $R = \sum_i t_i Y_i$. Differentiating tax revenue with respect to each tax rate, recalling that Y_i is endogenous in t_i, and assuming for convenience that tax bases are independently determined, we obtain that for each i[32]

[31] The caveat of the previous footnote applies again.
[32] Note that Leviathan in the present context will never operate on the backward bending part of any Laffer curve.

$$t^L_i = \frac{Y_i}{(\alpha+\beta)P} . \qquad (15)$$

Given the separability between private consumption and public goods in the utility function (1), the labour supply function is independent of γ, so that Leviathan tax rates are independent of consumer tastes for the public good.

The relative size of Leviathan, $s^L = \sum_i t_i Y_i / \sum_i Y_i$, is:

$$s^L = \frac{\sigma^2_Y + \bar{Y}^2}{(\alpha+\beta)P \ \bar{Y}} . \qquad (16)$$

s^L is increasing in mean preserving changes in income variance, but ambiguous in the level of mean income. Assuming again identical mean incomes for the probabilistic and Leviathan equilibrium, comparison of equations (12) and (16) yields

$$\text{Sign } (s^L - s^*) = \text{sign}\,\{(\sigma^2_Y + \bar{Y}^2)(I\sigma^2_{\theta Y} + \sigma^2_Y + \bar{Y}^2)\} > 0,$$

which implies sensibly that the relative size of the public sector is larger under Leviathan than in a competitive political system.

If a single flat tax rate is somehow imposed on Leviathan, as Buchanan and Congleton (1998) recently propose, its problem then is to choose the value of t which maximises $R = t \sum_i Y_i$. After the relevant manipulations this problem yields

$$t^L = \frac{\bar{Y}}{(\alpha+\beta)P} . \qquad (17)$$

In this case, the size of government varies positively with the size of mean income and is independent of income inequality. When one rate is somehow imposed, Leviathan cannot make use of the relationship between the distribution of income, tax structure and total revenue. As a result, $t^L < s^L$.

Finally, comparing equations (13), (14) and (17), and assuming average income is the same across models, we see that $t^L > t^M > t^*$. Of course since Leviathan always imposes a higher tax rate than will occur in either the median voter or the probabilistic voting models, and higher rates reduce income, the full equilibrium rates will be closer together than is implied by this comparison at a common average income.

Our comparative analysis of government size in the different models when there is only one tax rate is illustrated in Figure 1. The figure represents an approximate comparison of the models because equilibrium average income and the Laffer curve is assumed to be the same in each case. (Full equilibrium outcomes will be closer together than shown.) The figure also records the positive effect of an increase in the variance of income on the size of government in the probabilistic and Leviathan models when tax systems are complex and the covariance of income and influence is positive in the spatial voting model.

6. Concluding remarks

The size of government and the structure of taxation jointly depend on the traditional demand for publicly provided goods, coercion exercised under majority rule, the supply of taxable activities and the distribution of political influence, as well as the on the nature of legislative and other institutions.

In this paper we set issues of governance aside, and combine 'demand', 'supply' and 'political influence' in a spatial voting framework of the size of government and the strcuture of taxation. We draw out some of the implications of this integrative model for the interpretation of extant analytical and empirical results.

In contrast to the median voter model in the Meltzer and Richard (1981, 1983) tradition, which is now fading from use due to the limitations of its uni-dimensional issue space, all three moments (mean, variance and skewness) of the distribution of income matter in the integrative spatial voting model we explore. In particular, the variance affects the relative size of the public sector because of a relationship between this second moment, the structure of taxation and total tax revenue. In comparison to probabilistic models of fiscal systems such as that of Hettich and Winer (1988, 1999), the present study extends this mode of inquiry to explicitly deal with coercive redistribution, showing how the covariance of income and political influence arises as a factor determining the size of the fiscal system.

Even in the simple framework we have constructed, where several assumptions are made to permit the derivation of closed form solutions, the size of government is a complex phenomenon. In the integrative model, the relative size of the public sector depends on preferences for leisure and public goods and productivity in home production as well as on the moments of the distribution of income. The role of the covariance of influence and income, which cannot arise in a median voter world, is especially interesting. We know little about the empirical importance of this factor.

From the perspective provided by this framework, it is not surprising that studies which make use of data from different political jurisdictions, and which do not control for all of the factors studied here, reach various conclusions regarding Wagner's law, the Baumol effect or the effect of skewness in the distribution of income. There appears to be ample room for additional empirical work accounting for the role of all of the factors underlying the growth of government that are identified here.

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Appendix: The progressivity of the equilibrium tax system

To complete the analysis of the integrative model, we investigate the nature of equilibrium tax progressivity in this Appendix. Tax progressivity here differs from that in a median voter model at least because the tax system is of high dimension. It differs from that in a Leviathan framework because the distribution of political influence plays an important role along with the nature of taxable activities.

The income tax system which emerges in the political equilibrium (10) is one in which marginal tax rates t_i for each taxpayer i depend on the level of his or her earned income Y_i. For each taxpayer the tax payment may be written as $T_i = [t_i^*(Y_i)]Y_i$, where $t_i^*(Y_i)$ is given by equation (10). The individual average tax rate then is $ATR=t_i^*(Y_i)$, and the marginal tax rate in equilibrium is $MTR=2t_i^*(Y_i)$. (To derive this last result, we use equation (10) and its derivative with respect to Y_i.) Hence for each taxpayer, the marginal rate exceeds the average rate, implying that the set of rates, viewed as an income tax *system*, is progressive. An interesting question is: how progressive? That is, how does the marginal rate for the system change with income?

Define the progressivity of the marginal tax rate ($PMTR_i$) as the rate of change of the marginal tax rate with respect to income, that is, $PMTR_i \equiv \partial[t_i^*(Y_i)]/\partial Y_i$. From equation (10) we obtain that (where for simplicity we divide by 2):

$$PMTR_i = \frac{(\alpha+\beta)\gamma P^2 + I\sigma^2_{\theta Y} + (\sigma^2_Y + \bar{Y}^2)I(\bar{\theta} - \theta_i)}{[(\alpha+\beta)\gamma P^2 + I\sigma^2_{\theta Y} + \sigma^2_Y + \bar{Y}^2](\alpha+\beta)P} \quad . \qquad \text{(A1)}$$

Other things being equal, the expression in (A1) reveals that the degree of progressivity of the marginal tax rate, for each individual, will vary with the pattern of the relation between the income of the taxpayer and his or her relative political weight.

For situations in which $\theta_i = \bar{\theta}$ for all i, and hence where $\sigma^2_{\theta Y} = 0$, (A1) shows that there will be no marginal rate progressivity, though the marginal rate will still be greater than the average rate. This case is of special interest, because it indicates that marginal rate progressivity of some sort, possibly quite complicated in pattern, is to be expected in the present framework.

Assuming influence rises with income ($\sigma^2_{\theta Y} > 0$), for taxpayers with political influence below the mean influence, that is for $\theta_i \leq \bar{\theta}$, it will be unambiguously that $PMTR_i > 0$. For $\theta_i > \bar{\theta}$, the degree of marginal rate progressivity will decline with income since $\partial PMTR_i/\partial(\bar{\theta} - \theta_i) < 0$. This is a situation that is more favourable to the rich, who use their influence accordingly and, in this case, income and marginal rate progressivity are inversely related and the pattern of tax rates is certainly complex.

Suppose instead that the highest influence is possessed by the individual with the lowest income, and so on, implying that as Y_i declines, θ_i rises, and so $\theta_i < \bar{\theta}$, for $Y_i > \bar{Y}$ and $\sigma^2_{\theta Y} < 0$. In equilibrium (A1) indicates that these circumstances generate marginal tax rates which are increasing in income. Thus we see again the importance of the covariance of influence and income in determining the structure of the fiscal system.

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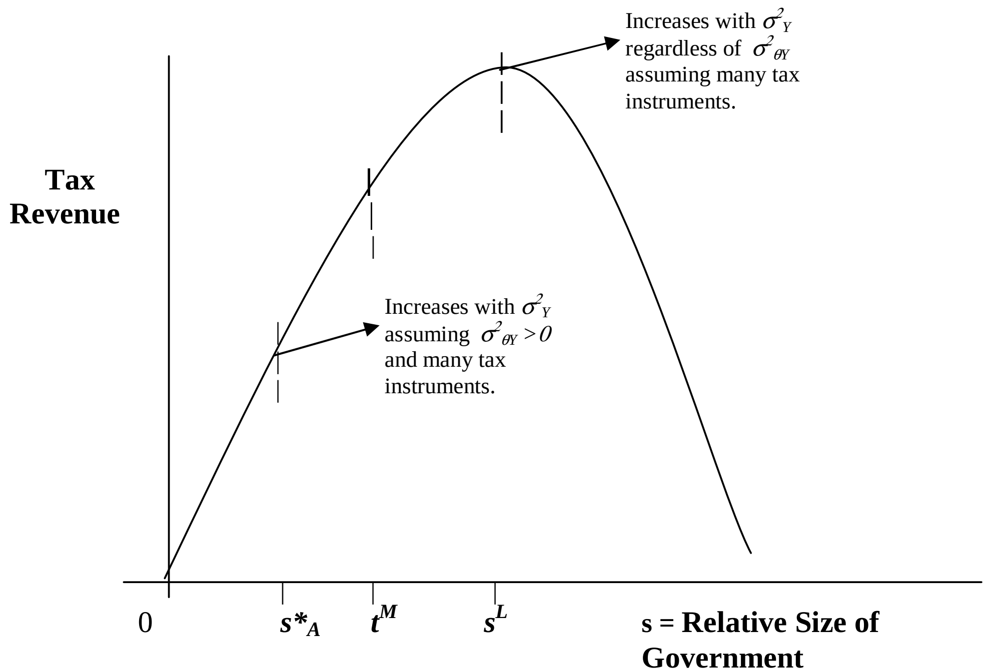
Figure 1
Comparison of probabilistic voting, median voter and Leviathan equilibria



s = the proportional income tax rate if there is only one tax instrument.

s^*_A: Single tax rate, probabilistic voting equilibrium when the covariance between income and political influence is $\sigma^2_{\theta Y} = \sigma^2_A > 0$. If there are many tax instruments, s^* is increasing in the variance of income σ^2_Y.

t^M: Median Voter equilibrium assuming $\sigma^2_{\theta Y} = \sigma^2_A > 0$. t^M is independent of σ^2_Y.

s^L: Single tax rate Leviathan equilibrium. If there are many tax instruments, s^L is increasing in σ^2_Y regardless of $\sigma^2_{\theta Y}$.

Note: All equilibria drawn on the assumption that mean income is the same under the three different models of political equilibrium. Full equilibrium rates will be closer together than shown.