



## Political equilibrium and the provision of public goods

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**Abstract.** This paper treats interest groups – people in their role as consumers of a public good and people in their role as taxpayers – as the unit of account for representative voting. Each group is allowed to make an effort to support its preferred candidate and, at the margin, the effort-benefit ratio is the political price the group is willing to pay to secure an additional dollar of benefits.

Under reasonable assumptions, a unique equilibrium is assured and its characteristics are quite intuitive. In particular, the marginal political benefit (from consumers) of the last unit of output must equal the marginal political cost (from taxpayers). Alternatively, the rate at which the politician can transform taxpayer income into consumer surplus must equal the ratio of their political prices. The result will be optimal only on the rare occasion when the effort-benefit ratios of the two groups are equal.

Since political goals are themselves “public goods” for the two interest groups, they face all the normal free rider problems. Moreover, even small differences in the effort-benefit ratios of the two groups lead to large welfare losses.

How bad can things get? Each group has an incentive to try to overcome free-rider problems and divert resources from private sector activities to politics. And any increase in political effort is always rewarded. However, (1) the marginal return is always higher for the group with the smaller effort-benefit ratio; (2) the differential return between the two groups grows the further we stray from optimality; and (3) both groups face diminishing returns. These incentives may act as natural checks on political outcomes – placing some limit on the amount of waste and inefficiency democracy is likely to produce.

The influence of a producer (of the public good) group that collects a rent increases the likelihood that public goods will be overproduced. In fact, it is conceivable to have a good with no value to consumers produced, solely because of the influence of producers. Comparative static analysis reveal that the political system will respond to changes in market conditions in a way similar to economic markets. The magnitude of these shifts differs from economic markets, however. For goods that are being overproduced, the political marketplace overresponds to changes in demand and underresponds to changes in costs. The converse is true for goods that are being underproduced.

### 1. Introduction

In an earlier paper (Goodman and Porter, 1985), we investigated the conditions under which government production and provision of a good would

be Pareto optimal, given two-candidate competition and probabilistic voting. The finding: the conditions for optimality are so extreme they are unlikely ever to be satisfied.<sup>1</sup>

In this paper we ask more basic questions. What determines whether the good will be under-produced or over-produced? How will the quantity of the good respond to changes in demand and changes in the cost of production? And how are these results affected by rent seeking on the part of the goods producers and by the charging of user fees?

The model used here appeared in Goodman and Porter (1988) and represents an integration of two distinct trends in the application of economics to political science. Following Stigler (1971), Posner (1974) and Becker (1983), we take the group rather than the individual as the unit of account. However, following Downs (1957), Buchanan and Tullock (1962) and many others, we take democratic elections to be the fundamental source of political outcomes; and, hence, we model the decision-making process as a two-candidate electoral competition.<sup>2</sup>

The approach taken here also fully incorporates the principle of marginalism which states that participants in the political system can always incrementally increase or decrease the level of effort they are willing to make to affect the political outcome; and these incremental changes always have an impact on political equilibrium, no matter how small (Goodman, 1976). This principle is notably absent in Stigler's winner-take-all model of regulatory capture, although it is central in Becker. The principle is also absent in one-person-one-vote models (e.g., the median voter model) that make voter decisions all or nothing and leave no room for the expression of intensity of preference that is found in models of probabilistic voting (Hinich, Ledyard and Ordeshook, 1972). Precisely because they violate the marginalist principle, one-person-one-vote models almost never have an equilibrium solution unless artificially constrained (Ordeshook and Shepsle, 1982; Goodman, 1984). When they do have an equilibrium solution, it is notoriously unresponsive: small changes in the preferences of voters on either side of the median voter have no effect on the winning platform.

Moreover, if one platform can defeat all others in a majority vote both candidates in a two-candidate contest will have an incentive to endorse the winning platform and insure its electoral success. It is in this sense that the characteristics and preferences of politicians "do not matter". Dye (1984) went so far as to assert that not only do politicians not matter, the institutional structure of government doesn't matter either.<sup>3</sup> However, there have been a number of recent empirical studies showing that institutions do matter. Merrifield (2000) has a useful review of the literature on state government spending and presents his own evidence that spending to produce goods pub-

likely is affected by such institutional variables as the number of legislators, the length of the legislative session, initiative and referendum, line item veto, etc. Persson and Tabellini (1999) produce international evidence that public spending on goods is affected by whether elections are majoritarian or proportional and whether political regimes are presidential or parliamentary. On the specific question of public production of goods, a useful summary of the recent literature is in Persson and Tabellini (1999). This includes legislative bargaining models (Baron and Ferejohn 1989; Baron 1991); bargaining between a president and local representatives (Chari, et.al., 1997; and Weingast, et.al., 1981); and comparison between congressional and parliamentary systems (Persson, et.al., 1997). By contrast, in pure voting models policy issues are determined by elections alone (See, for example, Lizzeri and Persico, 2001; and Persson and Tabellini, 1999).

The problem with most empirical studies is that they either explicitly or implicitly take the median voter model as their point of departure and thus suffer from the theoretical problems described above.<sup>4</sup> As a result, from an empirical finding that institutions matter we cannot be confident that they matter because they give politicians discretion (e.g., to behave in non-vote-maximizing ways), because they have differential impacts on the cost of political action for the beneficiaries and opponents of public provision, or because of some other reason.

What is needed is a theoretical model that avoids the defects of the median voter approach and at the same time generates testable predictions. That is the goal of this paper.

## 2. The model

Let  $Q$  represent the quantity of a good produced by the state and let  $V(Q)$  represent the aggregate value enjoyed by those who consume it. The cost of production  $C(Q)$  is assumed to be borne by taxpayers. In particular, taxpayers will enjoy private income  $Y$  subject to

$$Y(Q) = Y_0 - C(Q), \quad (1)$$

where  $Y_0$  is the amount of private income when  $Q = 0$ . We assume throughout an unspecified mechanism of taxation that allows government to transform  $Y$  into  $Q$ . The functions  $V(Q)$  and  $C(Q)$  are assumed to be continuous and twice differentiable, with normal properties:

$$\frac{\partial V}{\partial Q} > 0, \quad \frac{\partial^2 V}{\partial Q^2} \leq 0 \quad (2)$$

and

$$\frac{\partial C}{\partial Q} > 0, \frac{\partial^2 C}{\partial Q^2} \geq 0. \quad (3)$$

We choose to model the political system as a two-person, zero sum, symmetric, non-cooperative game in which two political candidates adopt platforms  $\theta$  and  $\psi$ , with  $\theta = Q_1$  and  $\psi = Q_2$ . The electorate consists of two groups. Other things equal, people in their role as consumers of the publicly provided good will prefer more of it and people in their role as taxpayers will prefer less of it. Each of the two groups is free to support the candidate that endorses the platform it prefers. We will denote by  $H^i(\theta, \psi)$  the support group  $i$  (taxpayers or consumers) is willing to give to a candidate with platform  $\theta$ , given an opponent who endorses platform  $\psi$ . Similarly,  $H^i(\psi, \theta)$  is the support group  $i$  is willing to give to a candidate with platform  $\psi$ , given an opponent who endorses  $\theta$ . Moreover,

$$H^i(\theta, \psi) = \begin{cases} h^i[B(\theta), B(\psi)], & \text{if } B(\theta) > B(\psi) \\ 0, & \text{otherwise} \end{cases} \quad (4a)$$

$$H^i(\psi, \theta) = \begin{cases} h^i[B(\psi), B(\theta)], & \text{if } B(\psi) > B(\theta) \\ 0, & \text{otherwise} \end{cases} \quad (4b)$$

where  $B(\bullet) = V(Q)$  for consumers of the good and  $B(\bullet) = Y(Q)$  for taxpayers.

Note that  $h^i$  is the effort a group is willing to make to secure the election of its preferred candidate and is a function of the benefits generated by the platforms of the two candidates. The support measure,  $h$ , is intentionally general. It could represent expected votes, campaign contributions or other forms of support. All that is required for our purposes is that  $h$  is a homogeneous measure of support that is equally valued by both candidates.

We assume throughout that the function  $H^i$  is continuous and the function  $h^i$  is continuous and twice differentiable with

$$h_1^i > 0, h_2^i < 0, h_{11}^i \leq 0, h_{22}^i \geq 0.^5 \quad (5)$$

Furthermore, we assume that the first derivative at the 'switching point' (i.e., where  $B(\theta) = B(\psi)$ ) is such that

$$\lim_{B_1 \rightarrow B_2^+} h_1^i = - \lim_{B_2 \rightarrow B_1^-} h_2^i \quad (6)$$

Each candidate, denoted by a superscript 1 or 2, maximizes an expected plurality (the difference between the candidate's own support and that of the opponent) given by

$$\phi^1(\theta, \psi) = \sum_i H^i(\theta, \psi) - H^i(\psi, \theta) \quad (7a)$$

$$\phi^2(\psi, \theta) = \sum_i H^i(\psi, \theta) - H^i(\theta, \psi) \quad (7b)$$

The game will be said to have an equilibrium if neither candidate can improve his or her position by any unilateral move. That is,  $(\theta^*, \psi^*)$  is an equilibrium if:

$$\phi^1(\theta^*, \psi^*) \geq \phi^1(\theta, \psi^*) \forall \theta \quad (8a)$$

$$\phi^2(\psi^*, \theta^*) \geq \phi^2(\psi, \theta^*) \forall \psi \quad (8b)$$

### 3. Equilibrium

Given conditions (1) through (6), it follows from a theorem of Goodman [1980] that an equilibrium exists that is both unique and stable.<sup>5</sup> Note that from the requirement of symmetry, if  $(\theta^*, \psi^*)$  is an equilibrium  $(\psi^*, \theta^*)$ ,  $(\theta^*, \theta^*)$  and  $(\psi^*, \psi^*)$  must also be equilibriums. But since the equilibrium is unique, we must have  $\theta^* = \psi^*$ . In equilibrium, both candidates endorse the same platform and  $Q_1 = Q_2 = Q^*$ .

Given the support functions of consumers,  $c$ , and taxpayers,  $t$ , the first order condition for the maximization of the expected plurality function given in Equation (7) is:

$$\frac{\partial \phi}{\partial Q} = \frac{\partial h^c}{\partial V(Q)} \frac{\partial V(Q)}{\partial Q} + \frac{\partial h^t}{\partial Y(Q)} \frac{\partial Y(Q)}{\partial Q} = 0 \quad (9)$$

Denote by  $\lambda_c = \partial h^c / \partial V(Q)$  the effort consumers are willing to make to reward the candidate of their choice per dollar of expected benefit in the neighborhood of the equilibrium point. Similarly,  $\lambda_t = \partial h^t / \partial Y(Q)$  is the effort taxpayers are willing to make per dollar of benefit they hope to receive. If political support can be measured in terms of money, then the  $\lambda$ s, or effort-benefit ratios, represent the amount each group is willing to spend to obtain a dollar of benefit. Note, however, that political effort to achieve a higher level of  $Q$  is itself a "public good" for all consumers of  $Q$ . Conversely, the political effort to reduce taxes through a lower level of  $Q$  is a "public good" for all

taxpayers. Given the standard free rider problems, we would expect the  $\lambda$ s to be less than one, and in the general case, much less than one.

It turns out, however, that what matters is not the absolute level of the  $\lambda$ s but their relation to each other. Rewrite (9) as:

$$\lambda_c P(Q) = \lambda_t MC(Q), \quad (10)$$

where  $P(Q)$  equals the marginal value of an additional unit of  $Q$  and  $\lambda_c$  is the “political price” consumers are willing to pay for a dollar of consumer surplus. Similarly,  $MC(Q)$  is marginal cost of an additional unit of  $Q$  and  $\lambda_t$  is the “political price” of raising a dollar in taxes. Equation (10) says that in equilibrium, the marginal political benefit from providing the last unit of  $Q$  to its consumers must equal the marginal political cost in terms of taxpayer resistance.

Alternatively, we may rewrite (10) as:

$$\frac{P(Q)}{MC(Q)} = \frac{\lambda_t}{\lambda_c}. \quad (11)$$

Here the left hand side of (11) represents the ability of the politician to transform taxpayer dollars into consumer surplus and the right hand side represents the ratio of the two effort-benefit ratios. Equation (11) says that the ratio of the marginal product of  $Q$  in generating benefits for consumers and costs for taxpayers must equal the ratio of their political prices.

Note that political benefit and political cost to the politician are different from benefit and cost to the economy as a whole. In general, optimal provision of the good requires that  $P(Q) = MC(Q)$ .<sup>7</sup> However, this result can occur if and only if  $\lambda_c = \lambda_t$ . Because of the public goods nature of the political goals, we expect the  $\lambda$ s to be determined by institutional parameters outside the model at hand. Put another way, there is no endogenous mechanism that makes  $\lambda_c = \lambda_t$ . If they are equal, it is by accident (Goodman and Porter, 1985).

From the earliest days of public choice economics there has been a strong interest in whether majority voting leads to overproduction or underproduction of public sector output. For example, Downs (1960) argued that there was a natural tendency for democracies to underproduce public sector goods, while Tullock (1959, 1961) argued the reverse. More recently, Lizzeri and Persico (2001) have developed a one-person-one-vote model in which public sector goods will be systematically underproduced if redistribution of income is an alternative. There is also a growing literature on the affects of voting institutions on optimality.<sup>8</sup> In the present context, we are interested in the implications of nonoptimal production.

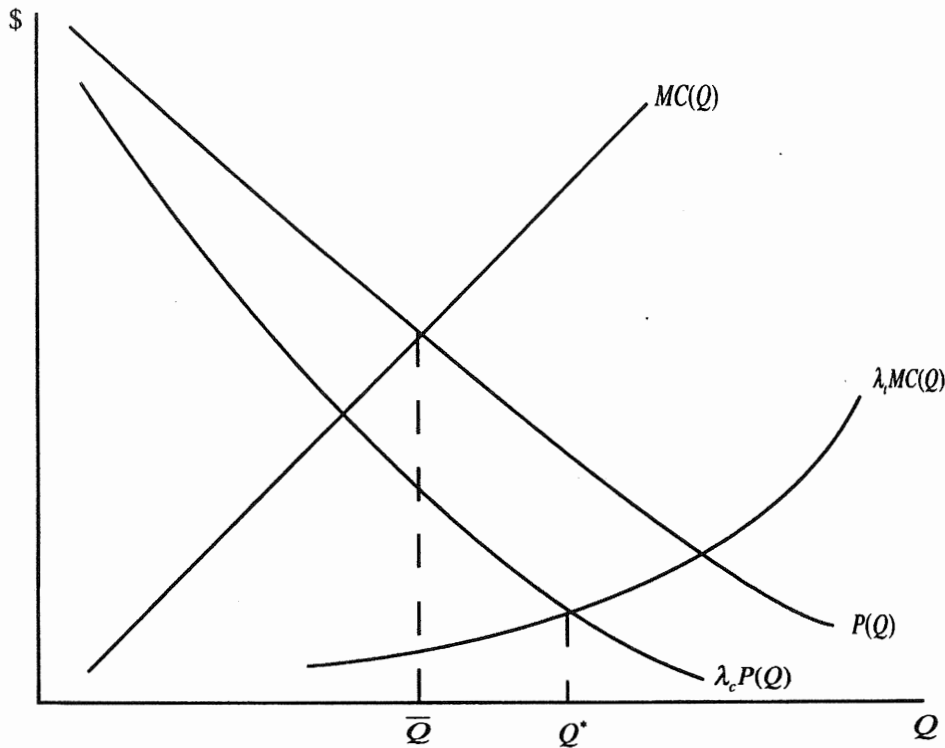


Figure 1.

If the effort-benefit ratios of the two groups are not equal, then we will have either overproduction or underproduction in the public sector. In general,  $\lambda_c > \lambda_t$  is a sufficient condition to guarantee overproduction, as is illustrated in Figure 1. Alternatively,  $\lambda_c < \lambda_t$  will guarantee less than optimal production.

To put this in perspective, recall that Harberger (1954) calculated the welfare loss from underproduction in the U.S. manufacturing sector to be about 1/10th of 1 percent of private sector output. Using the same assumptions and method of calculation, we find the welfare loss from misallocation in political markets is likely to be much larger. Harberger assumed constant marginal cost and unitary elasticity of demand. He approximated the welfare loss by  $WL = [P - MC] \times (\bar{Q} - Q^*) / 2$ , where  $Q^*$  is equilibrium output and  $\bar{Q}$  is optimal output. The welfare loss from political allocation as a percent of equilibrium political output is  $WL / MCQ^* = \theta^2 / 2$ , where  $\theta = (\lambda_t - \lambda_c) / \lambda_c$ .<sup>9</sup> If the effort-benefit ratios differ by a factor of 2 (e.g.,  $\lambda_c = 2\lambda_t$ ), the welfare loss will equal half the cost of politically determined output. If the effort-benefit ratios differ by a factor of 3, the welfare loss will be 100 percent of the cost of equilibrium output. Thus apparently small differences in political prices lead to large welfare losses, both in their own right and relative to the private sector.<sup>10</sup>

How bad can things get? If taxpayers put up no resistance (i.e.,  $\lambda_t = 0$ ), equilibrium will be reached at the consumer satiation point, where  $P(Q) = 0$ . But note that any positive  $\lambda_t$  is sufficient to prevent complete "consumer capture" of the political system. At the other extreme,  $\lambda_c = 0$  is a sufficient condition for  $Q = 0$ . But zero production of the publicly provided good is also possible as a corner solution, which will occur if  $\lambda_c P(Q) < \lambda_t MC(Q)$  for all  $Q$ .

#### 4. Comparative static analysis

How will the political system respond to changes in the model's parameters? Consider first a change in the "demand curve" for  $Q$  generated by altering the shift parameter  $p$ :

$$\frac{dQ}{dp} = \frac{\lambda_c}{\lambda_t MC'(Q) - \lambda_c P'(Q)} > 0. \quad (12)$$

The political market for goods responds in the same direction as the economic market for private goods. An increase in demand,  $dp > 0$ , generates a higher level of production, while a decrease in demand leads to less production. The magnitude of these changes is different from ordinary markets, however. Specifically, an ordinary market response to a shift in the demand curve is given by:

$$\frac{dQ}{dp} = \frac{1}{MC'(Q) - P'(Q)} > 0. \quad (13)$$

The value of  $dQ/dp$  in Equation (12) will be greater than (13) whenever  $\lambda_c > \lambda_t$ . Since  $\lambda_c > \lambda_t$  also guarantees overproduction, we conclude that when public sector goods are overproduced, we should expect exaggerated responses to changes in demand. Conversely, the value of Equation (12) will be less than (13) whenever  $\lambda_c < \lambda_t$ . This implies that when public sector goods are being underproduced we should expect ameliorated responses to shifts in demand. We discuss the implications of these and other findings below.

To simulate the response to changes in costs of production, we alter a shift parameter  $m$  in the marginal cost function to obtain:

$$\frac{dQ}{dm} = \frac{\lambda_t}{\lambda_c P'(Q) - \lambda_t MC'(Q)} < 0. \quad (14)$$

As in the case of demand shifts, the political marketplace responds to changes in costs in much the same way as private markets. An increase in the cost of



production induces a lower level of output, while a decrease in production costs induces higher output. But the magnitude of these changes is the opposite of the case of demand curve shifts. In particular, the output responses to a change in marginal cost will be exaggerated when the good is being under-produced and ameliorated when it is being over-produced.

The intuition behind these findings is that when the marginal influence of consumers is greater than that of taxpayers, the system will be more sensitive to changes in consumers preferences than to changes in taxpayer burdens. When the marginal influence of taxpayers is greater, the converse is true.

The political system also responds in predictable ways to changes in the political prices. For a change in the effort-benefit ratios, we have:

$$\frac{dQ}{d\lambda_c} = \frac{P(Q)}{\lambda_t MC'(Q) - \lambda_c P'(Q)} > 0 \quad (15a)$$

$$\frac{dQ}{d\lambda_t} = \frac{-MC(Q)}{\lambda_t MC'(Q) - \lambda_c P'(Q)} < 0 \quad (15b)$$

This implies that investments in political action are always rewarded, whereas a failure to invest is always punished. Any time a group succeeds in overcoming free rider problems and increasing the average contribution of its members, aggregate benefits to the group will increase. Any time there is slippage in support, aggregate benefits will diminish.

In general, the expected return from an additional dollar of support by a group is given by:

$$\frac{dV}{d\lambda_c} = \frac{[P(Q)]^2}{\lambda_t MC'(Q) - \lambda_c P'(Q)} > 0 \quad (16a)$$

$$\frac{dY}{d\lambda_t} = \frac{[MC(Q)]^2}{\lambda_t MC'(Q) - \lambda_c P'(Q)} > 0 \quad (16b)$$

Note that (16a) is greater than (16b), whenever  $P(Q) > MC(Q)$ . But this is also the condition for underproduction. So whenever the good is being underproduced, the return on an additional dollar invested in politics is always greater for consumers than for taxpayers. Moreover, the magnitude of the differential returns is larger, the greater the degree of underproduction. Conversely, whenever the good is being overproduced, the return to taxpayer investments is always greater than the return to consumers. And this difference also widens, as the degree of overproduction grows.

Presumably, an investment in politics is an alternative to private sector investments. So the further we get away from the optimal level of output, the greater the relative incentive for the underrepresented group to divert capital

from market to political activities. Responses to these incentives may create natural limits on the amount of public sector waste.

This conclusion is reinforced by the finding that each group faces diminishing returns to investment in political action, as is shown by:

$$\frac{d^2V}{d\lambda_c^2} = \frac{2P'P(\lambda_t MC' - \lambda_c P') \frac{dQ}{d\lambda_c} - P^2[\lambda_t MC'' - \lambda_c P''] \frac{dQ}{d\lambda_c} - P'}{(\lambda_t MC' - \lambda_c P')^2} < 0 \quad (17a)$$

$$\frac{d^2Y}{d\lambda_t^2} = \frac{2(MC)(MC')(\lambda_t MC' - \lambda_c P') \frac{dQ}{d\lambda_t} - MC^2[(\lambda_t MC'' - \lambda_c P''] \frac{dQ}{d\lambda_t} + MC']}{(\lambda_t MC' - \lambda_c P')^2} < 0. \quad (17b)$$

No matter how dominant an interest group becomes, there is likely a point at which further investment in political action simply does not pay.

#### 4.1. *User fees*

Economists have long known that user fees for government-provided goods improve economic incentives. How do they affect political equilibrium? Redefine consumer surplus as  $B(Q) - pC(Q)$ , where  $p$  is the portion of costs paid by consumers directly. Accordingly, the taxpayer burden is now  $(1 - p)C(Q)$ . In this case, the first order condition equivalent to Equation (10) becomes:

$$\frac{P(Q)}{MC(Q)} = p + (1 - p) \frac{\lambda_t}{\lambda_c} \quad 0 \leq p \leq 1 \quad (18)$$

Note that as  $p$  approaches 1,  $P(Q) \rightarrow MC(Q)$ . User fees unambiguously reduce political distortion. When  $p = 1$ , the good will be optimally provided, independent of the political influence of consumers and taxpayers. Of course, if it were possible to cover full production costs with user fees (and by implication exclude those that don't pay them) we wouldn't have a public good problem to begin with.

#### 4.2. *Producer rents*

Consider now the case where producers of  $Q$  are able to realize a rent  $R(Q)$ , say, because they own a unique resource, or because they are able to induce the government to give them an exclusive right to produce  $Q$ . In particular suppose that government purchases  $Q$  at the supply price  $MC(Q)$ . As a result, the producers will reap an infra-marginal rent given by:

$$R(Q) = MC(Q)Q - \int_0^Q MC(q) dq. \quad (19)$$

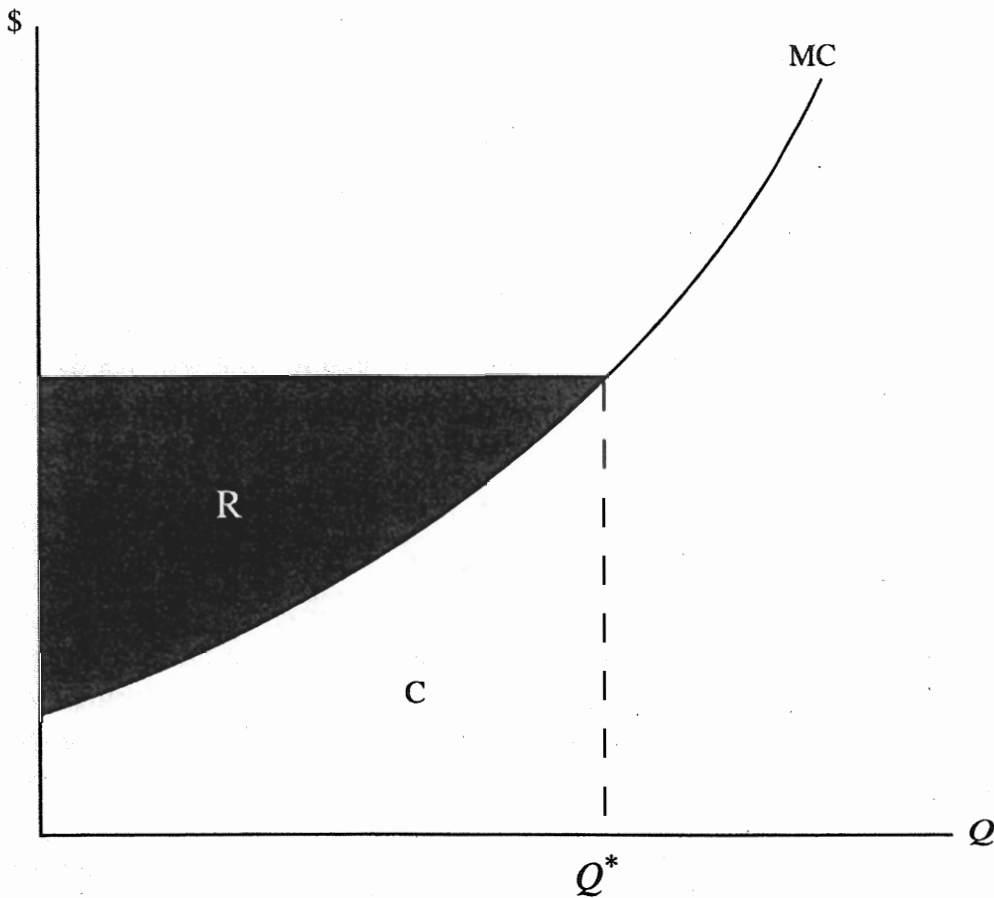


Figure 2.

As is shown in Figure 2, the taxpayer burden now becomes  $R + C$ . Under reasonable assumptions, Equation (19) is convex in  $Q$ . As a result, the candidate payoff functions may not be concave. The key here is the size of  $\lambda_p$ , the effort-benefit ratio of the producer group, relative to the other two  $\lambda$ s. For a sufficiently large  $\lambda_p$ , there may be no equilibrium. Or if there is one, it may occur at a corner solution.

If there is an equilibrium, the first-order condition for an interior solution is

$$\frac{\partial \phi}{\partial Q} = \lambda_c P(Q) - (\lambda_t - \lambda_p) Q (\partial MC / \partial Q) - \lambda_t MC(Q) = 0, \quad (20)$$

where marginal taxpayer cost is now  $MC + Q(\partial MC / \partial Q)$ .

As in the previous cases, equality among the effort-benefit ratios of the competing groups ( $\lambda_c = \lambda_t = \lambda_p$ ) is sufficient to guarantee optimality. But for reasons discussed above, this condition is unlikely to be realized.

Now suppose  $P(Q) = 0$ , which would be the case if the good had no value at all to consumers. An example might be an unnecessary military base or a worthless weapons system. Equation (20) says that even if  $Q$  is not a public good and even if it has no value to consumers, it may still be produced. In particular, Equation (20) becomes:

$$\lambda_p[Q \cdot MC'(Q)] = \lambda_t[MC(Q) + QMC'(Q)] \quad (21)$$

and the political contest now reduces to the clash of interests between producer rent seekers and taxpayers. Accordingly, equilibrium requires that the marginal political benefit derived from producers must equal the marginal political cost imposed by taxpayers. Rewrite (21) as:

$$\frac{Q \cdot MC'(Q)}{MC(Q) + Q \cdot MC'(Q)} = \frac{\lambda_t}{\lambda_p}, \quad (22)$$

and note that the ratio of the marginal products of coercion in generating benefits for producers and costs for taxpayers must equal the ratio of their political prices. Put another way, the ability of politicians to transform private sector income into producer rents must equal the willingness of the support groups to pay for such transformations as revealed by the political prices  $\lambda_t$  and  $\lambda_p$ .

How likely is this result? For a linear marginal cost curve,  $1 < \lambda_p/\lambda_t < 2$  is necessary for an interior solution.<sup>11</sup> For  $\lambda_p/\lambda_t \leq 1$ , there will be a corner solution at which none of the good is produced. For  $\lambda_p/\lambda_t \geq 2$ , there will be a corner solution at which the entire national income is devoted to the production of  $Q$ . The condition that the ratio of the political prices lies between 1 and 2 is highly restrictive. The permissible range of values for  $\lambda_p/\lambda_t$  becomes even narrower if the MC curve is convex. The implication is that the production of worthless goods must be rare, despite abundant political commentary suggesting that this type of pork barrel spending is common.

Now consider what producers have to gain by additional investment in political activity. That is, suppose the producer group increases  $\lambda_p$  by increasing organizational activities, policing free-riders in the industry, lowering the cost of organization (perhaps by utilizing the services of PAC's), etc. The incremental gain in rent (the rate of return to political effort) is

$$dR/d\lambda_p = (\partial R/\partial Q)(\partial Q/\partial \lambda_p) > 0 \quad (23)$$

This is positive since  $\partial Q/\partial \lambda_p = -Q(\partial MC/\partial Q)/\phi_{QQ}$  is positive, whenever  $\phi_{QQ}$  is negative, that is, when  $\phi$  is concave in  $Q$  and an interior equilibrium solution exists. Moreover,  $d^2R/d\lambda_p^2 = (\partial^2 R/\partial Q^2)(\partial Q/\partial \lambda_p)^2 + (\partial R/\partial Q)(\partial^2 Q/\partial \lambda_p^2) > 0$  whenever  $\partial^2 R/\partial Q^2 \geq 0$  which the quasi-convexity

of MC in Q assures.<sup>12</sup> In contrast to consumers and taxpayers, producers experience increasing returns to investment in political action. Successful political action on their part increases the incentive to invest even more.

If producers bear a proportion,  $p$ , of the tax burden, then

$$dQ/d\lambda_p = -[Q(\partial MC/\partial Q) - pQ(\partial MC/\partial Q) - pMC]/\phi_{QQ} \quad (24)$$

and increased political effort by producers will increase  $Q$  only so long as  $Q(\partial MC/\partial Q)(1 - p) > pMC$  or  $\eta > p/(1 - p)$ , where  $\eta$  is the industry elasticity of supply. When supply is very elastic and  $p$  is large, producers may want output to decrease. In the extreme, when supply is perfectly elastic, increases in  $Q$  generate no producer rents and any share of the tax burden on producers ( $p > 0$ ) will result in producer efforts to reduce output.

## 5. The multi-good case

Consider the case of  $n$  publicly provided goods produced by the state and assume that people in their role as consumers of each good constitute a well defined group that supports the election of candidates it prefers. For simplicity, we assume that consumption of these goods is separable, but the cost of production,  $C(Q_1, \dots, Q_n)$ , need not be.

So long as the benefit functions for these goods are concave and the cost function is convex, we can continue to rely on Goodman's theorem to guarantee the existence of a unique equilibrium. And continuing the practice of treating the effort-benefit ratios of each group as constant, we can write first order conditions as

$$\lambda_{c_i} \frac{\partial V_i(Q)}{\partial Q_i} = \lambda_t \frac{\partial C(Q_1, \dots, Q_n)}{\partial Q_i} \quad i = 1, \dots, n, \quad (25)$$

where  $V_i(Q_i)$  is the consumer surplus generated for the  $i$ th group by the public production of the  $i$ th good.

Take any two goods  $i$  and  $j$ , and rewrite (25) as

$$\frac{\frac{\partial V_i(Q_i)}{\partial Q_i} \div \frac{\partial C(Q_1, \dots, Q_n)}{\partial Q_i}}{\frac{\partial V_j(Q_j)}{\partial Q_j} \div \frac{\partial C(Q_1, \dots, Q_n)}{\partial Q_j}} = \frac{\lambda_{c_j}}{\lambda_{c_i}} \quad (26)$$

Note that the numerator on the left side of (26) represents the benefit created for the  $i$ th group from the last dollar spent on the production of  $Q_i$ . Similarly, the denominator represents the benefit created for group  $j$  by the last dollar spent on the production of  $Q_j$ . Condition (26) says the ratio of the marginal products of a dollar of spending on the two groups must equal the ratio of their political prices.

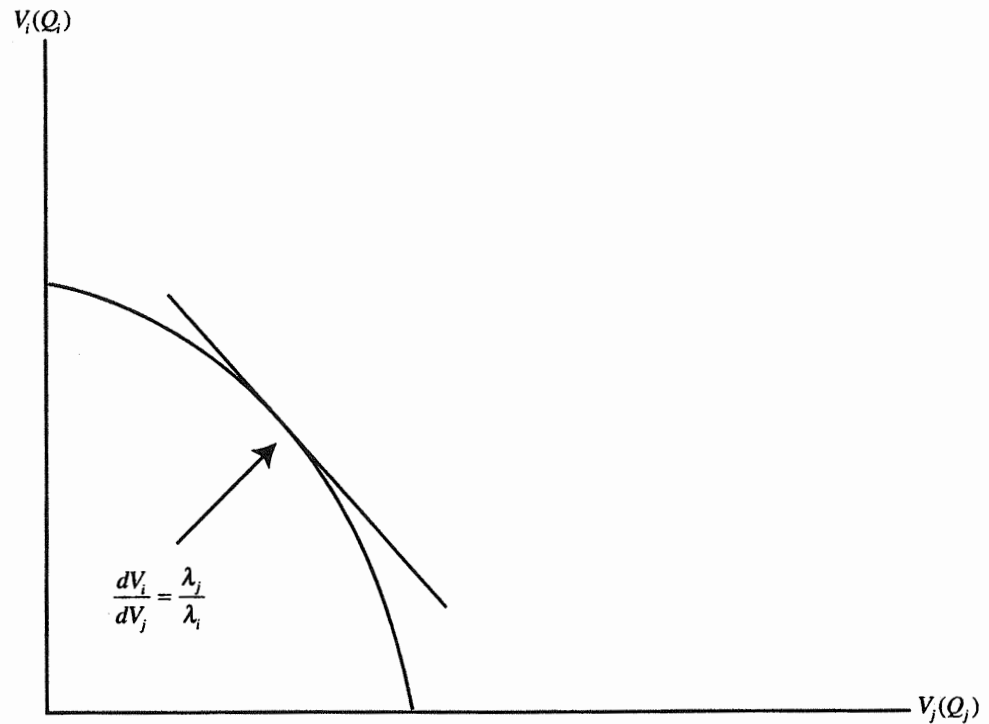


Figure 3.

This condition is illustrated in Figure 3, where the concave curve represents all possible combinations of consumer surplus ( $V_i$  and  $V_j$ ), given a constant tax burden. Note that for optimality, the marginal benefit of the last dollar spent on each of the goods must be equal. However, this will occur only if  $\lambda_{c_i} = \lambda_{c_j}$ . For  $\lambda_{c_i} > \lambda_{c_j}$ , there will be over-production of  $i$  relative to the production of  $j$ . For  $\lambda_{c_i} < \lambda_{c_j}$ , the converse will be true. As in the one-good case, however, there are limits on how inefficient the political process can be.

As long as  $\lambda > 0$ , an interior solution requires that some amount of every good will be produced. Moreover, under reasonable assumptions, there are diminishing returns to investing in  $\lambda$ . So even if it were possible for one group to get all the spoils, it doesn't pay them to attempt to do so.

## 6. Discussion of the results

The model developed here predicts that when goods are being overproduced in the public sector, reflecting the superior marginal influence of consumers vis-à-vis taxpayers, the public sector will tend to over-respond to changes in demand and under-respond to changes in costs. On the demand side, this prediction is consistent with the view that the historical ups and downs in military spending are exacerbated by overreactions to threats and peace. The

view that expansions and contractions of welfare spending are overreactions to changes in public demand for charity may be another example.

On the supply side, variable budget allocations tend to ameliorate the effects of changes in costs. So if the goods identified in the previous paragraph tend to be overproduced, then the model's predictions are consistent with a cost plus system of military procurement, entitlement programs that guarantee benefits regardless of cost, and targeted tax revenues (e.g., gasoline taxes) that guarantee a revenue source regardless of cost.

The theory developed here does not predict that every publicly provided good will be overproduced. Indeed, if the effort-benefit ratio of consumers is sufficiently small, a good will not be produced at all. In general, public provision of goods that are underproduced will underreact to changes in demand and overreact to changes in cost, reflecting the superior marginal influence of taxpayers vis-à-vis consumers. So if funding of basic research (say, on prime numbers) is suboptimal, we would expect the political market to respond slowly even when commercial applications (say, encryption) appear to greatly increase the value of such research. Moreover, in contrast to variable budgets, fixed budgets (which tend to fund "discretionary spending") tend to enhance the impact of cost changes on output.

When the political system must allocate spending among a number of programs, the model predicts that spending will be allocated based on political costs and benefits rather than economic costs and benefits. Thus, the allocation of medical research dollars should reflect the political power of disease lobbies, rather than an effort to maximize years of life saved. And the distribution of antipoverty dollars should reflect the political muscle of well-organized groups (e.g., the medical and housing industries) rather than the potential to reduce poverty (e.g., Head Start).

These observations have important public policy implications. For similar public programs (say, antipoverty programs) it may be preferable for government to choose a level of desired funding, but allow taxpayers (through the use of tax credits) to allocate dollars to specific programs. This is because private allocations reveal citizen preferences more accurately than they are revealed through the political process. Moreover, user fees, wherever possible, not only improve economic incentives, they also reduce political distortions.

On the whole, the model leads us to expect large welfare losses in the public production of goods – many times greater than what we generally find in the private sector. However, we have identified three countervailing forces that will tend to limit the amount of waste and inefficiency the political system is likely to produce.<sup>13</sup> First, whenever the political equilibrium is suboptimal, the potential return from an additional dollar invested in politics will always be greater for the group that has the lower effort-benefit ratio. If a good is

being underproduced by the public sector, an additional dollar invested in political action will produce a larger payoff for consumers than for taxpayers. This means that consumers will have a greater incentive to increase their investment in political action as opposed to private sector investments. The converse is true whenever goods are being overproduced.

Second, these differential incentive effects grow in magnitude, the further we stray from optimal production. For example, as a good becomes increasingly overproduced, the expected return to taxpayers from an incremental investment in political action grows relative to the expected return to consumers. The converse occurs, as the good is progressively underproduced.

Third, there are diminishing returns to investments in politics, just as there are in the private sector, both for taxpayers and consumers. This implies that there will be limits to the amount of spoils an interest group will enjoy, even against weak opposition.

A pessimistic finding is an exception to these generalizations. Under reasonable conditions there appear to be increasing returns for producers of public sector goods. This may help explain why the power of public employee unions seems to have grown over time even as the power of unions generally has been on the wane. Even here, however, we find likely limits on the degree of waste and inefficiency. Despite considerable political commentary suggesting that many programs exist solely because of the political power of producers, we find that the conditions needed to produce such results are so restrictive that real world instances of the public production of worthless goods is likely to be rare.

## 7. Conclusion

Traditional public finance theory teaches that the private sector will underproduce public goods and that government is needed to produce them in optimal quantities. However, the theory of public finance developed here strongly suggests that government is incapable of optimal production. Moreover, we expect that consumers of public sector output are often better organized and make greater political effort per dollar of expected benefit than taxpayers. This is partly the case because the consumers' benefit is often more concentrated while the taxpayer burden is often widely defused. Thus, if the private sector's fault is likely under-production of public goods, the public sector's sin is likely over-production. We cannot say *a priori* which outcome is worse.

Not only will the public sector tend to produce nonoptimal quantities of goods, it will tend to respond to changes in market conditions in nonoptimal ways. However, for the most part diminishing returns limit the degree of



public sector inefficiency. We are able to identify institutional changes that may improve public choices.

An important public finance question is whether it is better to attempt to achieve goals through the spending side or the tax side of the government's budget. For example, should government provide health care through spending programs, or should it create tax incentives to encourage the purchase of private insurance? Should state governments support higher education through direct spending or by giving tax credits to students and their families? The model developed here suggests that allowing citizens to make private choices through tax credits can reduce some of the distortions on the spending side. However, more complete answers to these questions require a more thorough investigation of the politics of tax policy. And that is the subject of another paper.

## Notes

1. Intensity of voter preference is reflected in the probability of voting. In general, optimality requires that the change in probability of voting for the preferred candidate per incremental dollar of benefit promised (increased public good consumption or lower taxes) must be the same for all voters in the neighborhood of the equilibrium point. Production of public goods also will almost never be optimal in the standard median voter model. The reason: with heterogeneous preferences, the median voter is unlikely to prefer optimal production except by accident.
2. For a review of different types of electoral systems and the difference they make, see Roger B. Meyerson (1999), Ahmed and Greene (2000), and Congleton and Bennet (1995).
3. See, however, the critical response from Poterba (1996) and Crain and Miller (1990).
4. In empirical studies, the median voter model is widely employed because it depends only on a single moment of the distribution of voter characteristics (Inman, 1978; Fort, 1988), and because it often is judged to make reasonable predictions (McEachern, 1978; Holcombe 1980; Mueller, 1984).
5. For a justification of these assumptions, see Hinich, Ledyard and Ordeshook (1972).
6. Goodman's theorem states that every game has a unique (Nash) equilibrium that is asymptotically stable provided that (1) the payoff function for each player is concave in his or her own strategy (matrix of second derivatives is negative definite), (2) convex in the strategy of the opponent, and (3) the sum of the payoff functions is concave in the strategies of all players. In a two-person, zero sum game, the third requirement is automatically satisfied, since  $\phi^1 + \phi^2 = 0$ . The assumed form of  $\phi$  satisfies the first two requirements.
7. We assume here, and throughout the rest of the paper, that the welfare losses from the act of taxing and the act of spending are zero.
8. For example, Leblanc (2000) builds on an influential bargaining model developed by Baron and Ferejohn (1989) to argue that majoritarian systems overproduce public consumption goods and underproduce public investment goods. Persson and Tabellini (1999) argue that majoritarian voting produces fewer public goods than proportional voting and presidential regimes produce fewer public goods than parliamentary systems.
9. Since  $\varepsilon_d = 1$ ,  $PQ^* = MC\bar{Q}$ . From equilibrium condition (10) we have  $\theta = (P - MC)/MC$ . Substitution yields  $WL/MCQ^* = \theta^2/2$ .

10. Tullock's (1967) argument that the welfare loss from government-sponsored monopoly must also include rent-seeking expenditures, implies that cost of political effort should also be added to the welfare loss.
11.  $\lambda_p$  must be greater than  $\lambda_t$  in order to satisfy the first order condition in (21); and  $\lambda_p$  must be less than  $2\lambda_t$  in order to satisfy the second order condition.
12. It is sufficient to assume that the third-order effect  $\phi_{QQQ} = (\partial^3 \phi / \partial Q^3)$  is zero. It is only necessary that third-order effects be sufficiently small or negative. That is,  $\phi_{QQQ} < [\phi_{QQ}^2 R_{QQ} \lambda_p] / R_Q QMC_Q - [\phi_{QQ}(MC_Q + QMC_{QQ}) / QMC_Q]$ .
13. Wittman (1989) argues that "economic distortions [from pressure groups] are limited by competition, rationality of the voters, and low transaction costs". (p. 1408) Our model assumes competition and rationality, and adds that when high transaction costs lead to differentials in group influence, increasing costs and diminishing returns limit how far a group can press its advantage.

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