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**Optimal provision of public goods under  
imperfect intergovernmental competition**

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# ***Optimal provision of public goods under imperfect intergovernmental competition***

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**Abstract:** The aim of this paper is to develop a model that includes two tiers of government providing public goods with the same tax base to finance them. Their rent is related to the level of competition. Citizens maximize their own utility starting from these different levels of competition. Therefore, they can decide to turn down the governments to induce them to behave efficiently. Moreover, governments can choose whether to accept the behaviour urged by citizens or to maximize their rent for a single period of office and consequently lose the next elections.

JEL classification: H11, H21, H71, H77.

## 1. Introduction

The choice among private goods and public goods is a topic developed by many handbooks<sup>1</sup> in economics and in public economics. The aim of this paper is to investigate this choice by analysing two hypotheses. First of all, we study a multi – tiered governmental system with governments that provide different public goods. Secondly, we deal with competition among governments. We consider vertical competition among governments at different tiers and horizontal competition among governments located at the same level.

Specifically, we want to show the best choice for a representative voter/citizen according to the following hypotheses. We will consider the consumption of three goods: a private good, produced in a perfectly competitive market, a local public good, produced by governments located at the lower tier and a central public good, produced by a single high – tiered government. To illustrate, the local public good is health, the central public good is security and the private good is food. The utility of citizens is positive if the amounts of health, security and food are positive. As mentioned before, there is competition among governments situated at the lower level and competition between the low – tiered governments and the high – tiered government. We start from a situation which features two governments located at different tiers and a median voter that chooses the optimal allocation of a private good and the two public goods. In fact, we choose a simple model with two political parties as in Downs (1957), because we know that an optimal solution for a community is very difficult in the presence of public goods. Therefore, the paper develops a second best – solution.

The paper is organised as follows. Section two discusses some related literature. The third section outlines the basic hypotheses and the fourth sets out the model. Section five examines the behaviour of governments after the choice of the optimal tax rates and section six presents some conclusions.

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<sup>1</sup> For example: Stiglitz (1989) and Varian (1990), chapter 35.

## 2. Related literature

We have a lot of analyses about interjurisdictional competition in literature. Tiebout (1956) analyses interjurisdictional mobility where citizens “vote by feet”. Salmon (1987) speaks about ranks that influence elections. Citizens compare the performance of their government with the performances of the governments of other jurisdictions and, hence, they choose to re-elect or not the government. Brennan and Buchanan (1980) argue that different governments located at the same tier can foster competition among them and tame the Leviathan. Also the literature on democratic choice is wide. Some important references can be found in Hettich and Winer (1999) and in Breton (1996) to analyse how the necessity of consensus influences the behaviour of governments. Hettich and Winer also compare different behaviours among democratic governments.

Competition in local governments implies benefits and costs. In this paper we focus on benefits. We consider that jurisdictions are wide with negligible spillovers and citizens are interested in the level of public goods as in Breton and Ursprung (2001). Then, competition does not lead to an inefficiently low level of taxation, as argued by Wilson (1986).

Our aim is to consider also the presence of vertical competition. In fact democratic states have different tiers of governments. In particular, even if we develop a theoretical model, we think that our analysis can be useful to represent the existing relationship between the United Europe and the European states (fifteen or more does not matter).

The most important contributions our analysis is based on concern the literature on incomplete contracts (Grossman and Hart, 1986, and Hart and Moore, 1990) and, in particular, decentralization and incomplete contracts (Seabright, 1996). We consider also paper dealing with vertical competition and Laffer curve (Flowers, 1988), and vertical and horizontal yardstick competition among governments (Bodenstein and Ursprung, 2001).

In particular, vertical and horizontal competition are used to generate an efficient allocation among private and public goods. This allocation is chosen by median voters. Incomplete contracts will be used to understand the behaviour of governments. They can choose between the efficient solution proposed by voters and an aggressive behaviour which maximises their rent for a single period of office, with the consequence of being voted out of office. We assume that no one (a judge, for example) can force governments in office to behave as citizens want. The Laffer curve associated to the Cournot solution will be used to analyse the allocation of the tax revenue when all governments opt for the aggressive strategy. In fact, we model governments as duopolists that simultaneously maximise their own rents and, hence, their tax revenues. As showed by Flowers (1988), the presence of vertical competition does not tame the Leviathan and the level of welfare for citizens diminishes with respect to the case of a monopolistic government. As showed by Brennan

and Buchanan (1980), horizontal competition produces the effect of taming the Leviathan. These two effects are contrasting. In our model the only way to tame the Leviathan is the presence of democracy and, hence, elections. Re-election is the only way to insure that governments behave in favour of citizens.

### 3. Hypotheses of the model

Following Bodenstein and Ursprung (2001), we will consider two parameters:  $\varphi$  and  $\theta$ . These two parameters allow a comparison of the performances of different governments. The assumption that local governments produce a good and the central government provides another good provides direct way to compare the performance of local governments and an indirect way to compare the performances of local governments versus central government. In particular, we assume the possibility to compare the performance of central government versus local government in producing two different goods that are consumed by the same citizen. Furthermore, we assume the possibility to compare the performance of local governments that produce the same good consumed by different citizens in different localities.  $\varphi$  is used to measure the first comparison and is associated, by hypothesis, to the rent that the central government can extract from citizens.  $\theta$  represents the second comparison and is associated to the rent of local governments.

We define  $\varphi$  as the level of vertical competition among different tiers of government and  $\theta$  as the level of horizontal competition among governments located at the lower tier. The value of the two parameters, as in Bodenstein and Ursprung, is equal to 1 in a situation of perfect competition (full comparability), or higher without perfect competition.

Obviously, and also very probably, the two parameters can assume different values. Different levels of competition produce different values of politicians' rents. With a higher value of  $\theta$  local governments can earn a higher rent. Similarly, a higher value of  $\varphi$  generates a higher rent for the central government. The two following formulas explain how competition can affect the provision of public goods starting from the tax revenue. In fact, we assume that:

$$G_L = (W_L \tau_L)^{\frac{1}{\theta}} \quad \text{with } W_L \tau_L > 1 \quad (1)$$

and

$$G_C = (W_C \tau_C)^{\frac{1}{\varphi}} \quad \text{with } W_C \tau_C > 1 \quad (2)$$

where  $G_i$  is the quantity of public goods provided by each government,  $\tau_i$  is the tax rate imposed by government  $i$  and  $W_i$  is the total income of the jurisdiction. As we said before, we consider a median voter in our model. He knows the levels of competition among governments and the rents of the governments. The number of citizens of a locality does not influence its rent. The median voter chooses the level of public goods and private good starting from his utility function,

which is similar to the utility function used by Hettich and Winer (1999)<sup>2</sup>: we consider two public goods instead of one but we do not consider leisure. We deal with an exogenous level of leisure because our model differs from a standard model where taxes do not influence the utility of a consumer. In particular, when our model is explicit, it would be difficult to assign an explicit preference to the variable leisure. As argued by Hettich and Winer, we will consider the income of the median voter (represented by  $w$ ). In particular, we assume a given value of  $w$  to maximize the utility of the median voter and we also assume that this value can be lower (because the median voter increases her leisure) if the governments do not choose the optimal allocations proposed by our median voter.

The utility function of the median voter is:

$$U_m = (x, G_L, G_C) \quad (3)$$

where  $x$  is the quantity of private good. Starting from our hypotheses, we can re – write this function as a generic Cobb – Douglas function:

$$U_m = x^\alpha \cdot G_L^\beta \cdot G_C^\gamma \quad (4)$$

where  $\alpha$ ,  $\beta$  and  $\gamma$  represent the preferences associated to the private good, the local public good and the central public good respectively.

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<sup>2</sup> “Democratic Choice and Taxation. A Theoretical and Empirical Analysis”, section 4.1.1.

## 4. The model

From equations (1), (2) and (4), we obtain:

$$U_m = x^\alpha \cdot (W_L \tau_L)^\frac{\beta}{\theta} \cdot (W_C \tau_C)^\frac{\gamma}{\theta}. \quad (5)$$

As in Hettich and Winer (1999), of our median voter is:

$$x = w(1 - \tau_L - \tau_C) \quad (6)$$

that can be re – written as

$$x + \tau_L w + \tau_C w = w. \quad (7)$$

where  $w$  is the (fixed) wage of the median voter. As we can easily note in the constraint,  $w$  represents the total income of the median voter.

Thus, our maximization problem becomes:

$$\max_{x, \tau_L, \tau_C} U_m = x^\alpha \cdot (\tau_L W_L)^\frac{\beta}{\theta} \cdot (\tau_C W_C)^\frac{\gamma}{\theta} \quad (8)$$

$$\text{s. t.} \quad x + \tau_L w + \tau_C w = w$$

that can be solved using the Lagrangian function:

$$L = x^\alpha \cdot (W_L \tau_L)^\frac{\beta}{\theta} \cdot (W_C \tau_C)^\frac{\gamma}{\theta} - \lambda(x + \tau_L w + \tau_C w - w). \quad (9)$$

Our First Order Conditions are:

$$\frac{\partial L}{\partial x} = 0 : \alpha x^{\alpha-1} \cdot W_L^\frac{\beta}{\theta} \tau_L^\frac{\beta}{\theta} \cdot W_C^\frac{\gamma}{\theta} \tau_C^\frac{\gamma}{\theta} = \lambda \quad (10)$$

$$\frac{\partial L}{\partial \tau_L} = 0 : W_L^\frac{\beta}{\theta} \cdot W_C^\frac{\gamma}{\theta} \cdot \frac{\beta}{\theta} \tau_L^{\frac{\beta}{\theta}-1} \cdot x^\alpha \cdot \tau_C^\frac{\gamma}{\theta} = \lambda \quad (11)$$

$$\frac{\partial L}{\partial \tau_C} = 0 : W_L^{\frac{\beta}{\theta}} \cdot W_C^{\frac{\gamma}{\phi}} \cdot \frac{\gamma}{\phi} \tau_C^{\frac{\gamma-1}{\phi}} \cdot x^\alpha \cdot \tau_L^{\frac{\beta}{\theta}} = \lambda \quad (12)$$

$$\frac{\partial L}{\partial \lambda} = 0 : x + \tau_L w + \tau_C w = w. \quad (13)$$

From equations (10), (11) and (12) we can write the values of  $\tau_L$  and  $\tau_C$  as a function of the level of  $x$ :

$$\tau_L = \frac{\beta}{\alpha\theta w} x \quad (14)$$

and

$$\tau_C = \frac{\gamma}{\alpha\phi w} x. \quad (15)$$

We can substitute these values in equation (13) to obtain the optimal value of  $x$  and, consequently,  $\tau_L$  and  $\tau_C$ :

$$x^* = \frac{w\alpha\theta\phi}{\alpha\theta\phi + \beta\phi + \gamma\theta} \quad (16)$$

$$\tau_L^* = \frac{\beta\phi}{\alpha\theta\phi + \beta\phi + \gamma\theta} \quad (17)$$

$$\tau_C^* = \frac{\gamma\theta}{\alpha\theta\phi + \beta\phi + \gamma\theta}. \quad (18)$$

Using  $\tau_L$  and  $\tau_C$  we can obtain the values of  $G_L$  and  $G_C$ :

$$G_L^* = \left( \frac{W_L \beta \phi}{\alpha \theta \phi + \beta \phi + \gamma \theta} \right)^{\frac{1}{\theta}} \quad (19)$$

$$G_C^* = \left( \frac{W_C \gamma \theta}{\alpha \theta \varphi + \beta \varphi + \gamma \theta} \right)^{\frac{1}{\varphi}} \quad (20)$$

We can easily note that parameters  $\theta$  and  $\varphi$  affect positively the quantity of the private good demanded by the median voter because a lower level of intergovernmental competition reduces the quantity of public goods provided by governments with the same tax revenue. Moreover, we can see that the preference for public good  $G_L$  depends on the value of the associated preference  $\beta$  and the level of vertical competition  $\varphi$ . This is due to the assumption that competition is perfect when  $\varphi = 1$  and its level decreases when  $\varphi$  increases. The same way of reasoning can be applied to  $G_C$ , using  $\gamma$  and  $\theta$ . In this case, we can note that  $G_L$  and  $G_C$  are substitutes. We can also note that lower levels of intergovernmental competition reduce the level of utility of the median voter.

## 5. The behaviour of governments

Given the values of  $\theta$  and  $\varphi$ , as in the model above, we have an optimal solution for the tax rates of the two governments:  $\tau^*_L$  (the optimal tax rate for the local government) and  $\tau^*_C$  (the optimal tax rate for the central government). If each government wants to be re-elected, it needs to adopt the optimal tax rate chosen by the median voter.

The rent of a re-elected local government is

$$R_L^* = (W_L \tau_L^* - G_L^*) \cdot \frac{1}{r} = \left( W_L \tau_L^* - (W_L \tau_L^*)^{\frac{1}{\theta}} \right) \cdot \frac{1}{r} \quad (21)$$

and the rent of the re-elected central government is

$$R_C^* = (W_C \tau_C^* - G_C^*) \cdot \frac{1}{r} = \left( W_C \tau_C^* - (W_C \tau_C^*)^{\frac{1}{\varphi}} \right) \cdot \frac{1}{r} \quad (22)$$

where  $r$  represents the discount rate of the period of office of the legislature.

For simplicity, we introduce the concepts of bad government and good government. Bad governments and good governments do not represent different types. A government always maximizes its rent.

Then, each government can choose  $\tau^*_i$  (with  $i = L, C$ ) and be re-elected or choose a higher tax rate and be voted out of office at the end of the period of office of the legislature. In the former case there is no direct competition between the two levels of government to get the lion's share of the tax revenue. The median voter decides the allocation of the tax revenue among governments and they accept this allocation ("good" governments).

If a government chooses to be turned down ("bad" government), its tax rate will depend on the choice of the other government. In particular, if a single government chooses to be turned down and the other chooses to stay in office, its optimal tax rate would be:

$$\tau_i = 1 - \tau_j^* \quad (23)$$

where  $\tau_i$  represents the "bad" government's tax rate and  $\tau_j$  the "good" government's tax rate. In the same way, if both governments choose to be voted out at the next elections and maximize their rents in the current period we have:

$$\tau_L + \tau_C = 1. \quad (24)$$

In both the cases just presented the two governments tax away all the income of the citizens. This means that the level of the private good is equal to 0 and the level of utility of the median voter is 0 consequently.

This result, in my opinion, is not very interesting. We need a new hypothesis to better develop this problem. We must consider the fact that citizens prefer a higher level of leisure when taxes increase, in particular when not all the taxes are converted into public goods, as in our case. Therefore, governments have to deal with distortionary taxes when they maximize their rent.

This hypothesis implies that the level of income of a locality is not given, but it decreases when the total amount of the taxes ( $T_L + T_C = W_L\tau_L + W_C\tau_C$ ) increases. Therefore, we cannot consider a given value of the total income. In particular, we know that our income has a given value if the level of taxes is  $(T_L^* + T_C^*)$ . If the level is  $(T_L + T_C) > (T_L^* + T_C^*)$  we know that our aggregate income is lower than the aggregate income that represents the optimal solution. In terms of equations (21) and (22), a higher value of  $(T_L + T_C)$  under the new assumption produces a lower value of  $W_i$ . We do not know if the level of  $T_i = \tau_i W_i$  is higher or lower, because we know that an increase in  $\tau_i$  causes a decrease of  $W_i$ .

Let us assume that an increase in  $\tau_i$  causes an increase in  $T_i$  if the sum of the tax rates is:

$$\tau_L + \tau_C < \bar{\tau}. \quad (25)$$

It the last equation  $\bar{\tau}$  represents the upper point of a Laffer Curve (Laffer, 1981). If the two governments can collude, this level of the tax rate is the alternative point that they can choose instead of  $\tau_L + \tau_C$ . We have this solution if there is at least an allocation  $\tau_L + \tau_C = \bar{\tau}$  that allows for the two governments to have rents higher than  $R_L^* + R_C^*$ .

If collusion is not available governments may behave as Cournot duopolists that maximize their own rent. In this case the sum of their tax rates is higher than  $\bar{\tau}$  and we have this solution if the rent of the local government is higher than  $R_L^*$  and the rent of the central government is higher than  $R_C^*$ .

In these two cases all the governments choose to be turned down.

There is a third case where only one government acts to maximize its rent in one period and the other chooses the tax rate proposed by the median voter. In this case, the “good” government has a rent of  $R_i^*$  and the other maximizes its revenue starting from the tax rate of the “good” government. The aggregate tax rate is lower than the duopoly case but higher than the monopoly

case. The rent for the “bad” government would be higher than its rent if it was “good”,  $R_i^*$ . This situation occurs when the median voter chooses levels of public goods that satisfy only one government. In particular, this result can be reached when the value of the preferences for local and central public goods ( $\beta$  and  $\gamma$ ) are different.

## 6. Conclusions

In this paper we have analysed a situation where citizens maximize their utilities in an imperfect intergovernmental competition model. As argued in the introduction, we look for a second – best solution. Consequently, this model describes an imperfect competition situation. In fact, with values of  $\theta$  and  $\varphi$  equal to 1 we have rents equal to 0, so no governments would exist.

If we consider the same citizens' preferences for local and central public goods and private good, the different levels of competition can be used to determine the efficient amount of public goods provided by central and local governments. In particular, a higher degree of vertical competition can justify a wide assignment of powers and functions to the central level. On the other hand, a higher degree of horizontal competition can be used to justify an assignment of powers to the lower tier of government, when interjurisdictional spillovers are relatively low.

At the same time, governments can choose if they want to accept the median voter's allocation or choose an aggressive behaviour to maximize their rent in only one period. This choice cannot be influenced by voters and it can lead to four outcomes. In the first case, governments behave as citizens want and the utility of the median voter is maximized. In the second cases only one government acts as the median voter wants but the other one imposes a very high tax rate. In the last two cases governments act aggressively. In the first one (monopoly case), they act aggressively towards citizens but they act yieldingly to each other. In the second case (duopoly case), they always behave aggressively: this is the worst case for citizens.

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- game theory;
- studies on social attitudes and preferences;
- political philosophy and political theory;
- history of political thought.

The Department has regular members and off-site collaborators from other private or public organizations.

## Instructions to Authors

Please ensure that the final version of your manuscript conforms to the requirements listed below:

The manuscript should be typewritten single-faced and double-spaced with wide margins.

Include an abstract of no more than 100 words.

Classify your article according to the *Journal of Economic Literature* classification system.

Keep footnotes to a minimum and number them consecutively throughout the manuscript with superscript Arabic numerals. Acknowledgements and information on grants received can be given in a first footnote (indicated by an asterisk, not included in the consecutive numbering).

Ensure that references to publications appearing in the text are given as follows:  
COASE (1992a; 1992b, ch. 4) has also criticized this bias....  
and  
“...the market has an even more shadowy role than the firm” (COASE 1988, 7).

List the complete references alphabetically as follows:

### Periodicals:

KLEIN, B. (1980), “Transaction Cost Determinants of ‘Unfair’ Contractual Arrangements,” *American Economic Review*, 70(2), 356-362.

KLEIN, B., R. G. CRAWFORD and A. A. ALCHIAN (1978), “Vertical Integration, Appropriable Rents, and the Competitive Contracting Process,” *Journal of Law and Economics*, 21(2), 297-326.

### Monographs:

NELSON, R. R. and S. G. WINTER (1982), *An Evolutionary Theory of Economic Change*, 2nd ed., Harvard University Press: Cambridge, MA.

### Contributions to collective works:

STIGLITZ, J. E. (1989), “Imperfect Information in the Product Market,” pp. 769-847, in R. SCHMALENSEE and R. D. WILLIG (eds.), *Handbook of Industrial Organization*, Vol. I, North Holland: Amsterdam-London-New York-Tokyo.

### Working papers:

WILLIAMSON, O. E. (1993), “Redistribution and Efficiency: The Remediableness Standard,” Working paper, Center for the Study of Law and Society, University of California, Berkeley.