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Taxation and social protection under governance decentralisation

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ABSTRACT

Governments do not have perfect information regarding constituent priorities and needs. This lack of knowledge opens the door for groups to lobby in order to affect the taxes they pay the government. We examine the political economy of a decentralised revenue-raising authority in light of social protection expenditures by constructing a theoretical model of hierarchical contests and comparing the implications of centralised with decentralised governance. Increasing information available to the government may generate additional expenditures by constituencies trying to affect government taxation decisions.

1. Introduction

Many countries have a federal governmental structure consisting of a central authority and various sub-central jurisdictions. Within these sub-central jurisdictions there are other jurisdictions; and within these, still other jurisdictions, each possessing different information about their constituents. Often there is a mismatch between where the taxing authority lies and where the expenditures are made. Sometimes, taxing authority lies with the central administration, though local governments make some expenditure, while elsewhere the reverse holds. This paper investigates one neglected cost of federalism – the impact of lobbying either directly or through sub-national governments. We are addressing *intergovernmental lobbying*, not special interest lobbying.

There is a large literature on intergovernmental decentralisation. Some of this literature, including various aspects of fiscal federalism, is nicely reviewed in Gramlich (1977), Oates (1999) and Tanzi (2001). Very recently Bahl and Bird (2018) and Channa and Faguet (2016) have synthesized and largely integrated writings on fiscal decentralisation. Among the concerns in the intergovernmental grants literature are revenue sharing (Fisher, 1979; Nitzan, 1977; Zhuravskaya, 2000), fiscal equalisation across subnational jurisdictions (Boadway and Flatters, 1982; Goodspeed, 2000), fungibility and flypaper effects (Zampelli, 1986; Hines and Thaler, 1995), foreign aid (Cashel-Cordo and Craig, 1990; Epstein and Gang, 2006; Gang and Khan, 1991; Heller, 1975; Pack and Pack, 1993; Swaroop et al., 2000), and taxation (Goodspeed, 1995). Bardhan (2002) suggests that decentralisation may need some protection against its own enthusiasts. In fact, the literature has frequently emphasized the difficulties that face decentralised authorities (Bardhan, 2002; Bardhan

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and Mookherjee, 2005; Fisman and Gatti, 2002; Treisman, 1999).

The literature on the assignment of revenue-raising instruments among levels of government is not as extensive as that on fiscal transfers or expenditures. Never-the-less it is quite compelling (Bardhan, 2002; Boadway, 2001). For example, Boadway et al. (2003) investigate the appropriate assignment of taxes to regional governments and the accompanying set of transfers in standard fiscal federalism models. Decentralised taxation has undergone extensive theoretical consideration in traditional political economy models of governments, with bureaucrats often playing the role of Leviathan (Seabright, 1996).

More recently the literature has addressed how decentralisation interacts with political institutions and incentives, in what has been called "second generation fiscal federalism" (Weingast, 2009, 2014). In this context strategic delegation in a federalist structure is addressed by Loeper (2013) and Callander and Harstad (2015). Loeper (2013) examines the actors' behaviours and outcomes where the central authority restricts the actions of local bodies, analysing where the central layer imposes bounds on local policies Callander and Harstad (2015) tell a story of heterogeneous localities as individual laboratories for policy experimentation. Over time the central authority draws on the most successful. Relevant recent work on contests in political economy by Zudenkova (2018) has localities competing over expenditures, while Hirsch and Shotts (2015) use all-pay contests to examine policy choices among competitors who have different ideologies but common objectives. Like this recent work our approach explicitly models the agents and the bargaining mechanisms that arise at the core of decentralised governance.

We start from the presumption that the central authority does not possess all of the information necessary to best allocate its funds and raise its revenues. The central authority needs information inputs; this opens the door for it to be influenced by rent-seeking activities. We ask the question: Is it better or not to have a decentralised structure with an intermediate level of government between the central authority and the local population? We think of the population organizing itself into constituency groups, which we refer to as *constituencies*. Thus, rather than examining the impact of taxation, we are interested in the impact of the competition among constituencies on the assignment of revenue-raising requirements among levels of the hierarchy and the costs of additional levels of hierarchy measured against the information gains. This is close in some sense to Wärneryd (1998) who shows that a system of federalism is especially significant in ameliorating distributional competition and conflict.

To address our question, we set up a theoretical model of hierarchical rent-seeking and compare the implications of centralised revenue-raising with decentralised taxation. The central authority may choose to directly tax constituent groups or it may choose to decentralise decision-making by allocating the taxation responsibilities to, for example, cities or provinces who in turn tax groups within their districts. This paper examines the political economy of decentralised revenue-raising authority by constructing a theoretical model of hierarchical contests with three levels - the government (one), cities (two) and constituencies in the cities (three). It then compares implications of centralised versus decentralised governance when information flows to the government are not perfect. In essence, we are comparing the outcome of a one-stage game (the central authority making its optimal taxation decisions with regard to the constituencies) to the outcome of a two-stage game (the central authority makes its optimal taxation decisions between two competing intermediate authorities which make their taxation decisions among competing constituencies within their jurisdictions, see Baik and Lee, 2000). We take into account the knowledge that the central and intermediate authorities have regarding each other and their constituencies. We also offer insight into whether decentralisation increases or decreases total rent-seeking activity, and how the level of information possessed by the central authority and the cities affects rent-seeking activity and the tax rate.

We obtain striking results from a relatively simple model, generally presuming the objectives of both the central as well as local governments are on average pro-poor. Increasing the information possessed by the government may generate additional expenditures on the part of those seeking to reduce their tax obligations. We also show the conditions under which decentralisation reduces rent-seeking, and by doing so, provide a nuanced analysis of whether decentralisation is necessarily more efficient.

2. The role of the government and the information structure

We assume that social protection expenditures are fixed and exogenous and are met by raising tax revenues. We use the terms taxes, revenues, tax rate, tax policy and revenue-raising interchangeably as we simplify by assuming the size of the tax base is fixed (Das-Gupta and Gang, 2005; Das-Gupta and Mookherjee, 1998). Keeping social expenditures fixed essentially allows us to examine policies that are neutral with respect to the revenue they raise.[1] Ultimately taxes are paid by the people who organize themselves into constituencies. As in Epstein and Nitzan (2002), central government politicians and bureaucrats are recipients of the lobbying efforts of cities and constituencies. Lobbying efforts may be dollars directly paid to members of the central government, political and business connections, or other such relationships. Below we specify the role of the central government and its objectives more formally.

Our model has the following features. There are three layers in the hierarchy. Characteristically, the top layer is the central government, the intermediate level is the state, provincial or metropolitan (city) government, and the lower level the local governments, or, possibly, the people, interest groups, institutes, organizations or constituencies. Of course, we could describe many other hierarchical relations. Here we assume there is a central authority called the government. At the intermediate level, there are two cities, city A and city B. Within each city, there are the people who organize themselves into constituencies. Lobbying to reduce taxation goes on at the different levels. For example, the constituencies may lobby their cities or the central authority (government) itself.

Consider a government that has to choose which city/constituency to tax more. Standard economic theory assumes that the

[1] In fact, if we relax the fixed social expenditure assumption (i.e., we allow the total amount of funds to be paid to change, say increase) it would not affect our results as everything changes proportionally. Thus, the outcome of the contest is such that each unit pays a proportion of R, the total funds the government needs to collect. Below, for example, examine equations (8) and (8"), noting that (8′) is independent of R as it is the equilibrium proportion. And so on.

government has utility that allows it to rank alternatives. The government then chooses the highest ranked alternative. Psychologists (e.g. Luce, 1959; Tversky, 1969, 1972) criticize this deterministic approach, arguing that the outcome should be viewed as a probabilistic process. Their approach is to view utility as deterministic but the choice process as probabilistic. The government does not necessarily choose the alternative that yields the highest utility; instead it has a probability of choosing each of the various possible alternatives.[2] Another way of looking at this is that governments are limited in the information they have and during the lobbying effort become more knowledgeable regarding the wealth of the cities/constituencies. Alternatively, governments consist of people who are affected by lobbying effort for political and other reasons (see for example, Epstein and Nitzan, 2002, 2003; 2007; Grossman and Helpman, 1994).

Our approach is to formulate a public-policy lobbying contest. Epstein and Nitzan (2006) propose a partial micro-foundation for the public-policy contest (see also, Hirsch and Shotts, 2015; Zudenkova, 2018). Under this structure the rationalisation of such contest success functions (CSFs) hinge on the existence of government (politician) preferences that take into account the lobbying outlays of the constituencies, in addition to public well-being.

Consider the information the central government has regarding the economic status or wealth of the different cities and constituencies. An extreme case is where the government has no information regarding the wealth of the cities and constituencies. In general, however, the government possesses partial knowledge of the cities/constituencies wealth. Indeed, it may well be the case that the government has full information yet creates a contest in order to receive transfers from the cities and constituencies in order to increase its power; however, in this paper we do not consider this circumstance. The government's information level determines the contest-success function (CSF). In the extreme first case, the contest success function is independent of the wealth of the constituency while in the general second case the contest-success function is positively related to city/constituency wealth.

Denote by w_i the economic status of constituency i – lower w_i constituencies should face lower taxes. w_i also captures the cost of lobbying per unit of lobbying. Lobbying to reduce taxation is time consuming, decreasing the time allocated to productive activities. Similarly, v_i is the economic status or wealth of a city; it is a weighted average of the economic status of its constituencies (see Section 3.1). By reducing the time spent on productive activities, lobbying is costly in terms of lost income. The lower the economic status of the city/constituency the lower the opportunity cost of lobbying and the more time spent lobbying. On the other hand, as their size increases they have greater say in setting (and reducing) their tax payments.

The probability/proportion of the tax paid by a city/constituency is a function of lobbying effort, the wealth of the city/constituency and the level of information the government has regarding its wealth.[3] This is captured in our contest success function. Hierarchical rent-seeking, as is present in our model, is also present in Hillman and Katz (1987). They evaluate the social losses from bribe contests that are transferred up a hierarchy. In the Hillman-Katz model, rent enters the hierarchy exogenously. In our model the value of the expected rent is endogenous, reflecting incentives to divide time between rent-seeking and productive activity. Inderst et al. (2007) on the other hand consider hierarchy as an instrument to channel activities and power. Furthermore, in the rent-seeking literature it has been established that asymmetry between the contestants reduces wasteful lobbying efforts. The asymmetry can be in terms of the lobbying capabilities, wealth endowments, attitudes toward risk or rent valuations of the contestants, as in, for example, Allard (1988), Gradstein (1994), Nitzan (1994), and Nti (1999). In a similar way in our model asymmetry affects lobbying efforts and thus the probability of paying a portion of the tax bill.

3. Government, cities and institutions

3.1. Competition between cities

In our model, we consider a government that wants to obtain a total amount of R funds from the different constituencies by means of the two cities, A and B.[4] Denote by L_i the lobbying effort of city i attempting to minimize taxes paid to the government. Denote by $\Pr_i$ the probability/proportion city i *pays* out of the total funds R the government has to collect. Therefore, the expected amount this city will pay in taxes is $\Pr_i R$. Each city invests resources in order to reduce the amount of tax paid by exerting lobbying effort L_i. The fraction of the city's resources not used up in lobbying is $(1\text{-}L_i)$. Even though we call this lobbying, we are talking about a model of *intergovernmental lobbying* and not special interest lobbying.

L_i is also the fraction of the city's resources used for lobbying. Thus, the cost for lobbying is $L_i\, v_i$, where v_i represents the weighted average wealth of the city, and as v_i increases the cost of lobbying increases. We must remember that we are not talking about a specific project. We also do not look at the benefit from the project. We consider a government that has decided to fund a certain project and now it must impose the funding on the different groups. Even if all constituencies want the project, they would prefer having the project without paying for it. So, they compete on who will pay less.

The cities are risk neutral. The objective of city i is to maximize its expected payoff, given by[5]:

[2] Along these lines, Luce (1959) proposes a model of "*bounded rationality*" (see also Sheshinski, 2002). Luce shows that when choice probabilities satisfy a certain axiom (the choice axiom), a scale, termed utility, can be defined over alternatives such that the choice probabilities can be derived from scales (utilities) of alternatives.

[3] In this paper we do not take into consideration whether the public policy benefits a certain city or is politically related to that city. Here we talk of how the effects of lobbying, the city size and the city's wealth, affect the funding of public policy.

[4] Note that there may be different government objectives. We focus on this simplified objective.

[5] Our paper talks about this simplified objective function for cities while there are other types of objective functions that could be analysed. For example, the cities might be risk averse rather than risk neutral, etc. We focus on a central government wishing to obtain a total amount of funds. The cities/constituencies want to maximize their risk neutral expected payoff. Moreover, below we have all levels of governance explicitly interested in making pro-poor decisions. This is only one goal; there may be others and these also may be captured in different types of objective functions.

$$E(U_i) = (1 - L_i)v_i - \Pr_i R \quad \forall\ i = A, B \tag{1}$$

where v_i represents the weighted average wealth of the city, $v_i = \sum_{j \in i} k_j w_j \quad for\ \ i = A, B$ where w_j represents the wealth or economic status of constituency j and k_i represents the "weight" of that constituency in the city (the weight may be a function of different variables).

The probability/proportion ($\Pr_i$) a city pays depends on a number of factors. It is a negative function of the lobbying effort of city i and is positively affected by the lobbying effort of city j. Moreover, $\Pr_i$ is positively related to own-city wealth and negatively to other-city wealth. As v_i increases city i is wealthier and thus will need to pay more to the government.

One could think of v_j as total wealth or as per capita. Since we also take into consideration the size of the city (see below), we think of city wealth as total wealth. Thus, we consider in the model the effect of the city's total wealth and the effect of the city's size.

$\Pr_i$ is also a function of the information level the government has regarding the cities' real wealth. Denote this level by α. α is assumed to be identical for all cities. As α increases the probability/proportion of funds received by the government from the city with the low v decreases. Moreover, it is assumed that the (population) size of the city is also a factor determining the probability of paying taxes. The idea behind this assumption is that larger cities have more weight in affecting the government's decision-making (the larger city size, the more noise it can make and the more influence it has on Election Day). We can also think about this as the relative lobbying ability of the different cities. In order to simplify, we assume that this ability is a direct function of the size of the city. We normalise the size of city B to unity; the effect of the size of city A is denoted by d. Thus d is a positive function of the size of city A. They lobby to decrease their tax responsibility and, as city A grows relative to city B (d is bigger) they have more influence and will pay lower taxes.[6]

The contest success function we employ is a variant of the Tullock (1980) lottery logit function. This function satisfies all the desired properties mentioned above. City A's probability/proportion of rent received versus city B's is given by[7]:

$$\Pr_A = \frac{\frac{1}{d\ L_A}\frac{1}{v_A}(v_A)^{\alpha+1}}{\frac{1}{d\ L_A}\frac{1}{v_A}(v_A)^{\alpha+1} + \frac{1}{L_B}\frac{1}{v_B}(v_B)^{\alpha+1}} = \frac{\frac{1}{d\ L_A}v_A^{\alpha}}{\frac{1}{d\ L_A}v_A^{\alpha} + \frac{1}{L_B}v_B^{\alpha}}, \tag{2}$$

thus,

$$\Pr_A = \frac{L_B v_A^{\alpha}}{L_B v_A^{\alpha} + dL_A v_B^{\alpha}},$$

where $(L_i v_i)$ is the value of lobbying and v_i is the wealth or the level of affordability of the city.

The idea behind this contest success function (CSF) is that as $\Pr_i$ is higher, city i pays a larger proportion of the funds sought by the government. This proportion (probability) is a function of a number of factors. As the value of the lobbying effort of the city $(L_i v_i)$ increases, the proportion paid will decrease. The idea is that the more they invest in lobbying, the more likely the outcome will be favourable for them. Therefore, this enters the function inversely: $\frac{1}{L_A}\frac{1}{v_A}$. Also, the effect of the lobbying depends on the relative size of the city (d): larger cities pay less. Thus we have lobbying expenditure and city size of the working in the same direction: $\frac{1}{dL_A}\frac{1}{v_A}$, i.e., a dollar a small city spends is not the same as a dollar a large city spends. The bigger city's dollar is worth more since the size of the city has an influence. On the other hand, the wealth of the city, v_i, has a direct effect on the portion a city pays. The wealthier the city, the more it should pay; v_i positively affects the proportion paid. Since the government does not have full information, the level of information about the city's wealth is very important. It is assumed that as information increases, wealth has a stronger impact on the probability/proportion paid by the city. The component $(v_A)^{\alpha+1}$ captures this – as it increases, the proportion paid by the city increases.

These components provide us with the final form of our contest success function, $\Pr_A = \frac{L_B v_A^{\alpha}}{L_B v_A^{\alpha} + dL_A v_B^{\alpha}}$. Thus, on average, the more city A (L_A) lobbies, the less it pays. The wealthier the city, v_A, the more it pays. On average, the more information the government has with regard to city wealth for a given wealth level, ${v_A}^{\alpha}$, the more they pay. And finally, as the relative size of a city (d) increases, the less it pays since its influence increases.

Note that all these assumptions regarding the function hold:

$$\begin{aligned}
&\frac{\partial \Pr_A()}{\partial\ L_A} < 0, \frac{\partial \Pr_A()}{\partial\ L_B} > 0, \frac{\partial \Pr_A()}{\partial\ d} < 0, \frac{\partial \Pr_A()}{\partial\ v_A} > 0, \frac{\partial \Pr_A()}{\partial\ v_B} < 0, \\
&\frac{\partial \Pr_B()}{\partial\ L_B} < 0, \frac{\partial \Pr_B()}{\partial\ L_A} > 0, \frac{\partial \Pr_B\ ()}{\partial\ d} > 0, \frac{\partial \Pr_B()}{\partial\ v_B} > 0, \frac{\partial \Pr_B()}{\partial\ v_A} < 0.
\end{aligned} \tag{3}$$

[6] The model is built so that it can consider different city sizes. The variable d represents the relative size of the city, the size of city A relative to the size of city B. Since the probability is relative, we use relative terms. Thus, we do not need to know the actual level of the city. We need to know its relative size with relation to the city it is "competing" against. Looking at a change in d enables us to understand how lobbying and paying taxes change when we are comparing two different cities where the relative size of one versus the other changes. Also, since d represents the relative size of a city it also takes into consideration migration from one city to the other. This is captured with a change is the relative size of city A with respect to city B.

[7] The idea is that even though taxes may well be progressive, in that the proportion of funds paid increases with wealth, in equilibrium the proportion of the taxes from the total wealth of the city may be lower for the wealthy city relative to the poorer city. In the contest success function, the wealth of the city has a positive effect, but the size of the city decreases the proportion of tax paid.

We focus on two groups. One way to view this simplification is to say that we look at only two groups with one "poor" and the other "rich". However, there may well be more than two groups, though we still only observe two groups participating in the contest in our contest success function. For example, we can think of three groups with the poorest constituency being so poor that the government does not take any resources from them; instead it draws its revenues only from the middle class and the rich. So in our contest success function, we would talk in terms of two groups, the rich and middle class. One could think of these as the relatively rich and the relatively poor (middle class). In these terms, all governance levels are explicitly interested in making pro-poor decisions. This is only one goal; there may be others and these also may be captured in different types of objective functions.

We are employing two elements that have opposite effects: total wealth increases the tax burden, while the size of the city decreases the tax burden. Moreover, for v_i v_j it holds that $\frac{\partial \Pr_i(.)}{\partial\ \alpha} < 0$ *and* $\frac{\partial \Pr_j(.)}{\partial\ \alpha} > 0$.[8] We assume d appears as a weight on the lobbying effort. Each unit of lobbying has a larger effect in big cities than in small cities:

$$\left.\frac{\partial \Pr_A(dL_A, L_B)}{\partial(d\ L_A)}\right|_{L_b = dL_A} = \left.\frac{\partial \Pr_B(L_B, d\ L_A)}{\partial\ L_B}\right|_{L_b = dL_A}. \tag{4}$$

This means that the function is symmetric and that there is a trade-off between lobbying effects and the effect of city size. It is also assumed that there are decreasing marginal effects of lobbying, ensuring that the second order conditions hold: $\frac{\partial^2 \Pr_A(dL_A, L_B)}{\partial\ (d\ L_A)^2} < 0$ *and* $\frac{\partial^2 \Pr_B(L_B, d\ L_A)}{\partial\ L_B^2} < 0$. Moreover, as $\Pr_A\ (dL_A, L_B) + \Pr_B(L_B, d\ L_A) = 1$, i.e., the sum of proportions paid by the cities is 1 and if one increases the other will decrease, it holds that

$$\frac{\partial^2 \Pr_A(dL_A, L_B)}{\partial(d\ L_A)\partial\ L_B} = -\frac{\partial^2 \Pr_B(L_B, d\ L_A)}{\partial\ L_B\ \partial(d\ L_A)}. \tag{5}$$

This contest success function is a variant of the non-discrimination rule of Tullock (1980) (see also Epstein and Nitzan, 2003; Hillman and Riley, 1989; Hirshleifer, 1989). The probability of winning the contest is therefore determined by: (i) The level of investment in lobbying activities, L_A and L_B; (ii) The effect of the relative size of city A, d; (iii) The wealth of the cities, v_A and v_B; (iv) The amount of information the government has regarding the wealth of the different cities, α. The α-value represents the government's level of information regarding the city's real wealth. As α increases, the government places greater emphasis on the city's wealth. If $\alpha = 0$, the government does not have any information regarding the cities' wealth and, thus, utility depends only on the cities' investment in lobbying activities. If $\alpha = \infty$, the government has full information about the cities' wealth, which is exclusively used to make decisions on the division of resources.[9] In the case where $\alpha = \infty$ the government would impose the full tax burden on the wealthiest city. However, it is not clear that this is optimal. We thus limit the value of α to be lower than infinity. For example, it could be 1: α $(0 \leq \alpha \leq 1)$.

So what is α? It is a weight on the local institution (in the case of equation (5) it is the constituencies; in another manifestation it may be the local governments). Thus, one could think of α as determined by whether the political party of the constituency is the same as that of the central government (or, depending on context, local governments). This can be a crucial aspect by which political decisions are made.[10] One could think about the relative value of a constituency to a local, or a national, government. Similarly, the relative linkages between the local and national governments could serve a similar role. This leads to saying the efficiency results (whether to determine the tax locally or nationally) will turn on the size of α.

A different way of looking at α is as the ratio between (i) the elasticity of a city's expected tax burden to v_i and (ii) the elasticity of a city's expected tax burden to L_i, its lobbying effort. Thus α is the relative importance of the fundamentals to lobbying. Information provides one possible micro-foundation for α, another is the greediness of the central government. In this paper we consider it as the information the government has. Note that α is *only one possible* way to model the quality of the government's information about v_A and v_B. For example, if the government was simply auctioning tax exemptions, then the quality of its information about v_A and v_B would not matter.[11]

3.1.1. The optimal lobbying effort

In this section we consider the optimal level of effort each of the cities will choose in equilibrium. Given these levels we can know

[8] A higher α increases the weight of wealth in Pr. Thus, as the government has more information about the wealth of the city, the government places more weight on a city's wealth in determining the city's proportion of the tax burden paid. In this paper we do not model how the information is received. One could think of a more extended model where lobbying is a way to transfer information.

[9] We assume that the information level is the same for all cities. One could think of the information with regard to a city as a function of its size. The government might then have less information the bigger the city. This would also connect the analysis to the issues surrounding migration from one city to a competing city.

[10] There may be other issues influencing the relative welfare weights.

[11] This function also can also be seen a specific case of *Luce's (Multinomial) Logit* Model. Luce's *(Multinomial) Logit Model* postulates that the probability of an individual choosing a certain alternative *a*, from the set of alternatives *S*, $a \in S$, $\Pr_a$, is given by: $\Pr_a = \frac{e^{q_a u(a)}}{\sum_{b \in s} e^{q_b u(b)}}$, where the parameter, q_a, represents the central government's preferences (discrimination between cities, or in the present context, the weight assigned to the size of the city or the lobbying ability of the city). If $q_b = 0$ for all *b*, then all cities pay the same proportion of the total rent. Uncertainty increases if the government does not have full information regarding the city's real needs. In this setting, *u(a)* is the value attributed by the government to the city's wealth. As stated above, cities invest effort in rent-seeking activities (to hide or reveal both their own and their opponents' actual wealth from the government). The utility the government attributes to city *i* is given by $u(v_i, L_i)$. Let the utility be the logarithmic function, such that $u(v_i, L_i) = Ln\left(\frac{v_i^a}{L_i}\right)$. Thus, utility decreases with the city's increased investment in lobbying activity, L_i, and in the wealth of the city, v_i^a.

what the expected payoff of each of the cities will be and we can calculate the proportion of taxes each city will pay. Thus we will calculate the Nash equilibrium lobbying effort and from that derive the equilibrium probability levels and the expected net payoff of each of the cities.

Each city maximizes its expected payoff (equation (1)). The first order condition for maximization is given by (second order conditions are satisfied):

$$G_i = \frac{E(U_i)}{\partial\ L_i} = -v_i - \frac{\partial \Pr_i}{\partial L_i} R = 0 \quad \forall\ i = A, B. \tag{6}$$

The optimal lobbying effort of both parties satisfies:

$$-\frac{\partial \Pr_A}{\partial(d\ L_A)} = \frac{v_A}{d\ R} \quad and \quad -\frac{\partial \Pr_B}{\partial\ L_B} = \frac{v_B}{R}. \tag{7}$$

The optimal solution is wealth over total revenue to be collected; i.e., each constituency's optimal lobbying is given by its wealth normalised by total revenue to be collected, adjusted by the *d*. Assuming an internal solution we denote the Nash equilibrium lobbying effort of both cities that solves (7) by L_A^* *and* L_B^*.

Using (5) we obtain that the optimal lobbying efforts of the cities are given by:

$$L_A^* = \frac{d\ R\ v_A^{\alpha} v_B^{\alpha+1}}{\left(v_A^{\alpha+1} + d v_B^{\alpha+1}\right)^2} \quad and \quad L_B^* = \frac{d\ R\ v_A^{\alpha+1} v_B^{\alpha}}{\left(v_A^{\alpha+1} + d v_B^{\alpha+1}\right)^2}. \tag{8}$$

Thus, we obtain that the equilibrium proportion paid by each city equals:

$$\Pr_A^* = \frac{v_A^{\alpha+1}}{v_A^{\alpha+1} + d v_B^{\alpha+1}} \quad and \quad \Pr_B^* = \frac{d\ v_B^{\alpha+1}}{v_A^{\alpha+1} + d v_B^{\alpha+1}}, \tag{8'}$$

and the expected payoff of each city is

$$E\left(U_A^*\right) = \frac{v_A\left(\left(v_A^{1+\alpha} + d {v_B}^{1+\alpha}\right)^2 - R v_A^{\alpha}\left(v_A^{1+\alpha} + 2d {v_B}^{1+\alpha}\right)\right)}{\left({v_A}^{1+\alpha} + d\ {v_B}^{1+\alpha}\right)^2}$$

$$and \tag{8''}$$

$$E\left(U_B^*\right) = \frac{v_B\left(\left(v_B^{1+\alpha} + d {v_A}^{1+\alpha}\right)^2 - R v_B^{\alpha}\left(v_B^{1+\alpha} + 2d {v_A}^{1+\alpha}\right)\right)}{\left({v_A}^{1+\alpha} + d\ {v_B}^{1+\alpha}\right)^2}.$$

3.1.2. The effect of a change in the relative size of city A on lobbying activities

We now consider the effect that a change in the size of *d,* the relative lobbying ability of city A, has on the lobbying effort of both cities. We have that *d* times their wealth is the value of the city and as this increases they pay less, however the value of the wealth itself is higher. So as they are wealthier they pay more on average. It can be shown that the Nash equilibrium in the determination of the lobbying effort of the cities satisfies:

$$\frac{\partial\ L_A^*}{\partial\ d} = \frac{R v_A^{\alpha} v_B^{\alpha+1}}{\left(v_A^{\alpha+1} + d v_B^{\alpha+1}\right)^2}\left(v_A^{\alpha+1} - d v_B^{\alpha+1}\right) \quad and \quad \frac{\partial\ L_B^*}{\partial\ d} = \frac{R v_B^{\alpha} v_A^{\alpha+1}}{\left(v_A^{\alpha+1} + d v_B^{\alpha+1}\right)^2}\left(v_A^{\alpha+1} - d v_B^{\alpha+1}\right). \tag{9}$$

Therefore, $Sign\left(\frac{\partial\ L_B^*}{\partial\ d}\right) = Sign\left(\frac{\partial\ L_A^*}{\partial\ d}\right)$. Moreover, $Sign\left(\frac{\partial\ L_B^*}{\partial\ d}\right) = Sign\left(\frac{\partial\ L_A^*}{\partial\ d}\right) \begin{matrix} > \\ < \end{matrix} 0$ if $\frac{v_A}{v_B} \begin{matrix} > \\ < \end{matrix} \sqrt[(\alpha+1)]{d}$. Without loss of generality, assume that $d > 1$. If $v_A < v_B$ then $Sign\left(\frac{\partial\ L_B^*}{\partial\ d}\right) = Sign\left(\frac{\partial\ L_A^*}{\partial\ d}\right) < 0$, otherwise the sign of the effect of a change in d is ambiguous.

Thus,

Proposition 1. *Assuming that city A is larger than city B, if city A's wealth is smaller than that of city B, then the (relatively) larger is city A the less lobbying effort will be invested by both cities. However, if the wealth of city A is greater than that of city B such that* $v_A > \sqrt[(\alpha+1)]{d}\ v_B$ *then the (relatively) larger is city A the more lobbying effort will be invested by both cities.*

This result states that if city A is larger than city B and A's wealth is greater, then both cities will increase their lobbying efforts.

3.1.3. The effect of a change in the wealth of the cities

We now address how changes in the relative wealth of a city affects its lobbying effort. Initial conditions matter. That is, whether the two cities are initially close in their wealth levels or far apart drives the results. Consider the effect of an increase the level of *v* on lobbying activities.

$$\frac{\partial L_A^*}{\partial v_A}=\frac{dRv_A^{\alpha-1}v_B^{\alpha+1}\left(-v_A^{\alpha+1}(2+\alpha)+\alpha dv_B^{\alpha+1}\right)}{\left(v_A^{\alpha+1}+dv_B^{\alpha+1}\right)^3},\ \frac{\partial L_A^*}{\partial v_B}=\frac{(1+\alpha)Rv_A^{\alpha}v_B^{\alpha}\left(v_A^{\alpha+1}-dv_B^{\alpha+1}\right)}{\left(v_A^{\alpha+1}+dv_B^{\alpha+1}\right)^3},$$
$$\frac{\partial L_B^*}{\partial v_B}=\frac{dRv_A^{\alpha+1}v_B^{\alpha+1}\left(-v_B^{\alpha+1}(2+\alpha)+\alpha dv_A^{\alpha+1}\right)}{\left(v_A^{\alpha+1}+dv_B^{\alpha+1}\right)^3}\ \text{and}\ \frac{\partial L_B^*}{\partial v_A}=\frac{(1+\alpha)Rv_A^{\alpha}v_B^{\alpha}\left(-v_A^{\alpha+1}+dv_B^{\alpha+1}\right)}{\left(v_A^{\alpha+1}+dv_B^{\alpha+1}\right)^3} \tag{10}$$

We obtain that if $\frac{v_A}{v_B}\ \begin{matrix}<\\>\end{matrix}\ \sqrt[(\alpha+1)]{\frac{\alpha d}{2+\alpha}}$ then $\frac{\partial L_A^*}{\partial v_A}\ \begin{matrix}>\\<\end{matrix}\ 0$ and if $\frac{v_A}{v_B}\ \begin{matrix}>\\<\end{matrix}\ \sqrt[(\alpha+1)]{\frac{2+\alpha d}{\alpha d}}$ then $\frac{\partial L_B^*}{\partial v_B}\ \begin{matrix}<\\>\end{matrix}\ 0$.

Thus, if $\sqrt[(\alpha+1)]{\frac{2+\alpha d}{\alpha d}}\ \begin{matrix}<\\>\end{matrix}\ \frac{v_A}{v_B}\ \begin{matrix}<\\>\end{matrix}\ \sqrt[(\alpha+1)]{\frac{\alpha d}{2+\alpha}}$ *then* $\frac{\partial L_A^*}{\partial v_A}\ \begin{matrix}>\\<\end{matrix}\ 0$ *and* $\frac{\partial L_B^*}{\partial v_B}\ \begin{matrix}<\\>\end{matrix}\ 0$. If $\frac{v_A}{v_B}\ \begin{matrix}>\\<\end{matrix}\ \sqrt[(\alpha+1)]{d}$ then $\frac{\partial L_A^*}{\partial v_B}\ \begin{matrix}>\\<\end{matrix}\ 0$ and $\frac{\partial L_B^*}{\partial v_B}\ \begin{matrix}<\\>\end{matrix}\ 0$. Therefore, if $\sqrt[(\alpha+1)]{\frac{2}{\alpha d}+1}>\frac{v_A}{v_B}>\sqrt[(\alpha+1)]{d}$, then $\frac{\partial L_A^*}{\partial v_A}<0$, $\frac{\partial L_B^*}{\partial v_A}>0$ and $\frac{\partial L_A^*}{\partial v_B}<0$, $\frac{\partial L_B^*}{\partial v_B}>0$. In words,

Proposition 2. *If the wealth of city A is sufficiently small, but not too small, then: (1) an increase in the wealth of city A will decrease city A's lobbying effort and will increase city B's effort. (2) an increase in city B's wealth will decrease the effort of city A and will increase city B's effort.*

Notice that $\frac{\partial L_A^*}{\partial v_A}=0$ *while* $v_A^{\alpha+1}=\frac{\alpha dv_B^{\alpha+1}}{(2+\alpha)}$; thus if $v_A^{\alpha+1}<\frac{\alpha dv_B^{\alpha+1}}{(2+\alpha)}$, increasing the wealth of city A will increase the lobbying of city A and if $v_A^{\alpha+1}>\frac{\alpha dv_B^{\alpha+1}}{(2+\alpha)}$, increasing the wealth of city A will decrease its lobbying. Moreover, $\frac{\partial L_A^*}{\partial v_B}=0$ *while* $v_A^{\alpha+1}=dv_B^{\alpha+1}$. Thus, increasing the wealth of city B above this level will decrease the lobbying investment of city A and in a similar way for the lobbying of city B.

What we can learn here is that if city A is sufficiently relatively wealthy, increasing its wealth increases its probability of paying more taxes. In equilibrium, city B will decrease its lobbying and in turn in equilibrium city A will decrease its lobbying. However, if city A is not sufficiently relatively wealthy, increasing its wealth will increase its lobbying and in turn increase city B's lobbying. Thus, there is a point in which both are sufficiently alike in terms of size and wealth that they are "symmetric" such that any move from this level will decrease the lobbying of one or both. For example if $\alpha=1$ and $d=1$, then both will invest the most effort on lobbying effort when $v_A=\frac{1}{3}v_B$.

3.1.4. The effect of a change in the government's information level

Let us now consider the effect of a change in the level of information, α, the government has regarding the cities' wealth on the total lobbying effort by the cities.

From (8), the sum of lobbying effort for both cities equals,

$$L_A^*+L_B^*=\frac{dRv_A^{\alpha}v_B^{\alpha}(v_A+v_B)}{\left(v_A^{\alpha+1}+dv_B^{\alpha+1}\right)^2}. \tag{11}$$

Therefore,

$$\frac{\partial\left(L_A^*+L_B^*\right)}{\partial\alpha}=\frac{dRv_A^{\alpha}v_B^{\alpha}(v_A+v_B)\left(-v_A^{\alpha+1}+dv_B^{\alpha+1}\right)(Ln(v_A)-Ln(v_B))}{\left(v_A^{\alpha+1}+dv_B^{\alpha+1}\right)^3}. \tag{12}$$

Without loss of generality assume $v_A>v_B$ $(Ln(v_A)>Ln(v_B))$: $\frac{\partial(L_A^*+L_B^*)}{\partial\alpha}\ \begin{matrix}>\\<\end{matrix}\ 0$ iff $\frac{Ln(d)}{Ln(v_A)-Ln(v_B)}-1\ \begin{matrix}>\\<\end{matrix}\ \alpha$.

As noted above, α is the ratio between (i) the elasticity of a city's expected tax burden to v_i and (ii) the elasticity of a city's expected tax burden to L_i, thus it is the relative importance of the fundamentals relative to lobbying.

Proposition 3. *If the information level (α) is not sufficiently high, then increasing the level of information will cause at least one of the cities to invest more effort in lobbying activities in order to offset the information the government has. However, if the information level is sufficiently high, then the total lobbying effort will decrease as lobbying becomes less effective.*

What drives Proposition 3 is that higher α decreases the effectiveness of A's (when $v_A>v_B$) lobbying, and when α is low enough, this change has a pro-competitive effect. Thus since the government has more information, lobbying increases as to offset the result of the information.

3.1.5. The effect on lobbying effort of a change in the relative size of city A

We want to see the effect of city size on lobbying efforts. If one city is small and the other is big what will happen to the total lobbying effort? From (11) we obtain that a change in city size, i.e., increasing the size of city A (or increasing *d*), will result in:

$$\frac{\partial\left(L_A^*+L_B^*\right)}{\partial d}=\frac{Rv_A^{\alpha}v_B^{\alpha+1}(v_A+v_B)\left(v_A^{\alpha+1}-dv_B^{\alpha+1}\right)}{\left(v_A^{\alpha+1}+dv_B^{\alpha+1}\right)^2}.$$

Thus $Sign\left\{\frac{\partial\left(L_A^*+L_B^*\right)}{\partial d}\right\}=Sign\{v_A^{\alpha+1}-dv_B^{\alpha+1}\}.\ Sign\left\{\frac{\partial\left(L_B^*+L_A^*\right)}{\partial d}\right\}\ \begin{matrix}>\\<\end{matrix}\ 0$ if $\frac{v_A}{v_B}\ \begin{matrix}>\\<\end{matrix}\ \sqrt[(\alpha+1)]{d}$.

And we have,

Proposition 4. *(1) If $d>1$, namely, city A is larger than city B and if city A's wealth is smaller than that of city B, v_A v_B, then the (relatively) larger is city A the less lobbying effort will be invested by both cities. (2) If d 1, namely, city A is smaller than city B then if the wealth of city A is*

greater than that of city B such that $v_A > \sqrt[(\alpha+1)]{d}\, v_B$ $(v_A < \sqrt[(\alpha+1)]{d}\, v_B)$ *then the (relatively) larger (less) is city A the more lobbying effort will be invested by both cities.*

To understand the proposition, we must remember that as the wealth of a certain city increases, the probability it will pay a larger proportion of taxes also increases. So, the wealthier city A is, the more it pays. However, as the size of city A increases, (*d* increases), city A pays less. Thus, in the first case, city A is larger than city B and the wealth of city A is smaller than city B so that further increasing the size of city A will decrease the probability it will pay more and thus, city A can decrease its lobbying which in turn will decrease city B's lobbying.

In the case that city A is smaller than city B, and city A is wealthier than city B these two effects move the probability of paying more tax in the same direction. Thus, city A's lobbying would increase. The equation is about whether it increases sufficiently to make city B also increase its lobbying. The condition for this is $v_A > \sqrt[(\alpha+1)]{d}\, v_B$. If this condition does not hold, then even though city A has increased its lobbying, city B will decrease its lobbying, resulting in a total reduction of lobbying efforts. In general, a city may want to invest efforts to overcome its natural disadvantage from being the small city.

3.2. Competition within the cities

Let us now concentrate on the competition between the constituencies within a city. In each city there are two constituencies that compete with one another.

The total amount of taxes needed by the government is *R*. City A invests effort to pay taxes at a level of $\Pr_i R$. This amount is part of the total taxes that are needed to be paid to the (central) government.

Since the city must invest effort at a level of $L_A^* v_a$ to reduce its tax payment this is part of the sum of revenues it needs to collect. Thus, the revenue that city A has to obtain from its constituencies is given by: $r_A^* = \Pr_A^* R + L_A^* v_a$. Namely, it has to raise revenue plus it has to finance its own lobbying activities.

To simplify we assume that there are only two tax paying constituencies in each city ($i = 1,2$). There is no conflict between the assumption of having two constituencies in each city and that the population size of the cities may differ. The expected payoffs for the constituencies are given by:

$$\text{For city A}: \; E(u_{iA}) = (1 - l_i)w_i - g_i\, r_A^* = (1 - l_i)w_i - g_i\left(\Pr_A^* R + L_A^* v_A\right), \tag{13}$$

$$\text{For city B}: \; E(u_{iB}) = (1 - l_i)w_i - g_i\, r_B^* = (1 - l_i)w_i - g_i\left(\Pr_B^* R + L_B^* v_B\right),$$

where w_i is the economic status, wealth or the level of income of constituency *i*, l_i is the lobbying effort of the constituency and g_i is the probability/proportion that constituency *i* will pay. It is assumed that the contest success function in the contest between the constituencies within the city is given by (in a similar way to the contest success function presented above). In city A we have constituency 1 and 2. In city B we have constituency 3 and 4.

The contest success function for constituency 1 in city A is (while for constituency 2 it is 1-g_1)

$$g_1 = \frac{\left(\frac{1}{z_1\, l_1}\right) w_1{}^{\beta_A}}{\left(\frac{1}{z_1\, l_1}\right) w_1{}^{\beta_A} + \left(\frac{1}{l_2}\right) w_2{}^{\beta_A}}, \tag{14A}$$

and for constituency 3 in city B (while for constituency 4 it is 1-g_3),

$$g_3 = \frac{\left(\frac{1}{z_3\, l_3}\right) w_3{}^{\beta_B}}{\left(\frac{1}{z_3\, l_3}\right) w_3{}^{\beta_B} + \left(\frac{1}{l_4}\right) w_4{}^{\beta_B}}. \tag{14B}$$

z represents the size of a constituency where z_A the size of constituency 1 relative to constituency 2 and z_B the relative size of constituency 3 relative to constituency 4. All the assumptions with regard to the contest success function are identical to the ones presented with regard to the contest success function (2). *z* is the weight assigned by the city to the wealth of constituency *i*. This may represent the relative size of this constituency, the city's preferences or the lobbying capability of the constituency. The city's information level regarding the wealth of the constituencies is given by β. It is assumed that as the city is more informed, an increase in β, the probability is that the less well-off constituency will pay lower taxes. As the city has more information it will make the richer pay more and the less wealthy pay less.

Each constituency maximizes its expected payoff. The first order condition for maximization for constituency 1 is given by (second order conditions are satisfied):

$$\frac{E(u_1)}{\partial\, l_1} = -w_1 - \frac{\partial\, g_1}{\partial\, l_1} r_A^* = 0, \tag{15}$$

where r_A^* represents the total tax the city needs to pay (including the efforts invested to affect the amount of tax paid) for the city.

The first order condition is satisfied when:

$$-\frac{\partial g_1}{\partial l_1}=\frac{w_1}{r_A^*}. \tag{16}$$

And in a similar way it is calculated for constituency 2, 3, and 4:

$$-\frac{\partial g_2}{\partial l_2}=\frac{w_2}{r_A^*},-\frac{\partial g_3}{\partial l_3}=\frac{w_3}{r_B^*}\ and\ -\frac{\partial g_4}{\partial l_4}=\frac{w_4}{r_B^*}.$$

Given that the marginal effect of lobbying on the probability of success decreases with an increase in lobbying effort (the second order condition is satisfied), we obtain that the higher is the amount the city needs to collect the more its constituencies will invest in lobbying effort. We can define net rent as the amount a city has to collect, including the amount the city has to pay to the government and for its lobbying efforts.

Substituting the results we obtained into the expected payment of city A (equation (8) into (1)) we have

$$r_A^*=R\frac{v_A^{1+\alpha}\left(v_A^{1+\alpha}+2dv_B^{1+\alpha}\right)}{\left(v_A^{1+\alpha}+d\ v_B^{1+\alpha}\right)^2}, \tag{17}$$

and,

$$\frac{\partial r_A^*}{\partial v_A}>0,\quad \frac{\partial r_A^*}{\partial v_B}<0\quad and\quad \frac{\partial r_A^*}{\partial d}<0. \tag{18}$$

As we can see, the r is a function of the characteristics of the city. Thus, the total tax and payment of city A is positively related its wealth and is negatively related to the wealth of city B, and negatively related to the size of city A (d). The competition between the constituencies within a city depends on the level of tax the city has to pay and it is a function of the size of the city. Thus,

Proposition 5. *As city A is larger relative to city B (its lobbying abilities are better than those of city B or the government prefers city A to city B) the net payment by city A falls while the lobbying effort by the constituencies in city A increase.*

4. An illustration comparing one and two-stage lobbying contests

Above, mainly in the introduction, we provided a brief overview of the extensive economics literature on the benefits and costs of federalism. For the most part the literature points to the benefits of federalism. In this paper we sound a note of caution. Under federalism, the lower level governments will lobby the central government. This within-government lobbying can be as costly as constituent lobbying, making it possible that a federalist governmental structure is just as costly as a national government structure, except that the source of lobbying cost changes. Here we provide an illustration.

We now compare the lobbying efforts that are extracted from constituencies and the probability that constituencies with lower economic status will pay less in taxes in two different situations: one and two-stage lobbying contests. In the two-stage contest, in the first stage we have two cities competing and then in the second stage two constituencies competing in each city. While in the one-stage we have 4 constituencies competing against one another. For clarity, we do this with an extended example.

If we calculate the total expenditure of both constituencies in each city, we obtain in a similar fashion to (11),

$$l_1^*+l_2^*=\frac{z_A r_A^* w_1^{\beta_A} w_2^{\beta_A}(w_1+w_2)}{\left(w_1^{\beta_A+1}+z_A w_2^{\beta_A+1}\right)^2}\ and\ l_3^*+l_4^*=\frac{z_B r_B^* w_3^{\beta_B} w_4^{\beta_B}(w_3+w_4)}{\left(w_3^{\beta_B+1}+z_B w_4^{\beta_B+1}\right)^2}. \tag{19}$$

In order to better understand the results, consider the following case:

1. Both cities have the same population size and the same lobbying abilities: $d=1$,
2. Cities have no preferences regarding the division of the rents between the constituencies and all constituencies have the same lobbying capabilities $z_A=z_B=1$,
3. Constituencies 2, 3 and 4 have the same wealth denoted by w ($w_2=w_3=w_4=w$) and constituency number 1's wealth is half as much as the others: $w_1=0.5w$,
4. The weighted wealth of a city is the sum of the wealth of the constituencies: $v_A=w_1+w_2$ and $v_B=w_3+w_4$,
5. The information level of the cities and the government are the same and equal to 1: $\alpha=\beta_A=\beta_B=1$.

In this situation, we can calculate the total investment in lobbying effort in both stages by all four constituencies and both cities, and the expected payoff of the worst-off constituency (number 1).

4.1. A two-stage contest

In the two-stage contest, the cities compete first against each other regarding how much of the taxes each will pay and then the

constituencies compete against one another. The city collects from the constituencies the tax it has to pay the government plus the cost of the city's rent-seeking activity. Using (11) and (20) we obtain the following:

City A: Total lobbying effort would be $l_A = \frac{0.1536}{w}R$;
Payoff: $E(U_A) = (1-l_A)1.5w - \Pr_A R = 1.5w - 0.5904R$.
Thus, city A will have to collect from the constituencies in the city $r_A = 0.5904R$.
City B: Total lobbying effort would be $l_B = \frac{0.1151}{w}R$;
Payoff: $E(U_B) = (1-l_B)\,2w - \Pr_B R = 2w - 0.8705R$.
Thus, city B will have to collect from the constituencies in the city $r_B = 0.8705R$.
Constituency 1: Total lobbying effort would be $l_1 = \frac{0.32}{w}r_A$;
Payoff: $E(U_1) = (1-l_1)0.5w - \Pr_1 r_A = 0.5w - 0.2125R$.
Constituency 2: Total lobbying effort would be $l_2 = \frac{0.16}{w}r_A$;
Payoff: $E(U_2) = (1-l_2)w - \Pr_2 r_A = w - 0.56678R$.
Constituencies 3 and 4: Total lobbying effort would be $l_3 = l_4 = \frac{0.25}{w}r_B$;
Payoff: $E(U_3) = E(U_4) = (1-l_3)w - \Pr_3 r_B = w - 0.6529R$.
The total expenditure of all four constituencies: Total funds paid$_{two}$ = 2.08608R.
Thus to pay R taxes to the government, the constituencies paid more than 100% because of lobbying.

4.2. A one-stage contest

Now let us consider the case where all four constituencies directly lobby the (central) government in a one-stage game. We assume that the contest success function is given by:

$$f_1 = \frac{\left(\frac{1}{x_1}\right){w_1}^{\beta}}{\left(\frac{1}{x_1}\right){w_1}^{\beta} + \left(\frac{1}{x_2}\right){w_2}^{\beta} + \left(\frac{1}{x_3}\right){w_3}^{\beta} + \left(\frac{1}{x_4}\right){w_4}^{\beta}}. \tag{20}$$

This contest success function is identical to the one presented in equation (2); here we generalise it to 4 players and add the assumptions made at the beginning of this section (section 4). In a symmetric way the probability of the other three constituencies are calculated. This function satisfies the general properties presented above.

Each constituency maximizes its expected payoff. The first order condition for maximization for each of the 4 constituencies is given by:

$$\frac{E(u_i)}{\partial l_i} = -w_i + \frac{\partial f_i}{\partial l_i}R = 0 \quad \forall\, i = 1,2,3,4. \tag{21}$$

Constituency 1: Total lobbying effort would be $l_1 = \frac{0.169884}{w}R$;
Payoff: $E(U_1) = (1-l_1)0.5w - \Pr_1 R_A = 0.5w - 0.161842R$.
Constituencies 2, 3 and 4: Total lobbying effort would be $l_2 = l_3 = l_4 = \frac{0.105416}{w}R$;
Payoff: $E(U_2) = E(U_3) = E(U_4) = (1-l_3)w - \Pr_3 R = w - 0.413016R$.
The total expenditure of all four constituencies: Total funds paid$_{one}$ = 1.401R.
Thus to pay R taxes to the government the constituencies paid 40% more as a result of lobbying. This gives us the following result,

Under this example, total expenditure of the constituencies is higher in the two-stage contest rather than in the one-stage contest. The expected payoff of all the constituencies is lower under the one-stage than under the two-stage contests. If the government's objective is to help the worst-off constituency as much as possible and to minimize wasted resources on lobbying, then a one-stage contest is optimal.

We are comparing two situations: (1) A two-stage contest where first the cities compete on the level of tax they have to pay, and then each constituency competes against its rival in the city to cover the tax needed to pay plus the city's effort. (2) A one-stage contest where all four constituencies compete on paying the tax the government needs to collect. The results show that in the first option spending is higher and expected payoffs of all the constituencies are lower. The reason for this is that in the first option, the constituencies have to cover both the tax level and the effort invested by the city. Moreover, in the one-stage, the competition is less extensive since 4 are competing, while in two-stage, we have two competing against each other in two rounds. The competition between two is more intensive and causes the players to spend more resources.[12]

4.3. Information aspects in a two-stage contest versus a one-stage contest

Another aspect that must be considered when comparing a one-stage contest to a two-stage contest is the information level the government has versus the information the city has regarding the economic status of the constituencies. It is reasonable to assume that the city has more information than the government. Increasing information increases the probability that the correct (richer) constituency pays more taxes. However, increasing information may increase the total wasted resources invested in lobbying activities. A two-

[12] There is nothing specific about lobbying costs exceeding the net benefits, that is simply an artefact of the parameterization of the model. The main point of the modelling is that it is the relative net benefits in the two governmental structures that is material.

stage contest may have the advantage that after the city knows the taxes it must pay; the city allocates the taxes due among its constituencies. In the one-stage contest the government allocates its collection among all constituencies. This may provide an advantage to the cities. The taxes the constituency has to pay directly to the government may be higher than they had to pay to the city as the government lacks information regarding the actual wealth of the city.

In the two-stage game the government determines how much each city has to pay. That said, each city can influence how much they will pay by investing resources (lobbying) so as to affect the government's decision. The cities maximize their level of investment to decrease their cost. Of course, a city could choose not to lobby – not invest effort into lowering their tax bill. In this case the city would have to pay the amount determined by the government. If, for example, there is the possibility that the lobbying costs will exceed the tax, the city would have to compare the net expected value when not investing to what the net would be if they invest. This is a corner solution. In this case the city may be in a situation where they will need to pay a lot if they do not enter. So they enter. Note that sometimes they enter the contest to minimize losses and sometimes they enter to maximize net payoff. Note that our results show that in the structure presented there are reasonable scenarios in which a national governmental structure may be at least as efficient as a federalist structure.

5. Conclusion

Governments do not have perfect information regarding the priorities and the wealth of different groups in the economy. This lack of knowledge opens the door for different groups to lobby the government in order to pay lower taxes. Such lobbying can be seen as rent-seeking activities manifesting themselves as attempts by different groups pay less tax. Thus, it is not clear that the tax burden will be allocated according to a group's wealth. Rather, greater taxes may be imposed on those who are not efficient rent-seekers. For example, wealthier groups may have greater influence on decision-makers causing the government to impose the tax on others or give those with influence greater tax reductions.

If the tax burden is allocated to the non-efficient rent-seekers or those who invest relatively less effort and resources in rent-seeking activities, there are two efficiency losses: *(a)* the worst-off may be those that have the highest tax burden and *(b)* a high rent dissipation, investment of effort and resources in rent-seeking activities, decreases the resources allocated to real production and thus decreases output. In an attempt to increase efficiency, the central government may decentralise decision-making by allocating the tax gathering to different cities. The cities, in turn, will obtain the required tax revenue from the different groups within its district.

We analyse this decentralisation of decision-making in a theoretical rent-seeking framework. We take into account the knowledge that the government has regarding different groups' wealth and the information the city has regarding these groups. We also provide some insight into the question of how decentralisation increases or decreases total rent-seeking activity, and how the level of information possessed by the government and the cities affects rent-seeking activity and the incidence of the tax burden.

While our model is of general interest for many intergovernmental structures, we concentrate in this paper on a central government authority, intermediate authorities (cities) under that central government's authority, and interest groups, constituencies or organizations within the cities representing the "people" who are the targeted beneficiaries of social expenditure policy and ultimately the source of the revenue needed to fund the programmes. We assume here that the goal of the government is to determine optimal taxation levels. Its problem is how to best structure its tax collection.

Our model is one of hierarchical rent-seeking in which the fixed social expenditure bill must be met by tax revenue which ultimately is the responsibility of the central government. We compare a one-stage game in which the central government directly sets the revenue due it from each local constituency (representing the people) to a two-stage game in which the central government sets the revenue due it from the cities and the cities do likewise for competing constituencies in their jurisdictions. All the actors spend funds to reduce their revenue obligations. The authorities do not know exactly the wealth of each group, but the intermediate authorities (cities) have more information than the central government, so more layers means more information. The richer your constituency the more taxes you may need to pay, so you will fight to convince the tax administrators that you should pay less.

Our extended example of fiscal federalism draws on the analysis and propositions presented earlier in the paper. We compare two situations: (1) A two-stage contest where first the cities compete on the taxes they must pay, and then each constituency competes against its rival in that city to cover the tax they must pay plus the city's lobbying effort. (2) A one-stage contest where all four constituencies directly compete with each other on trying not to pay the tax the government needs to collect. The results show that in the first option tax avoidance expenditure is higher and expected payoffs of all the constituencies are lower. The reason for this is that in the first option, the constituencies have to cover both the tax level and the effort invested by their city. Moreover, in the one-stage, the competition is less extensive since the four constituencies are competing, while in two-stage, we have two competing against each other in two rounds. The competition between two is more intensive and causes the players to spend more resources.

There is an extensive economics literature on federalism's benefits and costs, generally pointing to its benefits. This paper sounds a note of caution. The comparison of the one-stage game with the two-stage game is about the relative costs and benefits of federalism. On one level the importance of relative information has been well-known for a long time. On the other hand, the explicit demonstration of that possibility, and the implications for not only effective policy but for influencing rent-seeking is quite interesting. As we have shown, there are conditions in which the two-stage game dominates the one-stage game, and vice-versa. Within-government lobbying can be as costly as constituent lobbying, and thus it is possible a federalist governmental structure may be just as costly as a national government structure, except that the source of lobbying cost changes.

Conflicts of interest

None.

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References

Allard, R.J., 1988. Rent-seeking with non-identical players. Publ. Choice 57 (1), 3–14.
Bahl, R., Bird, R.M., 2018. Fiscal Decentralization and Local Finance in Developing Countries. Edward Elgar Publishing, Cheltenham, UK. ISBN: 9781786435293. https://www.e-elgar.com/shop/fiscal-decentralization-and-local-finance-in-developing-countries.
Baik, K.H., Lee, S., 2000. Two-stage rent-seeking contests with carryovers. Publ. Choice 103 (3–4), 285–296.
Bardhan, P., 2002. Decentralization of governance and development. J. Econ. Perspect. 16 (4), 185–205.
Bardhan, P., Mookherjee, D., 2005. Decentralizing anti-poverty program delivery in developing countries. J. Publ. Econ. 89 (4), 675–704.
Boadway, R., 2001. Inter-governmental fiscal relations: the facilitator of fiscal decentralization. Consititut. Polit. Econ. 12 (2), 93–121.
Boadway, R., Cuff, K., Marchand, M., 2003. Equalization and the decentralization of revenue–raising in a federation. J. Publ. Econ. Theor. 5 (2), 201–228.
Boadway, R., Flatters, F., 1982. Efficiency and equalization payments in a federal system of government: a synthesis and extension of recent results. Can. J. Econ. 15 (4), 613–633.
Callander, S., Harstad, B., 2015. Experimentation in federal systems. Q. J. Econ. 130 (2), 951–1002. https://doi.org/10.1093/qje/qjv008.
Cashel-Cordo, P., Craig, S.G., 1990. Public sector impact of international resource transfers. J. Dev. Econ. 32 (1), 17–42.
Channa, A., Faguet, J.P., 2016. Decentralization of health and education in developing countries: a quality-adjusted review of the empirical literature. World Bank Res. Obs. 31 (2), 199–241. https://doi.org/10.1093/wbro/lkw001.
Das-Gupta, A., Gang, I.N., 2005. Decomposing revenue effects of tax evasion and tax structure changes. Int. Tax Publ. Finance 7 (2), 177–194.
Das-Gupta, A., Mookherjee, D., 1998. Incentives and Institutional Reform in Tax Enforcement: an Analysis of Developing Country Experience. Oxford University Press, Delhi.
Epstein, G.S., Gang, I.N., 2002. Government and Cities: Contests and the Decentralization of Decision Making. IZA Discussion Paper 547. IZA, Bonn.
Epstein, G.S., Gang, I.N., 2006. Contests, NGOs and decentralizing aid. Rev. Dev. Econ. 10 (2), 285–296.
Epstein, G.S., Nitzan, S., 2002. Endogenous public policy, politicization and welfare. J. Publ. Econ. Theor. 4 (4), 661–677.
Epstein, G.S., Nitzan, S., 2003. Political culture and monopoly price determination. Soc. Choice Welfare 21 (1), 1–19.
Epstein, G.S., Nitzan, S., 2006. Politics of randomness. Soc. Choice Welfare 27 (2), 423–433.
Epstein, G.S., Nitzan, S., 2007. Endogenous Public Policy and Contests. Springer-Verlag, Berlin.
Fisher, R.C., 1979. Theoretical view of revenue sharing Grants. Natl. Tax J. 32 (2), 173–184.
Fisman, R., Gatti, R., 2002. Decentralization and corruption: evidence across countries. J. Publ. Econ. 83, 325–345.
Gang, I.N., Khan, H.A., 1991. Foreign aid, taxes and public investment. J. Dev. Econ. 34 (1–2), 355–369.
Goodspeed, T.J., 1995. Local income taxation: an externality, pigouvian solution, and public policies. Reg. Sci. Urban Econ. 25 (3), 279–296.
Goodspeed, T.J., 2000. Tax structure in a federation. J. Publ. Econ. 75 (3), 493–506.
Gradstein, M., 1994. Efficient provision of a discrete public good. Int. Econ. Rev. 35 (4), 877–897.
Gramlich, E., 1977. Intergovernmental grants: a review of the empirical literature, The Political Economy of Fiscal Federalism. Heath-Lexington, Lexington, MA, pp. 219–239.
Grossman, G.M., Helpman, E., 1994. Protection for sale. Am. Econ. Rev. 84 (4), 833–850.
Heller, P.S., 1975. A model of public fiscal behavior in developing countries: aid, investment and taxation. Am. Econ. Rev. 65 (3), 429–445.
Hillman, A.L., Katz, E., 1987. Hierarchical structure and the social costs of bribes and transfers. J. Publ. Econ. 34 (2), 129–142.
Hillman, A.L., Riley, J.G., 1989. Politically contestable rents and transfers. Econ. Polit. 1 (1), 17–39.
Hines Jr., J.R., Thaler, R.H., 1995. Anomalies: the flypaper effect. J. Econ. Perspect. 9 (4), 217–226.
Hirsch, A.V., Shotts, K.W., 2015. Competitive policy development. Am. Econ. Rev. 105 (4), 1646–1664.
Hirshleifer, J., 1989. Conflict and rent-seeking success functions: ratio vs. difference model of relative success. Publ. Choice 63 (2), 101–112.
Inderst, R., Müller, H.M., Wärneryd, K., 2007. Distributional conflict in organizations. Eur. Econ. Rev. 51 (2), 385–402.
Loeper, A., 2013. Federal directives, local discretion and the majority rule. Q. J. Polit. Sci. 8 (1), 41–74. https://doi.org/10.1561/100.00010096.
Luce, R.D., 1959. Individual Choice Behavior: a Theoretical Analysis. Wiley, New York.
Nitzan, S., 1977. Revenue sharing in multiperson public choice models. Q. J. Econ. 91 (2), 315–326.
Nitzan, S., 1994. Modelling rent-seeking contests. Eur. J. Polit. Econ. 10 (1), 41–60.
Nti, K.O., 1999. Rent-seeking with asymmetric valuations. Publ. Choice 98 (3–4), 415–430.
Oates, W.E., 1999. An essay on fiscal federalism. J. Econ. Lit. 37 (3), 1120–1149.
Pack, H., Pack, J.R., 1993. Foreign aid and the question of fungibility. Rev. Econ. Stat. 75 (2), 258–265.
Seabright, P., 1996. Accountability and decentralisation in government: an incomplete contracts model. Eur. Econ. Rev. 40 (1), 61–89.
Sheshinski, E., 2002. Bounded Rationality and Social Optimal Limits on Choice: an Example. Manuscript. Hebrew University, Jerusalem.
Swaroop, V., Jha, S., Rajkumar, A.S., 2000. Fiscal effects of foreign aid in a federal system of governance: the case of India. J. Publ. Econ. 77 (3), 307–330.
Tanzi, V., 2001. Pitfalls on the Road to Fiscal Decentralization. Carnegie Endowment for International Peace, Washington, DC.
Treisman, D., 1999. Political decentralization and economic reform: a game-theoretic analysis. Am. J. Polit. Sci. 43 (2), 488–517.
Tullock, G., 1980. Efficient rent-seeking, Toward a Theory of the Rent-seeking Society. A&T Press, College Station, Texas, pp. 97–112.
Tversky, A., 1969. Intransitivity and preferences. Psychol. Rev. 76 (1), 31–48.
Tversky, A., 1972. Elimination by aspects: a theory of choice. Psychol. Rev. 79 (4), 281–299.
Wärneryd, K., 1998. Distributional conflict and jurisdictional organization. J. Publ. Econ. 69 (3), 435–450.
Weingast, B.R., 2009. Second generation fiscal federalism: the implications of fiscal incentives. J. Urban Econ. 65 (3), 279–293.
Weingast, B.R., 2014. Second generation fiscal federalism: political aspects of decentralization and economic development. World Dev. 53, 14–25.
Zampelli, E.M., 1986. Resource fungibility, the flypaper effect, and the expenditure impact of grants-in-aid. Rev. Econ. Stat. 68 (1), 33–40.
Zhuravskaya, E.V., 2000. Incentives to provide local public goods: fiscal federalism, Russian style. J. Publ. Econ. 76 (3), 337–368.
Zudenkova, G., 2018. Electoral accountability and interdistrict competition. Am. Econ. J. Microecon. 10 (3), 143–176. https://doi.org/10.1257/mic.20150307.