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PARTIAL EXCLUSIVITY CAN RESOLVE THE EMPIRICAL PUZZLES ASSOCIATED WITH RENT-SEEKING ACTIVITIES

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PARTIAL EXCLUSIVITY CAN RESOLVE THE EMPIRICAL PUZZLES ASSOCIATED WITH RENT-SEEKING ACTIVITIES

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Abstract

This study presents a model in which interest groups compete for partially exclusive rents and the number of winners is stochastic. Partial exclusivity can explain the low empirical estimates of rent dissipation that create the Tullock paradox. However, partial exclusivity also increases aggregate effort and social waste. This study includes an empirical analysis of U.S. state-level lobbying expenditures, which reveals another puzzle regarding the constant relationship between aggregate expenditures and the number of spenders. In contrast to the existing rent-seeking contest models, this outcome is consistent with partially exclusive rents when the contest is designed by a rent-seeking maximising policymaker.

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1 Introduction

Contrary to theoretical predictions, rent-seeking expenditures are typically much less than the value of the relevant prize. This empirical puzzle has become known as the Tullock paradox (Tullock, 1980; Riley, 1999; Ansolabehere et al., 2003; Zingales, 2017). However, a large share of lobbying activities are conducted by or on behalf of interest groups that are not direct rivals, whereas the theoretical literature typically considers individuals or firms that compete for the same rents (see Hillman and Ursprung, 2016). The rents sought by different interest groups, such as import tariffs, subsidies, or favourable legislation, may be limited in number but need not be mutually exclusive. Thus, the main theoretical contribution of this study is presenting a multiple-winner Tullock contest model to account for this partial exclusivity. I argue that partial exclusivity can explain the Tullock paradox. However, partial exclusivity not only leads to lower rent dissipation but also increases the aggregate rent-seeking effort.

The tendency of theoretical models to predict too high levels of rent dissipation can be observed in the consistently higher indirect measures of rent-seeking expenditures as compared to their direct measures when both are available (Mueller, 2003; Del Rosal, 2011). This finding has led to various attempts to extend the basic model by considering limited entry and Stackelberg competition (Pérez-Castrillo and Verdier, 1992), asymmetric valuations or costs (Gradstein, 1995; Nti, 1999), risk or loss aversion (Van Long and Vousden, 1987; Cornes and Hartley, 2003), repeated games and collusion (Leininger and Yang, 1994), status quo bias (Polborn, 2006), and probability distortions (Baharad and Nitzan, 2008), among others. Similar to these studies, my model, which incorporates partial exclusivity, results in lower rent dissipation. Unlike any of the previous studies, however, I also show that *more* rent-seeking effort occurs at the same time. Thus, rent dissipation is a misleading measure of social waste in the presence of multiple rents and interests.

This study is also connected to the broader literature on multiple-prize and multiple-winner contests (Sisak, 2009). Among comparable models, the nested contest success function (CSF) of Clark and Riis (1996, 1998) has been a popular choice for previous analyses. However, that model assumes a series of hypothetical sub-contests, and generating comparative statics results using that model is cumbersome. Thus, I propose an alternative multiple-winner extension to the standard Tullock CSF that is both simple and intuitive. Furthermore, an important difference between this study and previous studies of multiple-winner contests is that the number of winners in this model is stochastic, which is an intuitive feature in the context of rent seeking[1].

[1] Naturally, this assumption also implies that the proposed CSF is not applicable to other contests in which the number of winners must be predetermined and given, as is generally the case in sports contests, for example.

I also consider the case in which the maximum number of rents is set by a self-interested policymaker, an issue which is related to the literature on contest design (e.g. Gradstein and Konrad, 1999). Particularly, in contrast to Fu and Lu (2009) and Chowdhury and Kim (2017), I show that the choice of a single grand contest or multiple sub-contests does not generally have any effect on the maximum aggregate effort under my CSF.

The Tullock paradox poses the question of why corruption is not more prevalent in practice given how profitable rent seeking seems to be. I show that partial exclusivity between interest groups can account for the Tullock paradox because rent dissipation is increasing in the degree of exclusivity. However, this result conceals the extent of the problem, as partial exclusivity also leads to higher aggregate effort. Specifically, a rent-seeking maximising policymaker can follow a simple rule by awarding at most half of the potential rents to the rent-seeking interest groups.

Finally, I present the results of an empirical analysis of a panel of U.S. state-level lobbying data. The main finding of the analysis is that the relationship between aggregate lobbying expenditures and the number of spenders is constant. Although this result contradicts the existing theories around rent seeking, it is consistent with the partial exclusivity model when the contest is designed to maximise rent-seeking efforts.

2 Preliminaries: A multiple-winner Tullock contest

We consider a rent-seeking contest between $n \geq 2$ identical risk-neutral interest groups, each of which attempts to secure an identical rent, R. Although the number of potential rents is also n, that is, at most one for each interest group, the maximum number of rents to be awarded is $k \in \{1, 2, \ldots, n\}$. The term 'partial exclusivity' refers to a situation in which more than one rent can be awarded but not every rent seeker receives a rent.

In many situations, rent seekers are not firms seeking the same rent but rather interest groups that represent the common interests of their members[2]. This scenario implies less competition for rents than the standard models assume. However, when $k < n$, some competition arises between groups that are not otherwise direct rivals. Potential rents may not be awarded for many different reasons, including political costs or constraints, indirect market constraints such that some rents are mutually exclusive, and time or budget constraints of policymakers[3]. Finally, strategic behaviour on the part of the policymaker leads to an intermediate number of actual rents, as I show later in the analysis.

Interest group $i = 1, \ldots, n$ expends effort x_i and successfully secures its

[2]I do not model the efforts of individual group members in these contests. Please see Nitzan (1991) and Hillman and Ursprung (2016) for such models.

[3]Groll and Ellis (2017) argue that policymakers' time is the key constraint in lobbying.

rent with a probability given by the modified Tullock CSF:

$$p_i(x_i, x_{-i}) = \frac{x_i^r}{\alpha \sum\limits_{j \neq i} x_j^r + x_i^r},$$

if $\sum x_i > 0$ and zero otherwise. x_{-i} denotes the efforts of interest groups other than i, $r > 0$ measures returns to scale, and $\alpha \in (0, 1]$ measures the degree of exclusivity and the intensity of competition[4]. The introduction of α provides a functional form for contests in which the number of winners is stochastic but is at most k. This parameter determines the extent to which the success of any one player hinders the others from attaining their goals.

Although n and k are integers and limit the values that α can take, I largely proceed as though α is a continuous variable, and I assume it to be exogenous in the present analysis. I return to this aspect of contest design and endogenise α in subsection 3.2. Note that $\alpha = 1$, which I refer to as 'perfect exclusivity' in this context, gives the standard Tullock CSF.

Given the CSF and assuming that the outcomes of different groups are dependent, the number of possible winners (and awarded rents) ranges from zero to k[5]. The connection between α and k is given by

$$\sum p_i(x_i, x_{-i}) = \sum \frac{x_i^r}{\alpha \sum\limits_{j \neq i} x_j^r + x_i^r} \leq k,$$

[4]Godwin et al. (2006) incorporate a similar competition parameter into their two-player model.

[5]An alternative interpretation is that the events are independent, in which case the number of winners ranges from zero to n. This would have no effect on the expected private and social gains, but it does depart from the usual stance in the literature.

where the left-hand side of the inequality determines the realised number of winners. That is, the realised number of winners cannot exceed the maximum number of rents that the policymaker awards. With unequal effort levels, the sum of the probabilities can be less than k, but it is never less than one. Furthermore, it follows that $\alpha = 0 \to k = n$ and $\alpha = 1 \to k = 1$. If $0 < \alpha < 1$ and $1 < k < n$, then the rents are neither mutually exclusive nor guaranteed to all. This partial exclusivity of rents is, to some degree, analogous to horizontal product differentiation in the industrial organisation literature.

Interest group i chooses x_i to maximise its expected payoff

$$\mathbf{E}(\pi_i) = \frac{x_i^r}{\alpha \sum\limits_{j \neq i} x_j^r + x_i^r} R - x_i. \tag{1}$$

The first- and second-order conditions of (1) are

$$\frac{r x_i^{r-1} \alpha \sum\limits_{j \neq i} x_j^r}{\left(\alpha \sum\limits_{j \neq i} x_j^r + x_i^r \right)^2} R - 1 = 0 \tag{2}$$

and

$$\frac{r x_i^{r-2} \alpha \sum\limits_{j \neq i} x_j^r ((r-1) \alpha \sum\limits_{j \neq i} x_j^r - (1+r) x_i^r)}{\left(\alpha \sum\limits_{j \neq i} x_j^r + x_i^r \right)^3} R < 0. \tag{3}$$

Proposition 1 *If $r \leq \frac{\alpha(n-1)+1}{\alpha(n-1)}$, then there exists a symmetric pure strategy*

Nash equilibrium in which each player's effort is

$$x = \frac{r\alpha(n-1)}{(\alpha(n-1)+1)^2}R. \tag{4}$$

Proof. I denote the equilibrium effort that each contestant exerts in a symmetric Nash equilibrium by x. From (2), it follows that

$$x = \frac{r\alpha(n-1)}{(\alpha(n-1)+1)^2}R.$$

Condition (3) holds if

$$(r-1)\alpha\sum_{j\neq i} x_j^r - (1+r)x_i^r < 0. \tag{5}$$

Summing (5) for all i gives

$$(r-1)\alpha(n-1)\sum x_i^r - (1+r)\sum x_i^r < 0 \tag{6}$$

and, thus, requires that

$$(r-1)\alpha(n-1) - (1+r) < 0. \tag{7}$$

The participation constraint requires that $\mathbf{E}(\pi) \geq 0$. Substituting x into (1) gives

$$\mathbf{E}(\pi_i) = \frac{1}{\alpha(n-1)+1}R - \frac{r\alpha(n-1)}{(\alpha(n-1)+1)^2}R \geq 0,$$

which holds if and only if

$$(1-r)\alpha(n-1)+1 \geq 0 \leftrightarrow r \leq \frac{\alpha(n-1)+1}{\alpha(n-1)}. \tag{8}$$

I leave the confirmation that (8) also satisfies (7) to the reader. ■

(4) further shows that, in the symmetric equilibrium, the probability of success for each interest group is

$$p = \frac{1}{\alpha(n-1)+1}, \tag{9}$$

the number of actual rents is

$$k = \frac{n}{\alpha(n-1)+1}, \tag{10}$$

and the expected rate of return is

$$\mathbf{E}(RR) = \frac{(1-r)\alpha(n-1)+1}{r\alpha(n-1)}. \tag{11}$$

3 Analysis

The main focus of this study is examining the effect of partial exclusivity, which takes the form of multiple rents that are limited in number, on rent seeking. I show that two outcomes which are seemingly in conflict arise. I conclude by considering the behaviour of a self-interested policymaker within this framework and the outcomes of this behaviour.

3.1 Partial exclusivity

Theorem 1 *Partial exclusivity of rents leads to a lower dissipation of (actual) rents.*

Proof. The dissipation of actual rents in the symmetric equilibrium is given by the ratio

$$\frac{nx}{kR} = \frac{r\alpha(n-1)}{\alpha(n-1)+1},$$

which is increasing in the degree of exclusivity, α, that is,

$$\partial\left(\frac{nx}{kR}\right)/\partial\alpha = \frac{r(n-1)(\alpha(n-2)+1)}{(\alpha(n-1)+1)^2} > 0,$$

which completes the proof. ∎

This result is further illustrated by Figure 1, which shows that perfect exclusivity, $\alpha = 1$, always leads to the highest level of rent dissipation. Thus, partial exclusivity of rents leads to lower rent dissipation and can account for the Tullock paradox. Importantly, not only is the observed rent dissipation affected by changes in rent-seeking efforts, but these changes are also relative to the number of rents provided, which is inversely related to α. Thus, under partial exclusivity, it only appears as if less rent-seeking effort is exerted.

Theorem 2 *Partial exclusivity of rents leads to higher aggregate rent-seeking efforts as long as* $\alpha > 1/(n-1)^2$ *or* $k < n-1$*, and these efforts are maximised*

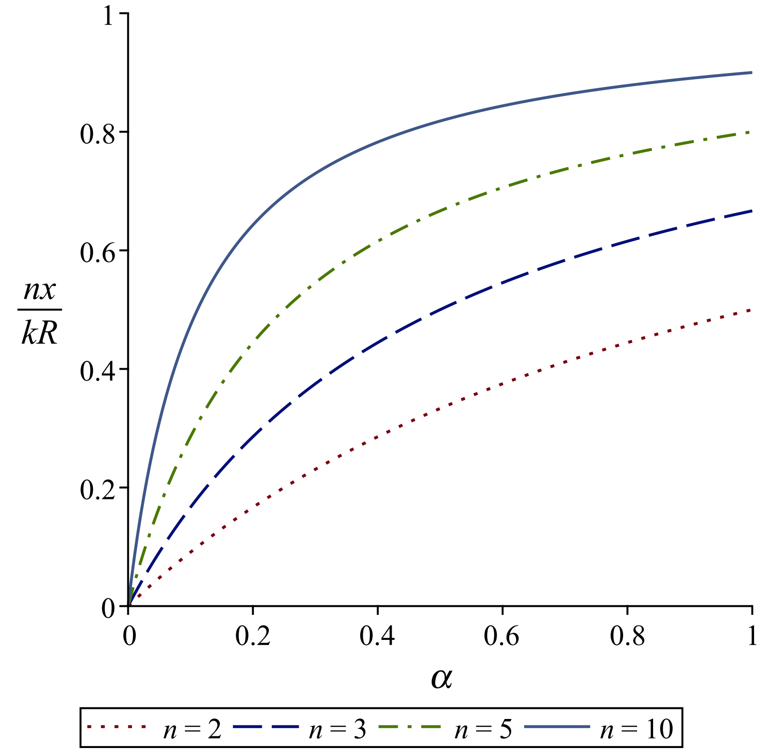

Figure 1: Dissipation of actual rents and the degree of exclusivity (with $r = 1$ and for different values of n).

for $\alpha = 1/(n-1)$ *or* $k = n/2$ *(or for either of the nearest integers when* n *is odd).*

Proof. Comparing the aggregate efforts, nx, under partial and perfect exclusivity of rents yields

$$nx(\alpha) = \frac{nr\alpha(n-1)}{(\alpha(n-1)+1)^2}R > \frac{nr(n-1)}{n^2}R = nx(1)$$

$$\leftrightarrow -\alpha^2(n-1)^2 + \alpha(n^2 - 2(n-1)) - 1 > 0$$

$$\leftrightarrow (1-\alpha)(\alpha(n-1)^2-1) > 0$$

$$\leftarrow \alpha > \frac{1}{(n-1)^2}.$$

(10) implies that

$$k < \frac{n}{\frac{1}{n-1}+1} = n-1.$$

To solve for the maximum effort, I differentiate nx with respect to α to obtain

$$\frac{\partial nx}{\partial \alpha} = \frac{nr(n-1)(1-\alpha(n-1))}{(\alpha(n-1)+1)^3}. \tag{12}$$

Setting (12) equal to zero and solving for α yields

$$\alpha = \frac{1}{n-1},$$

which is the argument of the maximum because (12) is clearly decreasing in α.

From (10), it follows that this value of α corresponds to

$$k = \frac{n}{2}.$$

Because k may have to be an integer, if n is odd, I compare

$$k = \frac{n+1}{2} \leftrightarrow \bar{\alpha} = \frac{1}{n+1}$$

and

$$k = \frac{n-1}{2} \leftrightarrow \underline{\alpha} = \frac{n+1}{(n-1)^2}.$$

Note that $\underline{\alpha} \leq 1 \leftarrow n \geq 3$, as is required for the smallest odd n value of interest. This comparison shows that

$$nx(\underline{\alpha}) = \frac{nr^{\frac{n+1}{n-1}}}{(\frac{n+1}{n-1}+1)^2}R = \frac{nr^{\frac{n-1}{n+1}}}{(\frac{n-1}{n+1}+1)^2}R = nx(\bar{\alpha})$$

$$\leftrightarrow \frac{n+1}{n-1}\frac{(n-1)^2}{4n^2} = \frac{n-1}{n+1}\frac{(n+1)^2}{4n^2},$$

which implies that the two nearest integers yield the same aggregate effort.

■

Theorem 2 shows that any degree of partial exclusivity such that the number of rents is at least one less than the number of rent seekers leads to at least as much aggregate rent-seeking effort as perfect exclusivity does. Thus, partial exclusivity leads to less dissipation of rents but more rent-seeking effort. Figure 2 shows that the expenditure-rent ratio for different numbers of rent seekers, which also reflects the dissipation of *potential* rents, is first increasing but then decreasing in α. $n = 2$ is a special case, as perfect and no exclusivity are the only possible outcomes in the case of two players when the number of the rents is an integer.

Figure 3 illustrates the general pattern in rent-seeking efforts (again, proportional to the rents) with respect to α; $\alpha = 1/(n-1)^2$ yields the same amount of rent-seeking effort as perfect exclusivity does, whereas $\alpha =$

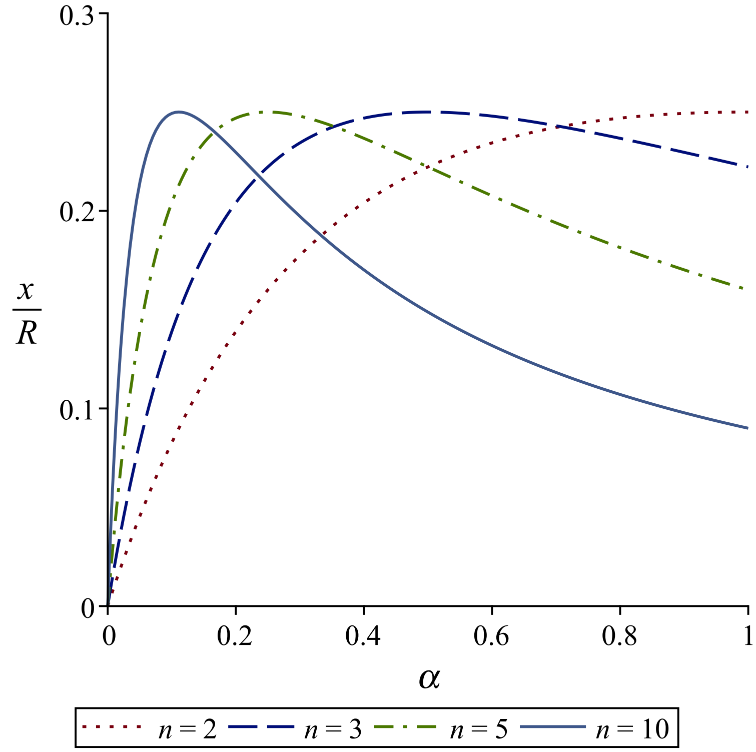

Figure 2: Dissipation of potential rents and the degree of exclusivity (with $r = 1$ and for different values of n).

$1/(n-1)$ maximises this effort. At first, the strategic effect of increased competition is to induce more effort, but when rents are scarce enough, this tendency is reversed.

The effort-maximising $k = n/2$ is an interesting result both for its simplicity and in comparison to the nested CSF, for which rent-seeking effort is maximised when $k \approx 0.632n$ (Clark and Riis, 1998). Furthermore, with this ratio, the equilibrium effort is $x = rR/4$, the dissipation of actual rents is $nx/kR = r/2$, and the dissipation of potential rents is $nx/nR = r/4$, ir-

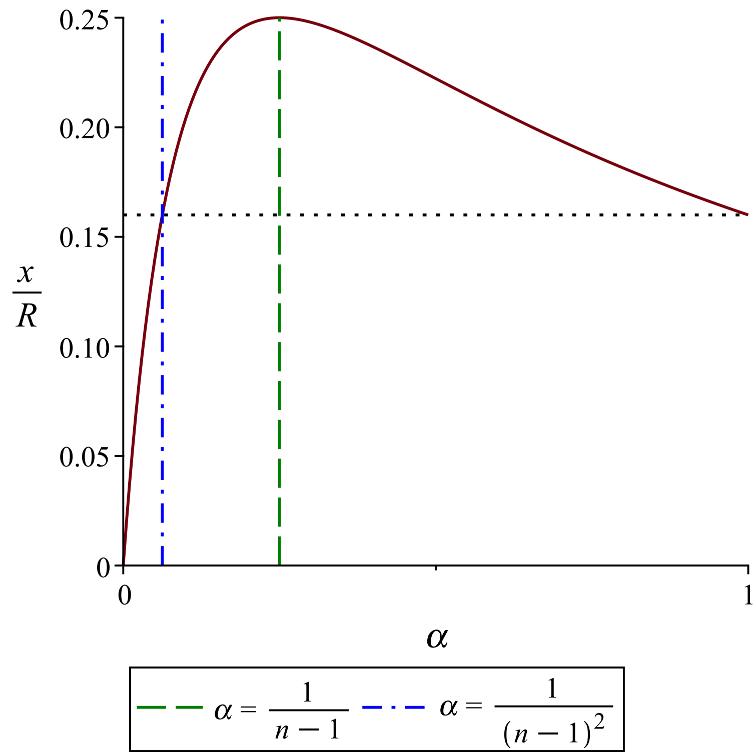

Figure 3: Dissipation of potential rents and the degree of exclusivity (with $r = 1$).

respective of the value of n. Additionally, the participation constraint (8) therefore holds for all $r \leq 2$, which is the same as in the basic model when $n = 2$ and is less restrictive if $n > 2$.

Equations (9) and (11) further show that when $k = n/2$, the probability of success is $p = 1/2$, and the expected rate of return is $\mathbf{E}(RR) = (2 - r)/2$. Thus, even when rent-seeking efforts are maximised, partial exclusivity can lead to a high rate of return, as shown in Figure 4. The only necessary condition to account for some of the incredibly high empirical estimates of the returns to lobbying is that the rent-seeking technology be fairly inefficient in terms of r[6].

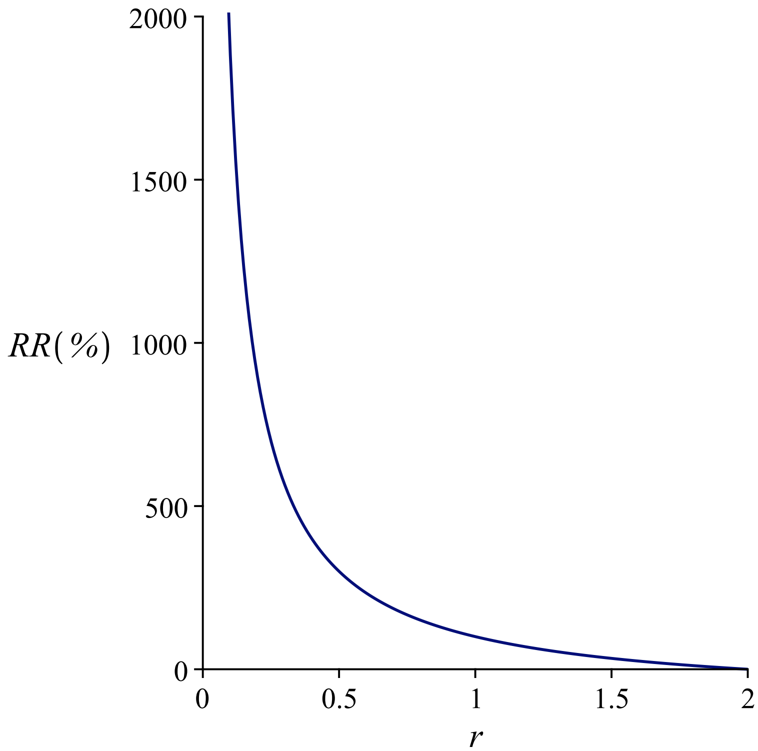

Figure 4: Expected rate of return and the scale parameter when $\alpha = 1/(n-1)$.

3.2 Contest design

Although the contest structure is exogenously given in some cases, it is also reasonable to assume that the politicians who allocate rents may affect the

[6] Alexander et al. (2009), for example, report that the corporations which lobbied for the tax benefits provided by the 2004 American Jobs Creation Act earned a return of 22,000 percent on their investment.

design of this allocation by, for example, choosing the maximum number of rents. Most often, analyses use the assumption that the objective of a self-interested policymaker is to maximise aggregate rent-seeking efforts (e.g. Gradstein and Konrad, 1999). I now briefly consider a few simple variations on this issue.

Suppose that the policymaker's utility is an increasing function of the aggregate effort: $U(nx), U' > 0$. Maximising U with respect to α when nx is given by Proposition 1 yields

$$\frac{dU}{d\alpha} = \frac{dU}{dnx}\frac{dnx}{d\alpha} = 0.$$

Because $U' > 0$, it clearly follows that $\alpha = 1/(n-1)$ or $k = n/2$, as established by Theorem 2.

For a policymaker who benefits from and wants to maximise rent-seeking effort, this outcome provides a simple rule: set $k = n/2$ or either of the closest integers as the maximum number of rents to be awarded. In essence, the policymaker induces the maximum effort by virtually pairing the interest groups for each prize.

However, the actual structure of the contest seems to have little or no effect on the aggregate effort. Fu and Lu (2009) and Chowdhury and Kim (2017) show that, for other multi-winner contests, the winner-selection mechanism is a determinant of whether a grand contest or multiple sub-contests elicit a higher equilibrium effort. The outcome differs here because both designs are (generally) equivalent.

Theorem 3 *If it is possible to symmetrically divide n rent seekers and the maximum number of rents k into m sub-contests such that $m = 1, \ldots, k$, then the equilibrium aggregate effort is independent of m and is the same for any collection of m sub-contests and a grand contest with n rent seekers and the maximum number of rents k.*

Proof. Let $n' = n/m$ and $k' = k/m$ be the number of rent seekers and the maximum number of rents in each of the m sub-contests, respectively. Assuming away the integer problem, Theorem 2 implies that $k' = n'/2$ maximises the effort for any n'. Given the maximum equilibrium effort, $x_{ij} = rR/4$ for all $i \in \{1, \ldots, n'\}$ rent seekers in all $j \in \{1, \ldots, m\}$ sub-contests, the aggregate effort over m sub-contests is then

$$\sum_{j=1}^{m} \sum_{i=1}^{n'} x_{ij} = m \times \frac{n}{m} \frac{rR}{4} = n \frac{rR}{4},$$

which is independent of m and is the same as in a grand contest with $m = 1$.

■

This finding of the irrelevance of contest design provides an interesting contrast to the previous results on this topic. The result is unsurprising in this case, however, because the contest designer can always choose the maximum number of rents to equal half of the number of rent seekers, rendering the choice between a grand contest and sub-contests irrelevant. Although the integer problem is typically ignored in the literature, I note the following for completeness.

Theorem 4 *If the number of rent seekers, n, is odd and if the maximum number of rents, k, must be an integer, then a grand contest maximises the aggregate effort.*

Proof. Theorem 3 indicates that the contest structure does not matter for any even number of rent seekers. Suppose then that an odd number of rent seekers, n, is divided into two sub-contests such that the first group contains an odd number n_1 of rent seekers and the second group contains an even number $n_2 = n - n_1$ of them. Given the equilibrium effort (4), the combined aggregate effort is

$$nx = n_1 \frac{r\alpha_1(n_1 - 1)}{(\alpha_1(n_1 - 1) + 1)^2} + (n - n_1)\frac{r\alpha_2(n - n_1 - 1)}{(\alpha_2(n - n_1 - 1) + 1)^2}. \tag{13}$$

Assuming that the maximum number of rents must be an integer in both sub-contests, Theorem 2 implies that the corresponding values of α that maximise the efforts are $\alpha_1 = 1/(n_1 + 1)$ (or, equivalently, $\alpha_1 = (n + 1)/(n - 1)^2$) and $\alpha_2 = 1/(n - n_1 - 1)$. Substituting these values into (13) yields

$$nx = n_1 r \frac{n_1 - 1}{n_1 + 1}\left(\frac{n_1 - 1}{n_1 + 1} + 1\right)^{-2} + (n - n_1)\frac{r}{4} = \frac{nn_1 - 1}{n_1}. \tag{14}$$

Because (14) is increasing and concave in n_1, allocating all rent seekers to this group and forming a grand contest maximises the aggregate effort. ■

The intuition behind the special case of Theorem 4 is straightforward, as a large n minimises the departure from the $k = n/2$ rule.

Naturally, even a rent-seeking maximising policymaker may face some constraints, as in Appelbaum and Katz (1987). Suppose that the policymaker faces an expected penalty that is increasing in rent dissipation: $P(nx/kR)$, $P(0) = 0, P' > 0$. Then, the policymaker's objective can be written as the maximisation of

$$O = U(nx) - P(nx/kR),$$

from which the condition

$$\frac{dU}{dnx}\frac{dnx}{d\alpha} = \frac{dP}{d(nx/kR)}\frac{d(nx/kR)}{d\alpha} \tag{15}$$

is obtained. Theorem 1 implies that the right-hand side of (15) is positive and, thus, so is $dnx/d\alpha$. This result implies that in the interior maximum, assuming that O is concave in α, the policymaker awards more than the effort-maximising number of rents k. This formulation illustrates the notion that the general public may only observe the dissipation rate, which it uses to penalise the policymaker. Naturally, different constraints may be in place as well.

Lastly, the policymaker may not benefit from rent-seeking efforts directly but rather awards rents to maximise political support. Following Peltzman (1976), suppose that V, the number of votes, is a function of both the utility of the rent-seeking voters, U_R, and that of the non-rent-seeking voters, U_{NR}:

$$V = V(U_R, U_{NR}), \frac{\partial V}{\partial U_R} > 0, \frac{\partial V}{\partial U_{NR}} > 0.$$

The rent seekers benefit from the awarded rents at the expense of the others, which, given the inverse relationship between k and α, implies that $dU_R/d\alpha < 0$ and $dU_{NR}/d\alpha > 0$. Assuming that V is concave in α, the vote-maximising policymaker sets α to satisfy

$$\frac{dV}{d\alpha} = \frac{\partial V}{\partial U_R}\frac{dU_R}{d\alpha} + \frac{\partial V}{\partial U_{NR}}\frac{dU_{NR}}{d\alpha} = 0$$

or

$$\frac{\partial V}{\partial U_R}\frac{dU_R}{d\alpha} = -\frac{\partial V}{\partial U_{NR}}\frac{dU_{NR}}{d\alpha}.$$

That is, he sets α such that the marginal gain in support from rent seekers equals the marginal loss in support from the others. Although the exact outcome depends on the sizes of these two groups and how strongly they react to the available number of rents, it is natural to assume that the chosen k is again somewhere in the middle. This discussion is far from a complete examination of the policymaker's behaviour, but it serves to demonstrate that partially exclusive rents and, thus, the combination of low rent dissipation and high aggregate efforts are natural outcomes under various circumstances.

4 An empirical study of U.S. state-level lobbying expenditures

The lack of data on rents, rent-seeking expenditures, or both makes the empirical analysis of rent-seeking activities challenging. A further challenge for testing the partially exclusive rent-seeking model presented in this study arises because it relies on a critical counterfactual, the potential rents that can be but are not allocated. Thus, although partial exclusivity is consistent with the Tullock paradox, it is not easily distinguished from alternative explanations. However, studying U.S. state-level lobbying expenditure data leads to another puzzle which can serve this purpose.

The aim of the empirical analysis is to demonstrate a *constant* relationship between aggregate annual state-level lobbying expenditures and the number of spenders, as shown in Figure 5. The effect of the number of spenders on aggregate expenditures has not been explored in the previous empirical literature on rent-seeking or lobbying activity, and the finding presents a challenge to the existing theory[7]. Specifically, the existing rent-seeking models predict that aggregate expenditures should be increasing in the number of spenders at a decreasing rate owing to competition between rent seekers. As was shown in Subsection 3.2, however, under partial exclusivity with effort-maximising contest design, individual efforts are independent

[7]See De Figueiredo and Richter (2014) for a recent survey of empirical research on lobbying.

of the number of contestants.

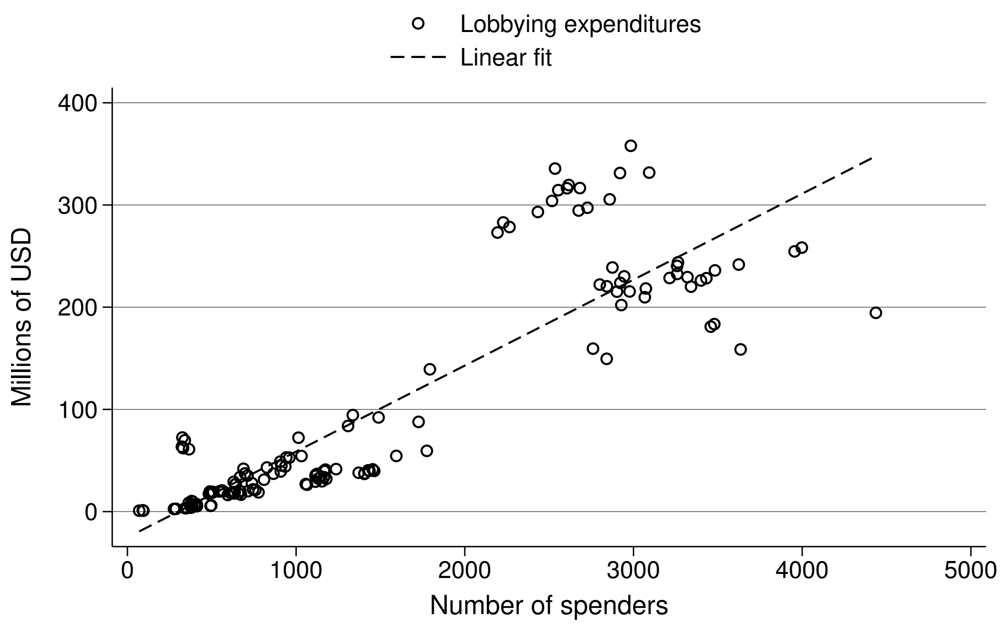

Figure 5: Annual U.S. state-level lobbying expenditures and the number of spenders.

4.1 Data and methodology

The lobbying expenditure data come from the National Institute of Money in Politics[8]. The data are an unbalanced panel of the 3–16 most recent annual observations from 20 states up until 2017, consisting of 144 observations in total. The states have different requirements regarding the disclosure and filing of lobbying expenditures, limiting data availability. This drawback

[8]Available at `https://www.followthemoney.org/`.

should therefore be kept in mind when interpreting the regression results.

My main interest is examining the relationship between aggregate lobbying expenditures and the number of spenders. The primary approach for modelling the effect of the number of spenders on aggregate lobbying expenditures in state s in year t is a linear regression with state fixed effects, which can be expressed as:

$$\begin{aligned} lobexp_{st} = {} & \beta_1 spender_{st} + \beta_2 spender2_{st} + \beta_3 pop_{st} + \beta_4 gdp_{st} \\ & + \beta_5 polcompt_{st} + \beta_6 parcomps_{st} + \beta_7 Dpol_{st} + \beta_8 Dpar_{st} \\ & + \beta_9 trend + \mu_s + \epsilon_{st}, \end{aligned} \tag{16}$$

where the β_i values are coefficients, μ_s is the state fixed effect, and ϵ_{st} is the error term.

The summary statistics of the variables are presented in Table 1. $lobexp_{st}$ is the aggregate reported lobbying expenditure in state s in year t. Expenditures are inflation adjusted to 2017 USD using the Bureau of Labor Statistics' consumer price index and are rescaled to thousands of dollars. $spender_{st}$ is the number of different spenders, excluding those who report zero total expenditures[9]. To examine whether the relationship is non-linear, I include the quadratic term of this variable, $spender2_{st}$, in the estimations. As Sobel and Garrett (2002) note, aggregate lobbying expenditures may underestimate the total rent-seeking effort. Assuming that other indirect and in-kind

[9] Although registration by an interest group provides the right to lobby, it does not necessarily mean that the group is active in lobbying (De Figueiredo and Richter, 2014).

expenditures are reasonably correlated with the reported lobbying expenditures, however, my assessment regarding the effect of the number of spenders remains valid.

Table 1: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
lobexp	144	98000	107000	897.826	358000
spender	144	1466.451	1126.153	70	4437
pop	144	11.2×10^6	11.7×10^6	623354	39.5×10^6
gdp	144	49913.85	9322.86	35359	73505
polcompt	144	-0.212	0.119	-0.67	0
parcomps	144	0.498	0.141	0	0.84
Dpol	144	0.410	0.493	0	1
Dpar	144	0.271	0.446	0	1

I include a few control variables to capture time-variant factors that may affect the availability and values of the rents and the rent-seeking technology. pop_{st} is the state's population on July 1st, as estimated by the U.S. Census. gdp_{st} is real GDP per capita in the state, adjusted to 2009 USD, as provided by the Bureau of Economic Analysis.

The variables measuring state political competition and partisan composition are based on data provided by the National Conference of State Legislatures[10] and by Klarner (2003) and his later updates[11]. $polcompt_{st}$ is

[10] Available at `http://www.ncsl.org/research/about-state-legislatures/partisan-composition.aspx`.

[11] Available at `https://dataverse.harvard.edu/dataverse/cklarner`.

a party-neutral measure of political competition defined as

$$polcompt_{st} = -\frac{|D_{st} - R_{st}|}{T_{st}},$$

where D_{st} is the number of seats held by Democrats, R_{st} is the number of seats held by Republicans, and T_{st} is the total number of seats in both of the state's legislative chambers. This measure follows from Besley et al. (2010) but counts the actual seats rather than votes and takes into account seats that are vacant or held by other parties. Theoretically, this variable ranges from -1 to 0, and higher values imply more political competition. To account for partisan composition, the variable $parcomps_{st}$ measures the share of seats held by the Democrats in both chambers:

$$parcomps_{st} = \frac{D_{st}}{T_{st}}.$$

I also include two related dummy variables. $Dpol_{st}$ takes a value of one if neither main party has the majority in both chambers or if the governor is not from the same party as the majority party in the legislature. $Dpar_{st}$ takes a value of one if the governor is a Democrat and that party has a majority in both chambers.[12]

The state budget is not included among the independent variables ow-

[12]The state of Nebraska (N), with three annual observations, has a unicameral, non-partisan legislature. Thus, the political and partisan composition variables for Nebraska are coded as $polcompt_{Nt} = 0, parcomps_{Nt} = 0, Dpol_{Nt} = 1$, and $Dpar_{Nt} = 0$ for all t. Excluding Nebraska from the sample does not lead to any noticeable differences in the results.

ing to its potential endogeneity to lobbying efforts[13]. Owing to the limited number of observations, I cannot use time dummy variables and instead use a time trend variable, *trend*.

In addition to estimating Equation (16), I estimate a total of six models to check robustness. Given the limited number of observations, I first estimate three parsimonious models (Models 1, 2, and 3) without control variables. As per the fixed effects, I can reasonably assume that several unobserved economic and political factors affect lobbying activities and vary across states but not across time during the examined period. Among others, the former factors include the state's industrial structure[14], and the latter factors include state legislation on corporate lobbying. I account for such factors by including state fixed effects in Models 2 and 5, which are the main specifications of interest. For both fixed-effects models, the F-test rejects the hypothesis that all μ_s are equal to zero.

For the sake of comparison, I also estimate pooled ordinary least squares (OLS) regressions with a common constant, β_0, in Models 1 and 4. Furthermore, to consider the persistence of lobbying expenditures, I include the lagged dependent variable, $lobexp_{st-1}$, in Models 3 and 6. These two models are estimated using the Arellano-Bond linear dynamic panel data estimator, which is commonly known as the difference generalized method of moments

[13]See Mueller and Murrell (1986) and Hoyt and Toma (1993), for example, for further discussion of the impact of interest groups on government spending.

[14]For example, firms in more competitive industries tend to lobby together (Bombardini and Trebbi, 2012).

(GMM) estimator[15]. Testing for autocorrelation in the GMM estimations, I reject the null hypothesis of no autocorrelation of order 1 but not that of no autocorrelation of order 2, which suggests that the Arellano-Bond model assumptions are satisfied.

4.2 Regression results

The regression results are presented in Table 2. Based on the modified Wald test and the Woolridge test, the data contain heteroskedasticity and within-state serial correlation. To address these issues, the standard errors are clustered at the state level in Models 1, 2, 4, and 5. Arellano-Bond robust variance composition estimators are used in Models 3 and 6. With the exception of Model 4, in which the state population seems to account for a large share of lobbying expenditures in the absence of state fixed effects, the effect of $spender_{st}$ is positive and statistically significant, as expected. Most importantly, *in all six models, the quadratic term,* $spender2_{st}$*, is statistically insignificant*. Furthermore, most of the control variables are statistically insignificant as well. In the fixed effect estimation, Model 5, only $Dpar_{st}$ is significant, suggesting that lobbying expenditure is greater in states controlled by the Democrats. Furthermore, the adjusted R-squared is largely unchanged between Models 2 and 5, as most of the variation is explained by the number of spenders and state fixed effects.

[15] I do not use the system GMM estimator because it sets additional restrictions and the data set is rather small.

Table 2: Regression Results

Model	**OLS**	**FE**	**GMM**	**OLS**	**FE**	**GMM**
	(1)	(2)	(3)	(4)	(5)	(6)
lobexp(-1)			0.1832541			0.0520887*
			(0.1119085)			(0.0847442)
spender	128.2253**	46.82747***	38.61462***	34.40129	43.37802***	39.99136***
	(61.07871)	(11.62973)	(11.07183)	(27.86252)	(12.98483)	(10.78606)
spender2	-0.0116588	-0.0021121	-0.0006038	-0.0004519	-0.0027753	-0.001509
	(0.0142424)	(0.0020036)	(0.0016393)	(0.0066816)	(0.001806)	(0.0015931)
pop				0.0059778***	0.0001176	0.0034232**
				(0.0007345)	(0.0017191)	(0.0015953)
gdp				-0.1811258	-1.355887	-1.751043*
				(0.6801449)	(1.020482)	(1.008937)
polcompt				-75977.11*	-4436.34	-1750.277
				(41424.05)	(17595.52)	(17986.07)
parcomps				388.956	-43353.88	-61684.01*
				(34627.73)	(29212.4)	(32032.31)
Dpol				26921.84*	2692.257	4639.685*
				(13361.17)	(2636.901)	(2801.596)
Dpar				23792.4*	6811.007*	9308.126**
				(12612.14)	(3834.783)	(4367.346)
trend				585.9177	386.3991	677.1714*
				(1155.781)	(360.1839)	(401.232)
Constant	-50247.39	36565.39***	27913.15*	-49753.98	123343.5	107298.1
	(32124.3)	(12225.62)	(15015.8)	(30017.26)	(71669.67)	(75915.28)
Adj R2	0.788	0.994		0.947	0.994	
States	20	20	20	20	20	20
Observations	144	144	104	144	144	104

Notes: The dependent variable is total annual state-level lobbying expenditures in thousands of USD. Standard errors are clustered at the state level in specifications 1, 2, 4, and 5, and robust standard errors are used in specifications 3 and 6. All standard errors are reported in parentheses. ***, **, and * indicate statistical significance at 1%, 5%, and 10% levels, respectively.

The GMM specification of Model 6 shows significant but relatively small persistence in lobbying expenditures based on the lagged dependent variable. Model 6 also has more significant control variables than Model 5, in particular, does. In terms of pop_{st} and gdp_{st}, Model 6 suggests that lobbying expenditures increase as the size of the state increases but decrease as its wealth increases. The political variables seem to indicate mixed results, as lobbying expenditures are negatively correlated with seats held by Democrats, whereas the dummy variables indicate that expenditures are lower in states in which Republicans have legislative control.

To summarise, although the sample is admittedly small, the results suggest that the number of spenders has a positive but constant effect on total state-level lobbying expenditures. To the best of my knowledge, this result contradicts the existing theories of rent-seeking contests, as it suggests that rent seekers do not engage in any apparent competition. However, the outcome is consistent with partially exclusive rent seeking when the contest is designed to maximise aggregate expenditures.

5 Conclusion

Given the apparently high returns to rent seeking, the Tullock paradox asks why corruption is not more prevalent in practice. The answer may be that corruption is more common than it *looks*. Rent-seeking activity is largely due to interest groups with separate goals as opposed to firms fiercely competing for the same rents. When the rents are not mutually exclusive but are still limited in number, imperfect competition for rents results, leading to lower rent dissipation. However, this finding is not all good news, as aggregate rent-seeking efforts can simultaneously be higher. In particular, a policymaker may appear to follow a relatively harmless policy while simultaneously maximising rent-seeking efforts.

In this study, I have proposed a simple and intuitive extension to Tullock CSF incorporating a stochastic number of multiple winners. Unfortunately, this extension does not seem to fit well with the analysis of asymmetric rents. As in the related literature, a closed-form solution cannot be derived in that case. In general, the relationship between (partial) exclusivity and effort is likely to persist with asymmetric players. However, if the differences in the rents are large enough, the maximum number of rents may also affect the number of active participants. Thus, this leaves an open question for future study.

The key counterfactual of the partial exclusivity model is the rents that could have been allocated, which makes testing the model empirically challenging. However, I demonstrated that another empirical puzzle emerges from the U.S. state-level lobbying data. While consistent the model of partially exclusive rents, the constant relationship between total expenditures and the number of spenders is a critical finding in itself because it contradicts the standard theory. Thus, it is important to observe whether the same outcome emerges from other, possibly larger, data sets.

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