A model of corporate rent-seeking through tax legislation

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Abstract

An analytic model is developed to examine the role of rent-seeking expenses on tax legislation. Rent-seeking expenses are found to be only a fraction of the tax benefits at stake. Rent-seeking expenses increase when firms cannot cooperate, when very general tax legislation is proposed, and when there is legislative support for tax cuts. © 1999 Elsevier Science Inc. All rights reserved.

1. Introduction

Over the past few years, considerable attention has been given to lobbying and attempts to influence members of Congress. ¹ Particular attention has been given to campaign contributions made to members of Congress in attempts to influence votes on tax legislation (see Freed and Swenson, 1995). To the extent that corporations can influence such votes, there is an ethical issue for both the lawmaker and the corporation.

During the 1980s, approximately $15 million was given by corporate political action committees (PACs) to tax-writing members of Congress (Freed and Swenson, 1995, p. 881). Suprisingly, the per firm contributions were less
than $3 thousand, with some firms making substantial contributions, and others making virtually none (Freed and Swenson, 1995, p. 882). In empirical accounting research on rent-seeking, a significant relationship was found between these campaign contributions to tax-writing members of Congress and impending tax legislation during the 1980s (Freed and Swenson, 1995, p. 886). Two unexplained phenomena were also observed in that study: the seemingly insignificant campaign contributions (or rent-seeking expenditures) relative to the taxes at stake and the high variability of contributions across firms (Freed and Swenson, 1995, p. 882).

The purpose of our paper is to theoretically examine why these rent-seeking payments can be so low with such a high variability. The results have implications for both empirical work and for policy. The results can help guide empirical work linking tax legislation and campaign contributions by adding covariates for probabilities of legislative success, industry settings where cooperation is likely (i.e., concentrated industries), and for shared tax benefits (i.e., legislation affecting a broad cross-section of firms). The policy implication relates to ethics: if it is desirable to discourage rent-seeking, the model may help to identify situations which are at higher risk for rent-seeking activity.

Briefly, the findings are as follows. Under all circumstances, rent-seeking expenses are only a fraction of the tax benefits at stake. One reason is that incremental expenditures are progressively less effective, so that inframarginal expenditures are highly cost-effective relative to marginal expenditures. A second reason for relatively small rent-seeking expenses is cooperation among firms. When industries are concentrated, they are better able to coordinate efforts and reduce expenses.

Rent-seeking expenses are also reduced when there is free riding on tax benefits. Thus, where very general tax laws are proposed which apply to all industries (e.g., MACRS depreciation), per firm rent-seeking expenditures are lower than where industry or firm-specific tax provisions are at stake, e.g., the Tax Reform Act of 1986 (TRA86). Finally, overall increases in legislative support for tax cuts result in increased rent-seeking expenditures if tax benefits are not shared. Conversely, legislative antipathy toward tax cuts results in decreased rent-seeking expenditures under those conditions.

2. Background

2.1. Taxes and politics

Although no formal theoretical (analytic) research exists on rent-seeking and taxation, theoretical work does exist linking interest group theory and
taxes (cf. Hettich and Winer, 1988). They (1988, pp. 702–711) found that small, easily organized groups are most successful in obtaining rents. Various non-empirical (e.g., Birnbaum and Murray, 1987) studies have considered rent-seeking and business tax breaks. Because other types of rent-seeking expenses are not publicly available (e.g., employment after leaving office) or cannot be linked specifically to tax legislation (lobbying expenses and speaking honoraria), contributions by PACs have been the focus of these studies. See Freed and Swenson (1995, p. 877) for a discussion of this literature.

In the only published regression analysis of rent-seeking and taxes, Freed and Swenson (1995) examined individual firms’ contributions and their tax benefits at stake prior to passage of Economic Recovery Tax Act of 1981 (ERTA) and TRA86. Campaign contributions included both PAC contributions and bundled individual campaign contributions by the firms’ employees, officers, and directors. They found that such contributions were related to all tax law changes of ERTA, but only to special industry-specific preferences on the table prior to the passage of TRA86 (Freed and Swenson, 1995, pp. 885–887).

Freed and Swenson (1995, p. 881) found that observed PAC contributions varied widely by firm, and were only a small percent of tax benefits at stake. This finding was similar to all published non-tax empirical studies [see cites in Freed and Swenson (1995, pp. 893–894)]. As an indication of the magnitude of PAC contributions, Table 1 in Freed and Swenson (1995, p. 881) reported aggregate PAC contributions during 1980s, when a number of tax bills were enacted. The absolute and relative contributions were substantial; $5.3 million was given to tax writing members of Congress by corporate PACs prior to the enactment of TRA86, which was about 12% of PAC contributions to all political candidates during this period (Freed and Swenson, 1995, p. 881). Freed and Swenson’s (1995) analysis also found that prior to ERTA, which had very general provisions affecting virtually all firms, contributions were relatively small (Freed and Swenson, 1995, p. 881). In contrast, Freed and Swenson (1995, p. 881) found that equivalent per firm contributions just prior to the TRA86 were substantially higher. These observations agree with analytic propositions later in the paper.

2.2. Rent-seeking models

Independent of the empirical studies above, a theoretical literature (e.g., Tullock, 1967, 1980; Berry, 1993) has developed that models firms’ decisions to make rent-seeking expenditures. The models are general in nature, and do not refer to rents from tax legislation.

In these general Cournot–Nash game theoretic models of rent-seeking [see Tullock (1967, 1980), and subsequent variations by other authors, e.g., Berry (1993)], agents make expenditures to win a prize with a fixed and certain value.
With the exception of Berry (1993), there is a single winner of the prize. The prize is awarded to the highest bidder, or bidders in the case of Berry (1993). The probability of winning depends on the size of the agent’s expenditures relative to expenditures across all agents. A number of features of the tax legislative process require that these more general models of rent-seeking be expanded. The additional features of our paper’s model are: (1) the prize may or may not be won by rent-seekers, depending on a stochastic process; (2) firms can cooperate or compete; (3) the prize can be won by any number of rent-seekers, each with a probability dependent on its expenditures; and (4) there may be asymmetric legislative support across agents.

3. The basic model

Assume that there are \( N \) risk neutral firms who seek favorable tax legislation, and \( m \) of these firms will actually receive or win such benefits. The firms cannot cooperate (e.g., form an industry PAC) to pool influence expenditures, and instead compete for such legislation. Aggregate tax benefits are denoted by \( R \), where \( R_W > 0 \) is the payoff to a single winner and \( R_L \geq 0 \) is the payoff to each of the losers if there is at least one winner. Aggregate tax benefits can then be written as \( R = R_W + (N - 1)R_L \). If there is more than one winner, the sharing rule is:

\[
\frac{R_W + (m - 1)R_L}{m}.
\]

This fixed-pie representation of the payoff is common to other rent-seeking models and is representative of most tax legislation. In most tax legislation, firms seek a specific law (or set of laws) that have a revenue cost to the government that can be estimated.

The setting where firms do not share tax benefits is characterized as a winner-take-all environment where \( R_L = 0 \) and \( R_W = R \) in the case of a single winner. Similarly, sharing of tax benefits implies that \( R_L > 0 \) and \( R_W < R \) for a single winner. Unlike the more general regulatory setting where the government can, for example, award a franchise to a single firm, tax legislation typically involves laws which can be used simultaneously by a number of firms and/or industries (although firm-specific or rifle shot laws occasionally are written). For example, tax benefits resulting from rapid depreciation under the ERTA accrued to almost all firms, even though lobbied for by only certain capital intensive firms (see Birnbaum and Murray, 1987).

Successful legislative outcome for any one issue is governed by a probabilistic mechanism \( \Theta(a_i) \), where \( \Theta \) is a probability function, and \( a_i \) are rent-seeking expenditures (constrained to be non-negative). An example of \( \Theta \) is the binomial distribution, in which \( \Theta = 1 - (1 - p)^{ai} \). In this specification, each
rent-seeking firm can purchase a number of independent attempts to influence tax legislation, each with a probability \( p \) of success. Across time, any one attempt can result in a legislative success. The cumulative probability of success increases with each attempt, but the incremental probability falls with each attempt. This setting is representative of real world tax legislation if each attempt is with respect to a separate lawmaker or committee, or lawmakers’ preferences can stochastically fluctuate from attempt to attempt (say, because of fluctuating pressures from other interest groups).

We assume \( d/d_a \Theta(a_i) > 0, d^2/d_a^2 \Theta(a_i) < 0 \). That is, the function is increasing and concave in \( a_i \). Incremental expenditures become marginally less effective over time for the simple reason that previous expenditures have already provided a significant probability of success and there is not as much left to gain. The probability can increase significantly from 1%, but not from 99%.

Assume that rent-seeking expenditures, \( a_i \), can be made in units \( x \) (assumed to be continuous), \(^3\) which have a constant per unit cost of \( c \). For example, if the firm hires a lobbyist, \( x \) might represent the hours of the lobbyist’s time, and \( c \) the lobbyist’s hourly billing rate. An analogy can be made for the use of employees in lobbying, or campaign contributions, which are often made in multiples of $100. Firms simultaneously choose their levels of \( x \). The expected profit for a firm \( i \) as a function of the units of rent-seeking expenditures is:

\[
E \left[ \prod_i (x_i, x_j) \right]
\]

\[
= \Theta(x_i) \sum_{m=1}^{N} \left( \left( \frac{R_W + (m - 1)R_L}{m} \right) \left( \frac{N - 1}{m - 1} \right) \Theta(x_j)^{m-1} (1 - \Theta(x_j))^{N-m} \right) + (1 - \Theta(x_i))R_L (1 - (1 - \Theta(x_j))^{N-1}) - cx_i,
\]

(2)

where each of the \( N - 1 \) other firms choose \( x_j \) investments.

Eq. (2) has three terms: the first is expected profit, given \( i \) has one or more legislative successes. It is the product of the probability of firm \( i \) having a legislative success and the expected value of such a success. The value of a success is the sum of expected successful legislation for 1 to \( N \) possible winners. Each of these possible situations (shown in braces) is the value for firm \( i \) for that \( m \) number of winners times the number of combinations of getting \( m \) winners out of \( n \) firms, the joint probability of success by the \( m - 1 \) other firms, and the joint probability of no success by the remaining \( N - m \) firms. The second term is expected profit for \( i \) with no successes. It is the product of the probability that firm \( i \) has no success, the value of being a legislative loser, and

\(^3\) The binomial distribution discussed above would suggest that \( x \) is discrete. However, calculus requires continuity. Note that the functional form of the binomial is generalizable to a continuous case.
the probability that there is at least one legislative success among the $N - 1$ other firms. The third term is the certain constant cost of rent-seeking units of expenditures. We can differentiate (2) by $z_i$, set the result to zero to obtain the profit maximizing level of influence expenditures as follows:

$$
0 = \left\{ -R_L \left[ 1 - (1 - \Theta(z_j))^N \right] + \sum_{m=1}^{N} \left( \frac{R_W + (m-1)R_L}{m} \right) \right. \\
\left. \times \left( \frac{N-1}{m-1} \right) \Theta(z_j)^{m-1} (1 - \Theta(z_j))^{N-m} \right\} \frac{d\Theta}{dz_i} - c.
$$

Since $\Theta$ is concave in $z_i$, this condition is sufficient for a maximum, i.e., the second-order condition holds. A symmetric non-cooperative Nash equilibrium in rent-seeking expenditures for a single period is defined by (2) with $z_i = z_j$, i.e., each firm makes identical rent-seeking expenditures.

The term in braces is the benefit of winning, the difference between the expected payoff for the company as a winner and as a loser. Multiplying that by the marginal probability of winning due to an increase in $z_i$, gives you the marginal benefit of increased expenditures. That must equal the marginal cost of $c$.

The concavity of $\Theta$ ensures that inframarginally, each company has positive marginal benefits from lobbying. Also, each company gains at least some expected tax benefits even if no lobbying is done (the losers’ share). Therefore, each firm invests less in lobbying than its expected tax benefits.

**Proposition 1.** Rent-seeking expenditures are only a fraction of the rent at stake.

*What is surprising about this finding is how relatively small such rent-seeking expenditures can be.* The exact ratio of expenditures to rents is of course a function of the other variables in the model: $\Theta$, $N$, $m$, and the payoffs, $R_W$ and, $R_L$. Consider one plausible example: $\Theta = 1 - 0.9^2$, $N = 2$, $R_W = $100,000, $R_L = 0$ (i.e., there are no tax benefits to legislative “losers”), and $C = $100. Here, the predicted per firm expenditure is $3,780. Total expenditures are 7.56% of the rents at stake. This may explain why observed PAC contributions appear to be low relative to tax benefits at stake, for example (Freed and Swenson, 1995, p. 888).

The low total cost of lobbying relative to the total tax benefits received suggests that firms will strongly desire to play this game and prevent others from joining (and compete away the rents) if possible. Thus, an ethical corollary is:

**Corollary 1.** Firms will value a lobbying presence and will attempt to make the system as inaccessible to others as possible.
4. Expenditures in a cooperative setting

Suppose that instead of the non-cooperative model presented above, firms costlessly form industry coalitions such as an industry PAC [the reader is referred to Linster (1994) for the case of cooperation for a deterministic prize]. Expected group profit is then:

\[ E \left[ \prod_{N} (x) \right] = R \left[ 1 - (1 - \Theta(x))^N \right] - Nxc. \] (4)

This represents \( R \) times the probability of at least one success for any firm less the costs of \( N \) firms. Differentiating (4) with respect to group rent-seeking expenses and setting the result equal to zero gives maximized expected group profits:

\[ 0 = N \left\{ R \left( (1 - \Theta(x))^N \right) \frac{d\Theta}{dx} - c \right\}. \] (5)

To see how this cooperative solution is different from the non-cooperative one, we compare it to the setting of where the rewards to successful legislation are fully appropriable so that \( R_L = 0 \). Then (3) can be rewritten as:

\[ 0 = R \left( (1 - \Theta(x_j))^N \right) \frac{d\Theta}{dx_i} \]
\[ + \sum_{m=2}^{N} \left( \frac{R}{M} \right) \binom{N}{m-1} \Theta(x_j)^{m-1} \left( (1 - \Theta(x_j))^{N-m} \right) \frac{d\Theta}{dx_i} - c. \] (6)

Note that the second term in (6) represents the marginal benefit to firm \( i \) as a result of legislative success by rival firms, or ties. The possibility of being tied represents a private return for non-cooperating firms, since gains from legislative success are shared by all firms in the tie. This term is absent in (5), thus the incentive for over-investment. Said another way, in the non-cooperative setting a firm is better off tying because it can share in tax benefits. On the other hand, there is no benefit to more than one legislative (across firms) success in the cooperative setting. Accordingly:

**Proposition 2.** When firms cooperate to seek tax legislation, per firm rent-seeking expenditures are lower than if they do not cooperate in a non-sharing contest.

This is similar to the standard oligopoly model in which firms can collude by reducing their sales volumes in concert to increase the price (providing externalities to each other) and exploit monopoly power. By everyone reducing lobbying expenses in this case, the marginal benefit of lobbying increases for everyone (providing externalities to each other).
The potential scale of this effect is illustrated by the example in the previous section with $\Theta = 1 - 0.9^2$, $N = 2$, $R = $100,000, and $C = $100. Recall that absent collusion, each firm spends $3780. With collusion, each firm only spends $2210. Collusion leads to even greater cuts in spending when $N > 2$. An interesting feature of the binomial distribution (which is not true for any other distribution) is that total spending across firms is the same in the collusion case, independent of $N$. 1000 firms would spend the same amount as one firm.

Some interesting observations can be made from Proposition 2. An implication for empirical work is that observed PAC contributions should be lower for organized groups of firms than for others. Thus, firms in highly concentrated industries, especially if they have existing trade associations, should have small PAC/tax benefit ratios. An ethical implication is that, because uncons-

centrated industries make relatively larger contributions, law makers can receive more rents by proposing more widespread legislation, or:

**Corollary 2.** *Ceteris paribus, politicians find it more profitable to propose tax legislation to relatively unorganized industry groups.*

Note that this does not mean we should observe more rents actually going to such unorganized groups. Instead, it means that politicians can receive more money from entertaining tax legislation relevant to such groups.

Note that Proposition 2 assumes that firms costlessly form coalitions. This might occur where firms already belong to an industry trade association, perhaps with a PAC, such that the marginal cost of rallying member firms behind any one tax legislation effort approaches zero. On the other hand, it might be that firms are not already organized so that the cost is high, or that they are organized but there is still some marginal cost for any particular rent-seeking effort. Assume that the cost of organizing rises strictly with $N$. Rewrite (4) and (5) as:

$$E \left[ \prod_N (z) \right] = R \left[ 1 - (1 - \Theta(z))^N \right] - Nxz(c + o),$$

(4')

$$0 = N \left\{ R \left[ (1 - \Theta(z))^{N-1} \right] \frac{d\Theta}{dz} - c + o \right\},$$

(5')

where $o$ is the per firm organizing cost. Rewriting $NR(1 - \Theta(z))^{N-1}$ as $\beta^{N'}$ and rearranging (5') we get:

$$\frac{d\Theta}{dz} = \frac{c + o}{\beta^{N'}(z)}.$$

(7)

Recall that the *marginal* probability of legislative success is strictly decreasing in units of rent-seeking expenditures (concavity); i.e., the left-hand side (LHS) of
(7) is decreasing in \( x \). Since the right-hand side (RHS) of the first order condition (FOC) in (7) becomes larger as \( o \) increases, for the equality in (7) to be maintained, the LHS must increase as well. As noted above, when \( d\Theta/dx \) increases, this implies a decrease in the units of investment, because of the inverse relation between marginal probability of success and marginal units of expenditure. Accordingly, the model predicts that the higher the per firm organizing costs, the lower the rent-seeking investments in this cooperative model.

**Proposition 3.** In a setting where firms can cooperate to obtain favorable tax legislation, rent-seeking expenditures are lower when organizing costs are greater.

The above analysis assumes that the firms play a cooperative game. To the extent that coalitions are formed without enforceability of agreements, then the public goods (free-riding) phenomenon will occur and perhaps some or no firms will provide rent-seeking expenditures. This is essentially the non-collusive case with complete sharing of tax benefits in which minimal expenditures are optimal. According to Peltzman (1976, p. 239) we would expect cooperative behavior in more concentrated industry groups, because organizing costs and free riding are lower.

5. Expenditures assuming sharing of tax benefits

To examine the impact of sharing of tax benefits, first rewrite the model in (2) assuming no sharing. To simplify notation, define \( \hat{\beta}(x_j) \) as the expected payoff for firm \( i \) from winning given \( x_j \):

\[
\hat{\beta}(x_j) = \sum_{m=1}^{N} \left[ \frac{R_w}{m} \right] \left( \frac{N - 1}{m - 1} \right) \Theta(x_j)^m (1 - \Theta(x_j))^{N-m}
\]

which is decreasing in \( x_j \), and is substituted for most of the first term in (2). Since tax benefits are not shared, \( R_L = 0 \), and the second term in (2) drops out. Substituting in \( \hat{\beta}(x_j) \) we write (3) as:

\[
\hat{\beta}(x_j) \frac{d\Theta}{dx_i} = c,
\]

or marginal benefit equals marginal cost, which can be rewritten as:

\[
\frac{d\Theta}{dx_i} = \frac{c}{\hat{\beta}(x_j)}.
\]

By comparison, the profit maximizing condition under sharing of tax benefits, expressed as marginal benefit equals marginal cost is
where $\gamma(z_j) = R_L[1 - (1 - \Theta(z_j))^{N-1}]$ which is the expected payoff for $i$ from losing, and

$$\beta(z_j) = \sum_{m=1}^{N} \left[ \frac{R_W + (m-1)R_L}{m} \right] \left( \frac{N-1}{m-1} \right) \Theta(z_j)^{m-1}(1 - \Theta(z_j))^{N-m},$$

both of which are decreasing in $z_j$. Eq. (9) can be rewritten as

$$\frac{d\Theta}{dx_i} = c, \quad (10)$$

Recall that $(d\Theta/dx_i)$ is decreasing and convex in $x_i$ when $x_i$ is viewed as continuous. Note that $\hat{\beta} > \beta > (-\gamma + \beta)$. This in turn implies that the denominator in (8) is larger than the denominator in (10), which means that:

**Proposition 4.** When firms do not share tax benefits with other firms, per firm rent-seeking expenditures are larger than when firms must share tax benefits.

This is hardly surprising since the larger the sharing of benefits, the smaller the incremental payoff for winning and the smaller the incentive to win. The implication for empirical work is that observed per firm PAC contributions should be larger when rifle-shot (firm specific) tax legislation is proposed, than when widespread (e.g., MACRS depreciation, which applies to all firms) legislation is proposed. An ethical corollary is that politicians can receive more money in the non-shared tax benefit setting, or:

**Corollary 4.** Ceteris paribus, politicians prefer tax legislation which provides benefits to a clearly defined set of firms.

One conjecture resulting from this is that much of the complexity in the Internal Revenue Code might be due to numerous provisions which carefully define conditions for receiving tax benefits, i.e., to avoid benefit-sharing (free riding).

Note that shared tax benefits are essentially a public good. For the setting of a deterministic prize which is a public good, the interested reader is referred to Katz et al. (1990) and Linster (1993).

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\footnote{Note that this term is absent from (8) because legislative losers do not share in tax benefits in that winner take all setting.}
6. Parametric shifts in legislative probabilities

Suppose that there occurs a parametric shift in $\Theta$, or the probability that tax legislation will be enacted at a certain level of rent-seeking expenditures. Such a shift can be either positive or negative. An example of the former was the legislative mood prior to the passage of ERTA, where a pro-business, tax cutting mentality had broad popular and electorate support (see, for example, Freed and Swenson, 1995, p. 877). One example of a negative shift is the legislative mood prior to TRA 86, where tax loopholes of various corporations were targeted by the US Congress (see Freed and Swenson, 1995, p. 877).

To examine the effect of changes in legislative support for the provision of tax benefits, we will define legislative support as a parameter $g$, where $0 < g < 1$. Now $\Theta^*(z) = \eta \Theta^*(z)$ where $\Theta^*$ ranges from 0 to 1. This can be thought of as a two-stage lottery. In the first stage, it is determined whether legislators are or are not susceptible to lobbying. This stage is influenced solely by the degree of legislative support. In stage two, it is determined whether the firm’s lobbying is successful. This stage is influenced by the amount of rent-seeking expenditure. The firm must win both lottery stages to gain the desired tax benefits. If $g$ is high, then legislators are very amenable to providing tax benefits, while if $g$ is low, then the political environment is hostile and no amount of lobbying is likely to be successful.

The direction of the effect of a change in legislative support on rent seeking expenditures depends on how much sharing of tax benefits occurs and how many firms are competing. Consider the two extreme cases of no sharing and full sharing.

In the no sharing case, the first order condition is

$$c = \beta(z) \frac{d\Theta}{dz} = \beta(z) \eta \frac{d\Theta^*}{dz}.$$  

To determine the effect of $\eta$ on $z$, this equation must be differentiated with respect to $\eta$:

$$\frac{dc}{d\eta} = \left( \frac{d\beta(z)}{d\eta} + \frac{d\beta(z)}{dz} \frac{dz}{d\eta} \right) \eta \frac{d\Theta^*}{dz} + \frac{d\beta(z)}{dz} \frac{d\Theta^*}{dz} + \frac{d\beta(z)}{dz} \eta \frac{d^2\Theta^*}{dz^2} \frac{dz}{d\eta}. $$

Since $c$ is a constant, this can be rearranged as

$$\frac{dz}{d\eta} \left( \frac{d\beta}{d\eta} \frac{d\Theta^*}{dz} + \beta \eta \frac{d^2\Theta^*}{dz^2} \right) = - \left( \frac{d\beta}{d\eta} + \hat{\beta} \right) \frac{d\Theta^*}{dz}. \hspace{1cm} (11)$$

The term in parentheses on the LHS of (11) is negative since the first derivative of $\beta$ and the second derivative of $\Theta^*$ are both negative. The first derivative of $\Theta^*$ is positive so the sign of $dz/d\eta$ is the same as the sign of $\eta d\beta/d\eta + \hat{\beta}$. To determine the value of $\eta d\beta/d\eta + \hat{\beta}$, it is useful to first rearrange $\beta$. 

The derivative of \( \hat{\beta} \) can now be determined:

\[
\frac{\text{d}\hat{\beta}}{\text{d}\eta} = - \left[ \frac{R_W}{N\eta \hat{\Theta}^*} \right] [1 - (1 - \eta \hat{\Theta}^*)^N] - N \hat{\Theta}^* \left[ \frac{R_W}{N\eta \hat{\Theta}^*} \right] (1 - \eta \hat{\Theta}^*)^{N-1}.
\]

Now it can be shown that

\[
\hat{\beta} + \eta \frac{\text{d}\hat{\beta}}{\text{d}\eta} = R_W (1 - \eta \hat{\Theta}^*)^{N-1} > 0.
\]

Therefore, given (11), \( \text{d}x/\text{d}\eta \) must be positive. This proves the following proposition:

**Proposition 5.** When there is a shift in legislative support for favorable tax legislation, the change in rent-seeking expenditures are in the same direction as the change in legislative support assuming that there is no sharing of tax benefits.

An increase in \( \eta \) increases the total probability of success, but it also increases the marginal probability of success since \( \text{d}\Theta/\text{d}z = \eta \text{d}\Theta^*/\text{d}z \). Therefore, each unit of \( z \) is more effective, encouraging more expenditure. An increase in \( \eta \) also increases the probability that other firms will win, reducing the expected value of the prize. This effect discourages expenditures but is smaller than the effect on the marginal probability of winning.

The result is contingent to some extent on the specific way in which we model legislative support. In particular, Proposition 5 can only be proven by assuming that the legislative support effect on \( \Theta \) is proportional. The most basic mathematical concept of legislative support is that it increases the impact that lobbying has on the probability of success. In other words, the cross-partial derivative of \( \Theta \) with respect to \( z \) and \( \eta \) is positive. Unfortunately, this cross-partial derivative condition is not sufficient for lobbying to increase with \( \eta \). This is due to the effect that \( \eta \) can have on the probability of other firms winning, which can offset the cross-partial derivative effect. Counterexamples (with a positive cross-partial derivative) can be constructed in which lobbying falls as the legislative support increases. However, such counterexamples are very unusual. We feel that the additional structure used in our definition of legislative support (that it has a proportional effect) is a relatively harmless
necessity to allow a definitive proof and is representative of the more general case of a positive cross-partial derivative.

When tax benefits are shared, the situation is more complicated. To see this, now consider the extreme case of complete sharing in which $R_W = R_L$. In this scenario, the only incentive to lobby is to improve the probability of at least one winner. As long as someone else wins, you do not care whether you do as well. In this case, (10) can be simplified as

$$\frac{d\Theta}{dx} = \frac{c}{\gamma^*(x)},$$

$$\gamma^*(x) = R_L(1 - \eta \Theta^*)^{N-1}.$$  

Rearranging and differentiating as in (11) yields:

$$\frac{dx}{d\eta} \left( \frac{d\gamma^*}{dx} \eta \frac{d\Theta^*}{dx} + \gamma^* \eta \frac{d^2\Theta^*}{dx^2} \right) = -\left( \frac{d\gamma^*}{d\eta} \eta + \gamma^* \right) \frac{d\Theta^*}{dx}.$$  

(13)

The sign of $dx/d\eta$ is the same as the sign of $\eta d\gamma^*/d\eta + \gamma^*$. Given the definition of $\gamma^*$,

$$\frac{d\gamma^*}{d\eta} \eta + \gamma^* = -(N - 1)R_L \Theta^*(1 - \eta \Theta^*)^{N-2} \eta + R_L(1 - \eta \Theta^*)^{N-1}$$

$$= R_L(1 - \eta \Theta^*)^{N-2}[1 - N\eta \Theta^*].$$

The term in brackets is $1$ − expected number of winners. If the number of expected winners exceeds 1 (which it will if $N$ is sufficiently large), then an increase in $\eta$ leads to a decrease in $x$. This is due to the fact that an increase in legislative support significantly increases the probability of another firm winning, in which case there is less need for you to win as well. On the other hand, if the number of expected winners is less than 1 (which it will be if $N$ is sufficiently small), then an increase in $\eta$ leads to an increase in $x$. In this case, other firms’ experiences are less relevant to your decision, which is dominated by the fact that your lobbying is now more effective.

7. Unequal costs and benefits across firms

To this point the analysis has considered the case of symmetric ex-ante costs and benefits across firms. This leads to a symmetric equilibrium in which all firms spend identical amounts on rent-seeking. However, empirical evidence (Freed and Swenson, 1995, p. 812) finds high variability of PAC expenditures among firms. This section looks at some possible asymmetries that could lead to these variations. In particular, we consider cross-sectional differences in costs and benefits due to three factors: legislative support and size (affect benefits) and marginal cost (affects costs obviously).
7.1. Differential legislative support across firms

The foregoing analysis assumed identical legislative support levels across firms. Under some circumstances this might not be the case: some firms might be under particular congressional scrutiny for whom tax benefits would be unpopular; firms may have already garnered too many (too few) tax or non-tax benefits and are less (more) likely to obtain rents through favorable tax rules. Alternatively, some firms are more adept at working the legislative process and have better connections (due to past expenditures, for example). One example illustrates these ideas. TRA86 targeted repeal of special tax rules for companies whose financial statements revealed that they had large incomes but paid no federal corporate income taxes (see Birnbaum and Murray, 1987).

Consider the case in which one firm has a different legislative support level, \( \eta_i \). The FOC for the no sharing and sharing cases are respectively,

\[
\eta_i \frac{d\Theta^*}{dz_i} = \frac{c}{\beta(z_j)}
\]

and

\[
\eta_i \frac{d\Theta^*}{dz_i} = \frac{c}{-\gamma(z_j) + \beta(z_j)}.
\]

Changes in \( \eta_i \) have two effects on these equations. First, the LHS is proportional to \( \eta_i \). Second, the RHS is negatively related to \( \eta_i \), due to the strategic reaction of other firms. Other firms will reduce their expenditures if \( \eta_i \) increases because the expected incremental value to them of winning will be lower (since firm \( i \) is more likely to win). The reaction of the other companies will increase the incremental value of winning to firm \( i \), which is the denominator of the RHS. Both effects of a change in \( \eta_i \) have the same effect on \( \beta(z_j) \), since \( d\Theta^*/dz_i \) must change in the opposite direction of \( \eta_i \) to maintain equality in the above equations. Hence the following proposition:

**Proposition 6.** When a firm’s legislative support changes, its expenditures change in the same direction, while competing firms change their expenditures in the opposite direction.

It follows from this proposition that firms with greater legislative support will spend more on lobbying than firms with less legislative support, one possible explanation for heterogeneity across firms.

Unlike Proposition 5, Proposition 6 does not require that legislative support be specifically modeled as having a proportionate effect on \( \Theta \). Proposition 6 requires that the cross-partial derivative of \( \Theta \) with respect to \( z \) and \( \eta \) be positive. That is because there is now a negative effect of a change in one firm’s
legislative support on other firms’ success probabilities, resulting in a secondary effect that enhances rather than offsets the primary effect.

7.2. Size differences and rent-seeking expenditures

One of the most important differences between firms is relative size. In this context, size refers to sensitivity to changes in the tax code. This will roughly correspond to traditional measures of size as big firms have more to gain or lose from changes in tax rates and depreciation schedules, for example. In addition, some firms, particularly in industries with either significant excise taxes (e.g. tobacco) or tax subsidies (e.g. ethanol) will have greater size in this context.

The effect of size in the model is to change the magnitude of the prizes for a particular firm. The prizes are $\psi_i R_W$ and $\psi_i R_L$ where $\psi_i$ is the firm’s size. The FOC in the no-sharing and sharing cases become, respectively,

$$\frac{d\Theta}{dz_i} = \frac{c}{\psi_i \beta(z_i)}$$

and

$$\frac{d\Theta}{dz_i} = \frac{c}{\psi_i [-\gamma(z_i) + \beta(z_i)]}.$$  

These equations are similar to the differential legislative support case with $\psi_i$ replacing $\eta_i$. As in that case, $z_i$ is an increasing function of $\psi_i$. Hence, the following proposition:

**Proposition 7.** Larger firms that are more sensitive to the tax code spend more resources on rent-seeking than smaller, less sensitive firms.

7.3. Differential rent-seeking costs across firms

The foregoing analysis assumed that the marginal cost of rent-seeking expenditures, $c$, was identical across firms. There are a number of situations where this would not be true. If firms already have well-organized lobbying efforts, the marginal cost of rent-seeking might be relatively low. For example, well-established firms may already have lobbied before and politicians may be familiar with them and their lobbyists. Or, firms may belong to well-organized industry trade associations who have regular lobbyists with whom tax-writing lawmakers are familiar, and who have already set up a PAC.

Looking at (8) and (10), a decrease in the marginal cost $c$ has two effects on $z_i$. The first effect is to lower the numerator of the RHS of the FOC (which is the marginal cost itself). The second effect is to increase the denominator of the RHS of the FOC through the strategic response of the competing firms who
will reduce their spending in the face of stiffer competition from firm \( i \). Both effects drive \( x_i \) up. Hence, the following proposition:

**Proposition 8.** Firms with lower per-unit costs buy more units of rent-seeking than higher cost firms.

Since the above is based on quantity of influence units purchased, total expenditures can be obtained only by multiplying by the cost per unit. The sign of the change in dollars spent depends on the cost elasticity of \( x_i \). That in turn depends on the exact specification of \( \Theta \). Since expenditures are observable and units purchased are not, the unfortunate implication for empirical work is that, unless the researcher can otherwise distinguish between firms, *total rent-seeking efforts might appear similar or even inverted across* high and low cost firms based on observed PAC contributions, *ceteris paribus*. In contrast, differences in behavior due to variation in marginal benefits have an unambiguous effect on expenditures.

8. Numerical analysis

To see the comparative static results in action, a numerical analysis is performed. Define the probability function as \( \Theta = (1 - 0.9^a) \), \( c = 1 \), \( R_W = 50 \), \( R_L = 0 \), and \( N = 4 \) firms for the winner take all setting. In the sharing of tax benefits setting, \( R_W = 29 \) and \( R_L = 7 \) (per firm), which is equal in expected value to the winner take all setting. The symmetric Nash and cooperative solutions are shown in Table 1 for the case of the above parameters. The solutions were obtained using a computer spreadsheet. For comparison, the cases of \( \Theta_s = 0.5(1 - 0.9^a) \) (low legislative support), and the non-symmetric case where two of the firms face \( \Theta \) and two face \( \Theta_s \) are shown.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Legislative probability function, ( \Theta )</th>
<th>Tax legislation outcome, ( x )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No sharing of tax benefits</td>
<td>Sharing of tax benefits</td>
</tr>
<tr>
<td>1</td>
<td>((1 - 0.9^a) ) ∀ firms</td>
<td>7.77 (3.94)</td>
</tr>
<tr>
<td>2</td>
<td>0.5((1 - 0.9^a) ) ∀ firms</td>
<td>5.87 (3.92)</td>
</tr>
<tr>
<td>3</td>
<td>((1 - 0.9^a) ) for 2 firms</td>
<td>11.10 (7.89)</td>
</tr>
<tr>
<td></td>
<td>0.5((1 - 0.9^a) ) for 2 firms</td>
<td>1.73 (0)</td>
</tr>
</tbody>
</table>

\(^a\) \( x \) = amount of rent-seeking expenditures made by each firm. Value of rent is $50; cost per unit of rent-seeking is $1; Number of firms = 4. Cooperation assumes that firms can make side payments to each other.
As can be seen, all results are consistent with the comparative statics. The Nash solutions exceed the cooperative solutions in all winner take all cases, and expenditures in the winner take all settings exceed expenditures in the sharing of tax benefits setting. When legislative support decreases, expenditures decrease in both the sharing and no-sharing settings. In the asymmetric legislative support setting, expenditures are much higher for the legislative-favored firms than for non-favored firms. Indeed, in the sharing case, the non-favored firms do not bother to spend anything. Another notable result is the cooperative case with asymmetric support. The optimal strategy is to do all coalition lobbying through the favored firms and have the non-favored firms subsidize them through side payments. Also note that expenditures are higher in the cooperative case than in the sharing case in setting 2. This is evidence of free-riding in which firms fail to account for the positive externality they provide to others through their expenditures which increase the probability of at least one winner, enabling everyone to gain at least the loser’s prize.

9. Conclusions

Our paper has examined rent-seeking in the case of tax legislation. The model makes no assumptions about the time limit or direction of rents sought. For example, in any year lawmakers might propose taking away tax benefits, and firms would make expenditures with the intent of not losing the rent; this is what was observed as a large infusion of corporate PAC contributions prior to the passage of TRA86 (Godwin, 1990, p. 293, no. 3). If tax benefits are viewed as being on the table for each year’s legislative budget, then firms must constantly make rent-seeking expenditures, i.e., not just before attempting to obtain new legislation.

The large increase in rent-seeking expenditures prior to TRA86 is attributable to two separate effects: an increase in the number of firms affected by tax legislation (all firms were affected), and an increase in the amount of tax benefits on the table vis-a-vis other legislation. It is obvious that an increase in available rents increases per firm rent-seeking expenditures. However, holding available rent constant, an increase in firms decreases per firm expenditures through an erosion of the expected incremental value of winning (since there are more expected winners). In the non-sharing case in which losers gain nothing, the combined effect of a doubling of both is a net increase in per firm expenditures, a result consistent with observed campaign contributions prior to TRA86 (e.g., Freed and Swenson, 1995, p. 881).

5 This is evident from the fact that \( \beta \) increases as both \( R_W \) and \( N \) increase. See Eq. (12). The effects of \( R_W \) in the numerator and \( N \) in the denominator cancel each other leaving only the effect of \( N \) in the exponent of the second term.
One of the most important results which falls out of the model is that in a setting of probabilistic legislation (or other types of regulation), observed rent-seeking expenditures are only a fraction of possible tax benefits. In the fairly typical case discussed in Section 3, total rent-seeking expenditures are 7.56% of the tax benefits at stake. This general result may partly explain why observed PAC contributions in empirical studies are very small relative to the rents at stake; see discussion in Godwin (1990, pp. 291, 292), and empirical evidence in Freed and Swenson (1995, p. 888).

According to Halperin (1991, p. 7) an analytic model’s results should make sense notwithstanding the assumptions. Here the model assumes a specific competitive environment and a balanced government budget. For the former, the non-cooperative model assumes \( N \) firms are competing for tax legislation. Instead, we might view this as \( N \) industries who are competing; if firms cooperate within industries and organizing costs are negligible, the model’s predictions would not change. For the balanced budget assumption, \( R \) is assumed to be fixed. However, we might view \( R \) as being a function of \( z \), i.e., the politician may make the tax benefit larger than \( R \) (i.e., go beyond the budget) if rent-seekers value it enough. If we can make an assumption as to the recursive (implicit function) relationship between \( R \) and \( z \) then the model should be solvable.

Another aspect of the balanced budget setting is what group receives a tax increase equivalent to \( R \) (the tax rent). The model follows all prior analytic research by ignoring this aspect, or assuming it falls on individuals. Indeed, the latter is a reasonable assumption (see Peltzman, 1976, pp. 212–220) since individuals rarely exert enough political influence to deflect tax increases. However, the possibility exists that firms who are not legislative winners could be hit with the corresponding tax increase. This is modeled in Appendix A; as can be seen, the effect is to increase per firm rent-seeking expenditures.

Our paper makes no policy prescriptions with respect to the efficiency gains/losses in this setting. Undoubtedly, rent-seeking expenses are used to effect both deserved and undeserved tax benefits. An obvious ethical consideration is if the expenditures enable firms to buy votes as opposed to supporting their positions on tax legislation by funding campaigns. If the anecdotal evidence is correct and such vote buying occurs, then any rent-seeking expenditure \( z > 0 \) is unethical. Looking back at the paper’s findings, we see that such ethical violations can be reduced by:

- A cooperative setting. If firms are likely to cooperate on policy matters, then, if given the opportunity to lobby for tax legislation, they are likely to spend less;

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6 One assumption, consistent with the literature, is the simultaneous moves of the firms. For an example of sequential moves in a tax setting, see Beck et al. (1996).
• Unorganized industries. If firms do not already have trade associations or industry PACs, and there are high transactions costs in doing so (many and/or widely dispersed firms), the firms will spend less;
• Tax laws that are written to apply generally to many firms, instead of industry-or firm-specific laws;
• Potential tax legislation is considered only when there is hostility among legislators toward the provision of tax benefits; and
• Increasing the cost of expenditures. One way to do this would be to have a tax on PAC contributions. On the other hand, tax deductibility of rent-seeking costs (currently this is not allowed) would increase unethical activity.

Appendix A. Effects of having unsuccessful rent-seekers receiving tax increases

In the case of a tax increase on legislative losers to balance the budget, the profit-maximizing condition is:

\[ 0 = \left[ \delta(x_j) + \beta(x_j) \right] \frac{d\Theta}{dx_j} - c, \quad (A.1) \]

where

\[ \delta(x_j) = \sum_{m=1}^{N-1} \left[ \frac{R_W}{N-m} \right] \left( \frac{N-1}{m-1} \right) \Theta(x_j)^m (1 - \Theta(x_j))^{N-m-1} \]

and

\[ \beta(x_j) = \sum_{m=1}^{N} \left[ \frac{R_W}{m} \right] \left( \frac{N-1}{m-1} \right) \Theta(x_j)^m (1 - \Theta(x_j))^{N-m}. \]

Eq. (A.1) can be rewritten as:

\[ \frac{d\Theta}{dx_j} = \frac{c}{\delta(x_j) + \beta(x_j)}. \quad (A.2) \]

Comparing, we see that the denominator in (A.2) is smaller than the denominators in (8) and (10). The result is that per firm rent-seeking expenditures are higher when legislative losers are taxed. Of course, if firms can collude, then no rent seeking will take place at all in this environment, since rent seeking imposes externalities on other firms equal to the expected tax benefits.

References