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Modelling rent-seeking contests

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Abstract

This survey focuses on alternative ways of modelling rent-seeking contests. My primary concern is with the relationship between the extent of rent dissipation and the underlying contest characteristics: e.g., the number of players, their attitudes toward risk, the asymmetry among the players, the source of the rent, the nature of the rent or the nature of the rent setter. The survey concludes with a brief description of attempts to endogenize various components of the rent-seeking contest.

Key words: Rent-seeking contests; Rent dissipation

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1. Introduction

The emerging theory of rent seeking was first surveyed by Tollison (1982) and more recently by Brooks and Heijdra (1989). There was a natural need at the time to define the basic concepts (e.g., natural vs. artificial rents, rent seeking vs. profit seeking), clarify the main ideas, implications and messages of the theory and discuss its normative and positive aspects.

In the passing decade the rent-seeking literature has gathered momentum and advanced in many directions. On the one hand, the simplicity and stylized nature of the game-theoretic rent-seeking model studied by Tullock (1980) made it a natural starting point for numerous interesting extensions and modifications. On the other hand, considerable attention has been attracted by some unresolved controversies, in particular, regarding the

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question of the social costs of rent seeking. The purpose of the current work is to survey the alternative modelling of strategic 'winner take all' rent-seeking contests and to discuss their success in shedding light on some issues related to the measurement of the social waste associated with the rent-seeking process.[1] My chief concern will be with the relationship between the rent-seeking expenditures and the nature of the contest, the characteristics of the contested rents and the relevant parameters of the political-economic environment.

The rent-seeking contests on which I focus share the following characteristics:

(i) The contest is an N-player strategic game, $N \geqslant 2$.
(ii) The contested rent is indivisible in the sense that one 'winner takes all'.
(iii) The players expend effort (resources) to increase their probability of winning the rent.

These characteristics define the scope of the survey. While allowing a very rich class of models they exclude that part of the literature on interest groups, lobbying or regulation framed in terms of a *single agent* doing the rent seeking, *non-strategic* agents or agents lobbying for a *share* of the rent. The studies of Bhagwati (1980, 1982), Becker (1983, 1985), Kruger (1974) and Posner (1975), as well as the more recent contributions of Cairns (1989), Cairns and Long (1991) and Long and Vousden (1987) remain therefore beyond our general framework. I also almost disregard the game-theoretic models of interest groups based on a vote function and campaign contributions, a composite utility function or strategic transmission of information. For a useful review of these approaches the reader is referred to Potters and van Winden (1993). Since my primary concern is with alternative modelling of rent-seeking contests, no attention is paid to the applications of the theory in specific economic contexts (e.g., Anam (1982), Hillman (1982), Rodrik (1986), Mayer and Riezman (1987) – the reader is referred to Hillman (1989) for a comprehensive survey), to the studies attempting to empirically estimate the implications of the alternative models on the social costs of rent seeking (e.g., Laband and Sophocleus, 1989; Dougan, 1991; Katz and Rosenberg, 1989) and to the experimental work (e.g., Millner and Pratt, 1989, 1991; Shogren and Baik, 1991).

The literature that will be reviewed is closely related to the literature on incentives in elimination tournaments (Rosen, 1986; Lazear and Rosen, 1981;

[1] Assuming that rent-seeking expenditures have no social value, they are conceived herein as the real resources wasted in the rent-seeking process. Of course, the other possible component of the social cost of a contestable rent is the allocative inefficiency (deadweight losses) associated with the rent.

Nalebuff and Stiglitz, 1983), R & D rivalry and patent competition (Dasgupta and Stiglitz, 1980; Dasgupta, 1986; Leininger, 1991), electoral competition (Snyder, 1989), entry and entry deterrence in oligopolistic competition (Tirole, 1988) and, more generally, contest theory (Dixit, 1987) and auction theory (Riley and Samuelson, 1981; Milgrom and Weber, 1982). Undoubtedly, these literatures inspired some of the ideas and models in the rent-seeking literature. The fruitfulness of applied game theory in the past twenty years, especially in different industrial organization contexts, has certainly been a major factor accounting for the ongoing 'second wave' of contributions to the theory of rent seeking which started in the eighties and on which the current survey focuses.

In the following section I introduce the basic rent-seeking contest and discuss the effect of asymmetry in rent seekers' characteristics, risk aversion and uncertainty of rents on the extent of rent dissipation. Section 3 presents six extensions of the basic contest. In the first extension the source of the rent is taken into account and incorporated into the contest. In the second extended contest the competitors are no longer individuals, but groups of individuals. In the third extension the contested rent is allowed to possess public good attributes. The possibility of a rent awarded by a committee is considered in the fourth extension. The fifth line of extension is concerned with dynamic contests. Finally, I consider two examples of multiple-rent contests. The survey concludes with a brief description of attempts to endogenize various components of the (basic and extended) rent-seeking contests.

2. The basic rent-seeking contest

Consider N agents confronting the opportunity of winning a prespecified fixed prize, the contestable rent, R. The outcome of this static, non-stratified, 'winner takes all' contest on a private-good rent is the assignment to each player, rent seeker i, of a probability that he wins the contest. If player i's effort level in units commensurate with the rent is x_i, then the probability that he wins the rent is $\pi_i(x_1, \ldots, x_N)$ where $\sum_{i=1}^{N} \pi_i(x) = 1$ and π_i is nondecreasing in x_i and nonincreasing in x_j, $j \neq i$. Assuming that agent i's payoff is given by his expected utility, V_i, the static rent-seeking game may possess Nash equilibria in pure or in mixed strategies. The rent-seeking literature is concerned with the existence and characterization of Nash equilibria and, in particular, with the relationship between total rent-seeking outlays in equilibrium and the value of the contested rent. The ratio D between these two values is called the extent of rent dissipation. This ratio is important for empirical applications since it can serve as a direct measure for inferring the value of the resources spent on the contested rent from its value.

When $x^*=(x_1^*, \ldots, x_N^*)$ is a Nash equilibrium in pure strategies, $D=\sum_{i=1}^{N} x_i^*/R$. When the outcome of the rent-seeking contest is a mixed strategy equilibrium, $D=\mathrm{E}(\sum_{i=1}^{N} x_i)/R$, where $\mathrm{E}(\sum_{i=1}^{N} x_i)$ is the expected total rent-seeking outlays given the players' equilibrium mixed strategies.

The analysis of the basic rent-seeking game depends on the assumptions made regarding the contest outcome functions, $\pi_i(x)$,[2] and the number and characteristics of the players, viz., their endowments, lobbying capabilities and preferences (attitudes towards risk, valuations of the rent and, in general, their utilities) which determine their strategy sets and their payoffs, V_i. Let us turn to some special cases starting with Tullock's (1980) rent-seeking contest.

2.1. *Symmetry and risk neutrality*

When the probabilistic contest outcome functions are symmetric and of the logit form, then

$$\pi_i(x)=\frac{f(x_i)}{\sum_{i=1}^{N} f(x_i)},$$

where f is an increasing function. This logit form is used for contest analysis by Baik and Shogren (1992), Dixit (1987), Gradstein (1991), Rosen (1986) and Snyder (1989). In his seminal contribution to the rent-seeking literature, Tullock (1980) made the special assumptions that $f(x_i)=x_i^r$, $r>0$ and that the identical rent seekers are risk neutral. In this case the payoff function of player i, V_i, is equal to his expected profit, that is,

$$V_i=\pi_i(x)R-x_i=\frac{x_i^r}{\sum_{j=1}^{N} x_j^r}R-x_i.$$

In this contest, if an interior Nash equilibrium in pure strategies exists, then the extent of rent dissipation is at most one as $D=r(N-1)/N$.[3] For recent comprehensive studies of Tullock's rent-seeking game see Cleeton (1989) and Perez-Castrillo and Verdier (1992). The extent of rent dissipation is increasing in the number of rent seekers and in the parameter r, the marginal return to lobbying outlays. This conclusion is generalizable to any symmetric

[2] These functions are also called the success probability, winning probability, contest success, or influence functions (see Potters and van Winden (1993)).

[3] Such equilibria exist if and only if $r \leq N/(N-1)$. Mixed-strategy Nash equilibria exist when $r>(N-1)/N$, but the possibility of over dissipation of rents – which was conjectured in the earlier literature – does not arise in equilibrium (see Baye et al. (1993b)).

contest[4] where π_i is of the logit form. Namely, the extent of rent dissipation is a decreasing function of the degree of concavity of $f(x_i)$ and an increasing function of the number of players (see Gradstein, 1991). The rent-seeking outlays are maximal when f is linear. In Tullock's game, when the returns from outlays made are constant, $r=1$, $D=(N-1)/N$. In this widely used model, apparently because of its greater analytical tractability, the rent is totally dissipated when the number of rent seekers is sufficiently large. However, in small-number contests the rent is not fully dissipated. In particular, in the minimal, two-player game, only half of the rent is dissipated.

In perfectly discriminating contests with symmetric valuations the rent is fully dissipated, even when the number of rent seekers is small (Hillman and Samet, 1987; Hirshleifer and Riley, 1978; Moulin, 1986). In such contests identical players are risk neutral and

$$\pi_i(x)=\begin{cases}1/m & x_i \text{ is one of the } m \text{ maximal elements in } x_1,\ldots,x_N,\\ 0 & \text{otherwise.}\end{cases}$$

That is, the contender making the highest outlay wins the prize with certainty. If several contenders make the highest outlay, they win the prize in equal probability. In perfectly discriminating rent-seeking contests which are, in fact, first-price all-pay auctions (Baye et al., 1993a), mixed strategy equilibria exist and in equilibrium the expected value of the rent-seeking outlays equals the common valuation of the rent R, i.e., $D=1$.

In perfectly and imperfectly discriminating basic contests complete rent dissipation is not to be expected due to three main reasons: the rent seekers are usually risk averse, the rent seekers are usually heterogeneous and contests are often characterized by additional uncertainty which goes beyond the uncertainty regarding the ultimate winner of the contested rent.

2.2. *Risk aversion*

When the identical rent seekers are risk averse, there exists $R^e<R$, such that the equilibrium of the rent-seeking game with risk-neutral players competing for the prize R^e is the same as the equilibrium of the contest with the risk-averse players competing for the prize R. Put differently, R^e is the risk-neutrality equivalent rent which makes each player choose the same equilibrium rent-seeking outlay under risk neutrality as in equilibrium under risk aversion. As expected, rent dissipation in the presence of risk aversion is

[4] In a symmetric contest the rent seekers are identical. In particular, rent valuations by all players are equal and $f_i(x_i)=f(x_i)$ for any i.

reduced relative to the case where the rent seekers are neutral. Risk aversion implies incomplete dissipation of the rent (Hillman and Katz, 1984; Hillman and Samet, 1987).

2.3. Asymmetry

Under complete information and heterogeneous valuations of the contested rent by risk neutral players, the extent of rent dissipation is reduced, Hillman and Riley (1989). In perfectly discriminating contests asymmetric valuation acts as a barrier to entry and only the two agents with the highest valuations contest the prize. Moreover, the player with the lower valuation is inhibited in his outlays by the awareness to the higher valuation of his rival. Asymmetric equilibria may imply higher dissipation of the rent relative to the symmetric equilibrium (Baye et al., 1990).

In Tullock's game with $r=1$, the value of the rent-seeking outlays made in equilibrium is $((N-1)/N)R^h$, where R^h is the harmonic mean of the players' valuations of the rent R. When the rent seekers have different endowments of wealth and/or different attitudes towards risk, there exist risk-neutrality equivalent rents, $R_1^e, R_2^e, \ldots, R_N^e < R$, such that rent dissipation is incomplete. Specifically, $D=R^{eh}(N-1)/RN$, where R^{eh} is the harmonic mean of the risk-neutrally equivalent rents (Nitzan, 1991a).

Asymmetry in individual lobbying capabilities yields similar results. The case of asymmetric cost structures in a two-player contest is analyzed in Paul and Wilhite (1990). Allard (1988) and Leininger (1993) study Tullock's game when players have different abilities to influence the probability of winning in their favor. Gradstein (1991) analyzes a contest with risk-neutral players assuming that

$$\pi_i(x)=\frac{a_i f(x_i)}{\sum_{j=1}^{N} a_j f(x_j)}$$

($a_j>0$, $\sum_{j=1}^{N} a_j=1$ and f is increasing, weakly concave and $f(0)=0$). Here a_i can be interpreted as player i's prior likelihood to win the contest. Gradstein shows that in a two-player contest the extent of rent dissipation is decreasing in the asymmetry between the players' lobbying strength. For $f(x_i)=x_i$, this result is generalized to n-player contests. Specifically, an equalizing spread in the distribution of the players' lobbying capabilities increases the equilibrium rent-seeking outlays.

2.4. Uncertain rents

In the various modelling of the rent-seeking contest mentioned so far, it

has been assumed that one of the rent seekers wins the rent R with certainty. But often this assumption is not satisfied because under certain circumstances the rent is uncertain in the sense that in some positive probability nobody wins it. If this type of uncertainty is allowed, the expected value of an awarded prize is less than R and, consequently, rent dissipation is clearly reduced. Kahana and Nitzan (1993) study a contest where such rent uncertainty is due to imperfect government credibility. Uncertainty about the ability to maintain the rent (a monopoly position) is considered in Jadlow (1985).[5] Other types of rent uncertainty are discussed in the sequel when I refer to extended contests that take into account the source of the rent and the possibility of rent-avoidance activities by third parties (e.g., consumer organizations) and the possibility of rent sharing (Ellingsen, 1991; Rama, 1993; Schmidt, 1992). See also Gradstein, Nitzan and Slutsky (1992) for a general discussion of the effect of uncertainty on interactive behavior.

In the basic rent-seeking contest the amount of the expended resources is increasing in the individual risk-neutrality equivalents of the rent and in the intensity of competition on the rent as measured by the number of competitions or by the degree of homogeneity in their characteristics. The extent of rent dissipation is therefore usually incomplete due to risk aversion and uncertainty about the award of the rent, or due to the existence of a small number of rent seekers or the asymmetry in the competitors' rent valuations, endowments, attitudes toward risk or lobbying effectiveness.

In extended contests there are other reasons for the incomplete dissipation of the rent. In the next section I discuss several such reasons that have to do with issues that so far have been disregarded. Specifically, these reasons relate to the source of the rent (whether it is internal or external to the contest); the nature of the competitors (whether the rent is contested by individuals or by groups of individuals); the nature of the rent (whether it is a private-good or a public-good rent); the nature of the agent setting the rent (whether the rent is set by an individual or by a committee) and the nature of the contest (whether it is static or dynamic and whether it is a single or a multiple-rent contest).

3. Extended contests

3.1. The source of the rent

In the basic rent-seeking contest the source of the fixed pre-existing rent is disregarded. When the source of the rent is internal, viz., some of the players

[5] Uncertainty concerning other contenders' valuations of the rent has been analyzed by Hillman and Riley (1989). They show that such uncertainty increases the dissipation of rents because it erodes the barrier to entry or inhibition on active participation in the contest.

losing the contest pay the rent, the contest is slightly altered becoming a basic transfer contest. A player facing the risk of paying part of the rent might be expected to expend resources not only in an attempt to win the transfer, but also in an attempt to avoid the loss. In general, we would expect transfer contests to be more wasteful. Somewhat surprisingly, in Tullock's symmetric version of the transfer contest with $r=1$, if the transfer is equally paid by the $N-1$ losers, then the value of the expenditures made in the attempt to win the contest equal the value of the transfer received by the winner (Appelbaum and Katz, 1986a). In the symmetric perfectly discriminating version of this transfer contest the resources expended by the players exceed the transfer (Hillman and Riley, 1989).

When the source of the rent is external, that is, the rent involves deadweight losses or transfer of resources by agents who do not participate in the basic contest, a plausible modelling of the situation requires an extension of the basic contest that takes into account the possible response of the affected parties. In Appelbaum and Katz (1986a) and Wenders (1987) rent-avoidance activities lead to an increase of the resources expended in the contest. In contrast, in the more general setting studied by Ellingsen (1991) and Schmidt (1992), rent defending activities by consumers may lead to underdissipation of the rent. In these extended rent-seeking contests, consumers' participation implies that the rent associated with the monopoly status cannot be taken for granted. This reduces the expected profit of the rent-seeking firms and, in turn, their expenditures. Furthermore, it turns out that total rent-seeking expenditures of both firms and consumers may also be reduced since, in equilibrium, consumers' lobbying efforts can be more than matched by the reduction in firms' lobbying efforts. For similar reasons Bhagwati (1982) characterizes lobbying activities as directly wasteful but as potentially 'indirectly' productive. Rama (1993) proposes a further extension of the rent-seeking contest by adding to the competing firms and consumers the workers (or trade unions) who attempt to win a share of the rent created by restrictive regulation.

3.2. The nature of the competitors

In the basic rent-seeking contest the rent is contested by individuals. But often the rent is sought by groups of individuals and in such a case the competition in the corresponding extended contest becomes a stratified competition: the competing groups consist of competing individuals, Farrell and Lander (1989). Modelling group rent seeking requires therefore the introduction of explicit assumptions regarding intra-group competition that supplement the assumptions on inter-group competition.

Consider the following natural extended stratified n-group rent-seeking

contest, Nitzan (1991a). The assumptions of the basic contest are adapted to the inter-group competition. Let $N(i)$ be the number of members in groups i, $i=1, \ldots, n$. The total number of players in the extended game is $N=\sum_{i=1}^{n} N(i)$. Each of these players decides voluntarily on the extent of his rent-seeking efforts, x_{ki}, $i=1, \ldots, n$, $k=1, \ldots, N(i)$. The effort made by group i is x_i, $x_i=\sum_{k=1}^{N(i)} x_{ki}$. The probability that group i wins the rent is $\pi_i(x_1, \ldots, x_n)$.[6] Finally, suppose that in every group a mixed rule is applied to distribute the rent among its members; a proportion a of the rent is distributed on an egalitarian basis and the rest is distributed on the basis of the principle 'to each according to his relative effort'.[7,8]

In the above group rent-seeking contest rent dissipation is usually reduced relative to the basic contest. This is due to two basic reasons. First, within the groups there are free-riding incentives. Second, the intensity of competition in an extended contest is, in general, lower than the intensity of competition in the basic contest because the number of competitors in the former case is smaller. For example, under Tullock's assumptions regarding π_i and with $r=1$ and identical risk-neutral players, the extent of rent dissipation is equal to

$$D=\frac{(1-a)N+na-1}{N}.$$

If the group applies the egalitarian distribution rule ($a=1$), $D=(n-1)/N<(N-1)/N$. When the rent is wholly distributed according to relative effort ($a=0$), $D=(N-1)/N$, as in Tullock's basic rent-seeking contest. Note that an implicit assumption of this extended model is that effort can be costlessly observed and rewarded. If this simplifying assumption is modified and such costs are explicitly introduced into the model, total rent-seeking outlays would tend to decline. In any event, the extent of rent dissipation is positively related to n, the number of contesting groups as long as $a>0$ and it is inversely related to a, the degree of egalitarianism in distributing the rent. However, the effect of the total number of rent seekers, N, is ambiguous.[9] As in the basic contest setting, asymmetry among rent seekers, risk aversion and rent uncertainty still tend to reduce the extent of rent dissipation.

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[6] Notice that if $n(i)=1$ for every i, $N=n$ and the extended game reduces to a basic contest.

[7] Two special cases of this extended group rent-seeking contest are analyzed in Lee (1993a) and Baik (1993). The former study focuses on a two-group contest assuming that $a=1$. The contest analyzed in the latter study is equivalent to a $[(N-m)+1]$-group contest with $(N-m)$ single-member groups and one m-member group. See also Paul and Wilhite (1991).

[8] When different groups apply different sharing rules, the extended game need not have an equilibrium, see Nitzan (1991b).

[9] $\partial D/\partial N \geq 0 \Leftrightarrow a \leq 1/n$.

3.3. The nature of the rent

In group contests over a perfectly divisible private-good rent, free-riding incentives and the fact that the number of competing groups, n, is usually smaller than the number of individual rent seekers, N, tend to reduce the individual players' rent-seeking efforts. These considerations are also relevant when the group contest is over a public-good rent (e.g., a publicly funded park, pollution removal by a local authority from one of the locations under its jurisdiction, etc.) which costs R dollars (Katz et al., 1990; Ursprung, 1990).[10] When the contested rent has public good attributes there are other considerations that may explain underdissipation of the rent. In particular, when the group contest is over a pure public-good rent, i.e., there is a perfect non-excludability and perfect non-rivalness in the consumption of the rent within the group winning the contest, the free-riding incentives are maximal since, by definition, the public good is wholly and equally consumed by all members of the winning group. On the other hand, the pure publicness of the rent implies that the rent is not shared as in the group contest over the private-good rent. This induces the individual players to increase their rent-seeking efforts. It turns out that under Tullock's assumptions with $r=1$, the negative free-riding incentives within the groups just counterbalance the positive 'rent size' effect. Assuming that all players value the public good rent at αR dollars, $0<\alpha<1$, in such a case total rent-seeking outlays are equal to $(n-1)\alpha R/n$. That is, the value of the resources expended in the contest is smaller than the value of the public good to a single individual. Clearly, rent-seeking efforts tend to be very small relative to the aggregate value of the contested public-good rent (see Katz et al., 1990) and Ursprung (1990) for a discussion of a number of other issues that arise in a contest over a public-good rent).

3.4. The nature of the rent setter

In the basic rent-seeking contest it has been implicitly assumed that the award of the rent is to be made by a single agent who is typically an administrator or a politician. However, the decision of awarding the rent is often made by a committee and not by an individual rent setter. In such a case the rent seekers would try to affect the deliberations of the committee by expending resources that are distributed among the committee members. Modelling an extended rent-seeking contest with committee decisions on the award of the rent requires explicit assumptions regarding the characteristics

[10] Rent seeking for public goods is also studied in Magee et al. (1989) using a model with competing interest groups that do not interact strategically. See also Varian (1989).

of the committee and, in particular, the number of the committee members and the decision rule that they use. Congleton (1984) studies a stylized two-person, committee-directed, rent-seeking contest assuming that the committee consists of three homogeneous members who apply a simple majority rule. He examines the effect of committee versus one-man administration in a perfectly discriminating contest and in Tullock's rent-seeking contest. His main argument is that in both cases relatively smaller efforts tend to be invested to influence the deliberations of committees than those of single administrators. Two reasons account for this tendency. First, since more people have to be influenced under committee administration, the participation threshold is greater and thus more prohibitive. Second, the absence of stable majority coalitions in the committee allows the rent seekers to economize on efforts devoted to influencing the committee deliberations by targeting alternative majority coalitions. This interesting claim needs, however, to be formally demonstrated in both contexts explored by Congleton (1984). The analysis of more general extended committee-directed rent-seeking contests certainly deserves further careful attention.

3.5. The nature of the contest

The rent-seeking contests considered so far have been modelled as static non-cooperative games in normal form in which the rent seekers move simultaneously. The analysis of these contests resorted exclusively to the Nash equilibrium solution concept. But in the political-economic reality rent seeking often has a dynamic nature. The challenge of extending the static rent-seeking contest to a dynamic one was undertaken by Baik and Shogren (1992), Leininger (1993), Leininger and Yang (1992) and Yang (1991).[11] These studies demonstrate that in a dynamic setting the extent of rent dissipation is reduced relative to the outcome in the corresponding static rent-seeking contest.

Leininger and Yang (1992) analyze a two-player dynamic rent-seeking contest with finite or infinite alternating bids. The contest outcome functions are assumed to be of Tullock's type. In the infinite-move game, which is considered as the more appropriate model, threats and counter-threats in a tit-for-tat subgame perfect equilibrium make implicit collusion possible. This implies a reduction in the extent of wasteful rent-seeking efforts relative to the static contest.

Baik and Shogren (1992) and Leininger (1993) study a two-player, two-stage contest in which a player's strategy consists of two components: the timing of his move (making his rent-seeking outlay early or late) and his

[11] See also Cairns (1989), Stephan (1993) and Wirl (1991).

rent-seeking effort. In the first stage of the game the players simultaneously decide whether to move early or late.[12] If both players make the same timing decision, the rent-seeking contest is played with simultaneous moves. If the players make different timing decisions, the game is played sequentially. When the contest outcome functions are of the logit form, there is a unique subgame perfect equilibrium in which the weaker player (the player with the lower valuation of the rent and/or the lower lobbying effectiveness) moves first. Total rent-seeking expenditures are smaller than those of the Nash equilibrium of the static (simultaneous move) contest.[13,14]

3.6. Multiple-rent contests

The rent-seeking literature is typically concerned with contests (basic or extended) over a single prespecified rent. The study of multiple-rent contests has hardly begun. I conclude this section by pointing to two preliminary attempts of modelling multi-rent contests. In the first case the same players are assumed to simultaneously confront several fixed rents. In the second case the assignment of a single rent is assumed to give rise to a multi-tiered rent-seeking contest.

Gradstein and Nitzan (1989) analyze a stylized game of competitive allocation of fixed resources by N identical players on m prespecified relatively high (advantageous) indivisible rents. In this so called advantageous multiple rent seeking game the contest outcome functions are assumed to be perfectly discriminating. The game can be interpreted therefore as a generalized first-prize all-pay auction. It turns out that in this multi-rent contest rent seekers concentrate their resources on single objects. This occurs regardless of whether the prizes are equally or differently valued by the players. The equilibrium ratio between the number of players concentrating on any two prizes approximates the ratio between their respective values.

Hillman and Katz (1987) explore the possibility of a single rent that, in a

[12] The first stage can be interpreted as an announcement stage, Hamilton and Slutsky (1990).

[13] Tullock (1980, 1985) argues that the assumption of simultaneous moves is justified since the players have an incentive to be first movers. Leininger (1993) challenges this argument by pointing to his finding that, in the endogenously determined order of moves, the players do not compete for the first move, that is, they agree on a particular sequential order which makes the weaker player the leader in the game.

[14] Wirl (1991) studies a two-player infinite-horizon game of lobbying. His lobbying game, which is not a contest as defined herein, is modelled as a differential game and its subgame perfect equilibrium in linear feedback strategies is shown to yield rent-seeking efforts which are considerably smaller than the expenditures associated with an open-loop equilibrium. A finite-horizon contest over a prize awarded at the final stage of the game in which only open-loop strategies are allowed is studied in Waldow (1989).

first stage, may give rise to two contests, one for the rent itself, and another to designate the bureaucrat who is to become the beneficiary of part of the resources expended in the course of the contest over the initial rent. A further contest is formed if part of the resources expended in the second contest also become a prize to be contested. And so the process continues. This finite sequence of contests is analyzed assuming that in each contest the probabilistic outcome function is of Tullock's type with $r=1$. The analysis focuses on the relationship between the value of the rent, the transfers (bribes) made in the course of this multi-rent contest and the value of real resources expended in rent seeking.

4. Endogenous contests

Given my space constraint, the description of the efforts to endogenize the components of the rent-seeking contest will be brief. This part of my review is organized in accordance with the sequence of contests as introduced in the preceding sections. The implications of endogenous contests on the extent of rent dissipation will be only very briefly highlighted.

The early analysis of the basic rent-seeking contest led researchers to try to endogenize the number of participants in the contest. This task was initially undertaken by allowing free entry into the contest (long-term competition). In Tullock's version of the basic rent-seeking contest with identical risk-neutral players and $r=1$, the introduction of free entry results in complete dissipation of the rent (Corcoran, 1984; Corcoran and Karels, 1985; Perez-Castrillo and Verdier, 1992; Tullock, 1984).[15] Exploring an alternative two-player contest, Higgins et al. (1985) established a similar result. In their setting there exists a symmetric mixed strategy equilibrium in which the rent is expectationally dissipated. Hillman and Riley (1989) derive the rule limiting entry to Tullock's type contest with $r=1$ and asymmetric rent valuations. They show that the number of agents actively participating in the contest is small, unless valuations of the rent are very similar. This implies that, in general, rent dissipation will be incomplete. Similarly, in a perfectly discriminating contest with asymmetric valuations of the rent, free entry into the contest does not imply a large number of contenders. Again, asymmetric valuations act as a barrier to entry and, in turn, reduce the extent of rent dissipation. A different approach is proposed by Michaels (1988) who studies a version of Tullock's basic contest with entrance fees. His focus is on the number of rent seekers which is optimal from the rent setter's (the politician's) point of view. Other attempts to endogenize the number of rent

[15] The effect of changes in the value of the rent and in the entry fee on the number of rent seekers is studied in Appelbaum and Katz (1986b).

seekers in extended contests in which the source of the rent is taken into account and in extended two-stage contests with strategic entry deterrence can be found in Appelbaum and Katz (1986c), Gradstein (1991) and Baye, Kovenock and de Vries (1993a). In the two-stage contest analyzed in the latter study, given a set of potentially active rent seekers, the politician determines in the first stage of the game the subset of rent seekers actually participating in the contest. In the second stage of the game, a first-price all-pay auction determines the outcome of the contest. It turns out that the politician has an incentive to preclude from participation in the contest the potential rent seekers most valuing the rent. This interesting finding means that in this context rent dissipation is, again, incomplete.

Endogenization of other parameters of the basic rent-seeking contest is in its infancy stage. See, however, Glazer (1993), Michaels (1988) and Kahana and Nitzan (1993) that contain preliminary attempts to endogenize, respectively, the contest outcome function, the parameter r of Tullock's logit contest outcome function and the duration of the contest. The common feature of the above studies is that they all view the relevant parameter as a control variable determined by a politician who maximizes his wealth and, therefore, the total rent-seeking expenditures.[16]

More efforts have been directed to the endogenization of the contested rent. Appelbaum and Katz (1986c) study a three-player game where the rent setter (a regulator offering a rent to firms) is himself a rent seeker (seeking the support of consumers–voters). In their extended contest the value of the rent is determined endogenously.

Gradstein (1993a) studies two alternative extended contests with endogenously determined rents. In the static version, the basic contest is supplemented with an exogenous function relating (positively) the value of the rent to the rent seekers' efforts. In the second sequential version of the extended contest, the rent setter (the government) becomes a player who sets the value of the contested rent in the first stage of the game. In the context of two different extended two-group contests over a public-good rent, Ursprung (1990) and Riaz et al. (1991) endogenize the contested rent, or more precisely, the rent seekers' valuations of the rent.[17] Notice that when the rent is variable, the extent of rent dissipation is only a partial and, in general, unsatisfactory measure of the efficiency implications of rent seeking, even when no deadweight losses are associated with the rent.

Recently, several attempts have been made to endogenize group formation and group sharing rules in extended group rent-seeking contests over a

[16] See also Guttman, Nitzan and Spiegel (1992) for a study of the possibility of endogenizing the rent seekers' altruistic utilities.

[17] Ursprung's (1990) contest is more general as he endogenizes the rent seekers' valuations by embedding the extended rent-seeking contest into a spatial model of candidate competition.

private-good rent. The endogenization of group formation is based on the introduction of long-run inter-group mobility (Lee, 1992; Nitzan, 1991a). Alternative modes of endogenous determination of sharing rules are discussed in Nitzan (1991a), Lee (1993) and Baik (1993). The long-run intra-group sharing rule can be extremely egalitarian, based only on individual efforts or indeterminate, depending on whether it is set by a central planner or by the rent seekers. Of course, in the former case the nature of the sharing rule depends on the objective function of the planner and in the second case it depends on the assumptions made on the mechanism applied by the individuals to determine the sharing rule.

The endogenous determination of the order of moves in a two-player two-stage rent-seeking contest was already discussed in the preceding section. Baik and Shogren (1992) and Leininger (1993) are, so far, the only studies concerned with endogenizing elements of dynamic rent-seeking contests.

Let me finally turn to the challenge of endogenizing multiple-rent contests. Politically contestable rents may take the form of individual private-good transfers, group private-good transfers or group public-good transfers. The determination of governmental transfer patterns is a complex process and the question is can the theory of (endogenous) rent seeking shed some light on it. One possible approach is to view the transfer pattern as a variable which is under the control of an optimizing politician. Adopting this approach, Nitzan (1993) explores the possibility of specialization in the 'provision of transfers' and derives the relationship between the parameters of the extended multiple-rent contest and the preferred kind of transfer. The parameters of the model are the distribution of potential rent seekers across groups, the sharing rule used within groups to distribute the private-good transfers and the relative value of a dollar spent on the provision of a (local) public good.

5. Concluding remarks

I have confined my attention in the current work to alternative modelling of rent-seeking contests. My primary concern has been with the question how do different contests affect the extent of rent dissipation.[18] The difference between contests can be in terms of the value of the parameters of the same type of contest or in terms of the underlying contest characteristics.

[18] The broader efficiency implications of rent seeking, especially in a general equilibrium political-economic setting, and their implications in terms of evaluating alternative forms of government intervention are beyond the scope of the current review. For an interesting evaluation of governmental provision of public goods in the presence of rent seeking (see Gradstein (1993b)).

The last part of the paper is devoted to the important and intriguing question how are rent-seeking contests determined. Namely, how are they affected by the interaction among potential rent seekers and rent setters as well as any other affected agents who all operate in some given political-economic environment. Whereas the study of questions about the nature of contest equilibria seems to have reached an advanced stage, the analysis of equilibrium or endogenous contests has reached only a very preliminary and inadequate stage of development. Future progress in this direction will constitute a significant contribution to the theory of rent seeking, public choice and, more generally, to political economy.

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