Behavioral Dimensions of Contests

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Abstract

The standard theoretical description of rent-seeking contests is that of *rational* individuals or groups engaging in socially inefficient behavior by exerting costly effort. Experimental studies find that the actual efforts of participants are significantly higher than predicted in the models based on rational behavior and that over-dissipation of rents (or overbidding or over-expenditure of resources) can occur. Although over-dissipation cannot be explained by the standard rational-behavior theory, it can be explained by incorporating behavioral dimensions into the standard model, such as (1) the utility of winning, (2) relative payoff maximization, (3) bounded rationality, and (4) judgmental biases. These explanations are not exhaustive but provide a coherent picture of important behavioral dimensions to be considered when studying rent-seeking behavior in theory and in practice.

Keywords: rent-seeking, contests, experiments, overbidding, over-dissipation

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1. Introduction

The variety of economic and political contests that can be described as rent seeking has attracted attention from economic theorists and applied economists (see the papers in Congleton, Hillman, and Konrad 2008a, 2008b). Rent seeking describes socially inefficient but personally profitable behavior (Tullock 1967; Krueger 1974). People can engage in productive behavior (creating income and wealth) and unproductive behavior (such as contesting for already existing resources). The unproductive behavior is known as rent seeking. The two most commonly used models to describe rent seeking are the probabilistic contests of Tullock (1980) and the all-pay auction (Dasgupta 1986; Hillman and Samet 1987; Hillman and Riley 1989). The models provide many important theoretical results (see for example the overview by Long 2013).

The rent-seeking contest models have been extensively tested in controlled laboratory settings (for a comprehensive review of this literature see Dechenaux, Kovenock, and Sheremeta 2014). Most laboratory studies find support for the comparative statics predictions of the theory of rent-seeking contests. However, the studies also uncover important behavioral phenomena not predicted by the rational-behavior theory. One of such phenomena is over-dissipation of rents (Sheremeta 2013). This phenomenon is also known as overbidding or over-expenditures of resources. Participants in laboratory experiments exert effort significantly higher than predicted by the standard Nash equilibrium.

The standard rational-behavior theory cannot explain over-dissipation, but it can be explained by incorporating behavioral dimensions into the standard model, such as (1) the utility of winning, (2) relative payoff maximization, (3) bounded rationality, and (4) judgmental biases. This chapter describes these behavioral dimensions of contests in detail. Attention is restricted mostly to rent-seeking contests of the Tullock (1980) type, since such contests have attracted most attention from experimental researchers (Dechenaux, Kovenock, and Sheremeta, 2014) and the over-dissipation phenomenon for these contests has been extensively explored (Sheremeta 2013).

I begin by introducing a standard theoretical contest model. Then, I provide a short overview of experimental literature on rent-seeking contests and discuss the over-dissipation phenomenon. Then, in order to explain over-dissipation, the theory of contests is extended to the behavioral dimensions of the utility of winning, relative payoff maximization, bounded rationality, and judgmental biases. I conclude by suggesting directions for future research and discussing potential mechanisms that can reduce over-dissipation.

2. The standard theoretical contest model

Perhaps the simplest model of rent-seeking is a lottery contest model proposed by Tullock (1980). In such a contest, there are n identical risk-neutral individuals competing for a prize value of v. The probability that individual i wins the prize depends on individual i's effort e_i and the efforts of all other individuals. Specifically, individual i's probability of winning the prize is defined by a contest success function (Skaperdas 1996):

$$p_i(e_i, e_{-i}) = \frac{e_i}{\sum_{j=1}^{n} e_j}. \tag{1}$$

Given (1), the expected payoff for individual i is equal to the expected benefit, i.e., the probability of winning the prize $p_i(e_i, e_{-i})$ times the prize value v, minus the cost of effort, i.e., $c(e_i) = e_i$. That is

$$\pi_i(e_i, e_{-i}) = p_i(e_i, e_{-i})v - e_i. \tag{2}$$

Differentiating (2) with respect to e_i and accounting for the symmetric Nash equilibrium leads to an equilibrium effort:

$$e^* = \frac{(n-1)}{n^2} v. \tag{3}$$

There are no asymmetric equilibria in the lottery contest and the symmetric equilibrium (3) is unique (Szidarovszky and Okuguchi 1997).[1] Therefore, each individual has an equal probability of winning in equilibrium, i.e., $p(e^*) = 1/n$. The equilibrium expected payoff can be calculated by substituting (3) into (2), which gives

$$\pi(e^*) = \frac{1}{n^2} v. \tag{4}$$

The dissipation rate, measured as a ratio of the total expenditures ne^* to the value of the prize v, is

$$d(e^*) = \frac{(n-1)}{n}. \tag{5}$$

The economic intuition behind this model is straightforward. A higher value of prize v implies higher equilibrium effort e^*, i.e., $\partial e^*/\partial v > 0$, and a higher payoff $\pi(e^*)$, i.e. $\partial \pi(e^*)/\partial v > 0$. On the other hand, a higher number of competitors n implies lower equilibrium effort e^*, i.e., $\partial e^*/\partial n < 0$ (due to so-called "discouragement effect"), and lower payoff $\pi(e^*)$, i.e., $\partial \pi(e^*)/\partial n < 0$.[2]

The classic formulation of a Tullock contest demonstrates the tension between the socially optimal and the individually rational behavior. The socially optimal level of effort is zero. In such a case, no effort is wasted, i.e., $e = 0$, and all individuals have equal probability of winning, i.e., $p(e) = 1/n$. The expected payoff is $\pi(e) = v/n$ and the dissipation rate is $d(e) = 0$. However, in equilibrium, the rational economic agent engages in an unproductive competition by exerting costly effort, i.e., $e^* = (n-1)v/n^2$, thus causing rent dissipation, i.e., $d(e^*) =$

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[1] Multiple equilibria may arise if one formally introduces behavioral spillover (Chowdhury and Sheremeta 2011a, 2011b, 2014) or risk preferences (Cornes and Hartley 2012)

[2] Theoretically, the "discouragement effect" arises because, when facing a stronger individual (or more individuals), a weaker individual cuts back on his costly expenditures (Baik 1994; Gradstein 1995; Stein 2002). The "discouragement effect" has been well documented by numerous experimental studies (Fonseca 2009; Anderson and Freeborn 2010; Deck and Sheremeta 2012; Kimbrough, Sheremeta, and Shields 2014).

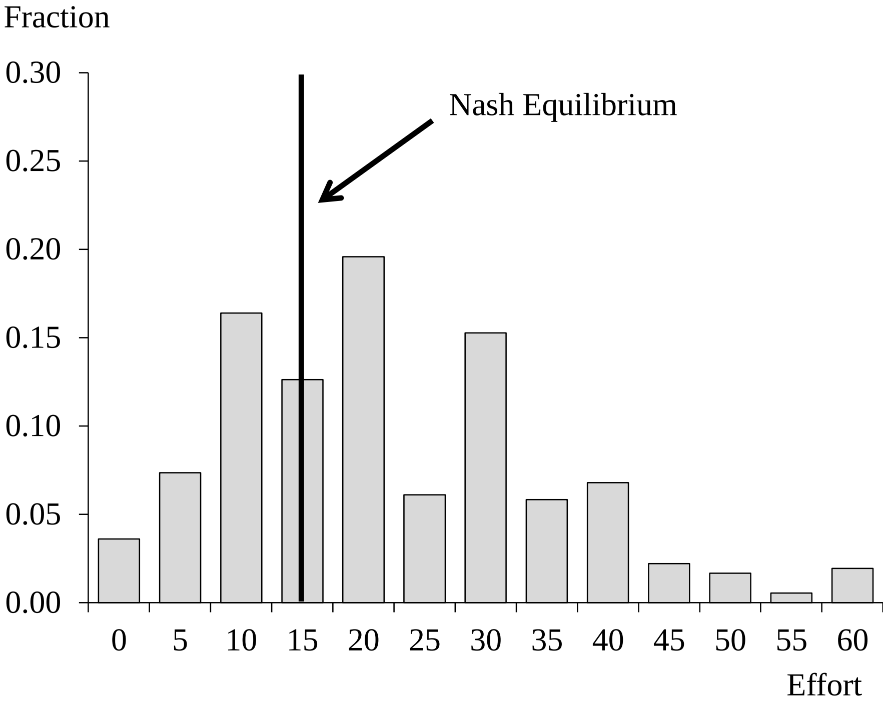
$(n-1)/n$. Each individual earns a positive expected payoff, i.e., $\pi(e^*) = v/n^2$, and, as in the socially optimal case of no effort, all individuals have equal probability of winning, i.e., $p(e^*) = 1/n$.

3. Experimental findings on contests

Millner and Pratt (1989) were the first to examine a lottery contest using a laboratory experiment. In their experiment, participants were placed in groups of two, i.e., $n = 2$, and group composition changed from period to period. In each period, participants could submit their bids (efforts) in order to win a prize of \$8, i.e., $v = 8$. Given these parameters, the unique equilibrium effort is \$2, i.e., $e^* = v(n-1)/n^2 = 2$, the expected payoff is \$2, i.e., $\pi(e^*) = v/n^2 = 2$, and the dissipation rate is 0.5, i.e., $d(e^*) = (n-1)/n$ = 0.5. The results of the experiment showed the actual average effort of \$2.24 and the dissipation rate of 0.56 as significantly higher than predicted. The magnitude of over-dissipation was about 12%.

Since Millner and Pratt (1989), many other experiments have replicated the phenomenon of over-dissipation (for a review see Dechenaux, Kovenock, and Sheremeta 2014). Based on a sample of 30 contest experiments examined by Sheremeta (2013), the median over-dissipation rate is 72%. The magnitude of over-dissipation in some studies is so high that on average participants receive negative payoffs (Sheremeta and Zhang 2010; Price and Sheremeta 2011, 2014; Chowdhury, Turocy, and Sheremeta 2014; Mago, Samak, and Sheremeta 2014). Figure 1 shows a typical distribution of effort in lottery contests. The data are taken from Sheremeta (2011), where $n = 2$ individuals compete for a prize of v = 60. According to the theoretical prediction, the equilibrium effort is 15. Nevertheless, most participants exert effort that is significantly higher than predicted, with average over-dissipation of about 31%.

Figure 1: Distribution of efforts



Note: The data are taken from Sheremeta (2011).

Why do participants over-dissipate relative to the standard Nash equilibrium prediction? In the next section, I extend the theory of contests to behavioral dimensions to explain the phenomenon of over-dissipation.

4. Behavioral dimensions of contests

4.1 Utility of Winning

The standard theoretical contest model is based on the assumption that individuals care only about the monetary value of the prize, i.e., v. However, participants in actual contests also may care about winning itself. One way to incorporate the utility of winning into a contest model is to assume that, in addition to the prize value v, individuals also have an additive non-monetary utility of winning w (Sheremeta 2010). Therefore, the updated expected payoff of individual i can be written as

$$\pi_i^w(e_i, e_{-i}) = p_i(e_i, e_{-i})(v + w) - e_i. \tag{6}$$

Differentiating (6) with respect to e_i and accounting for the symmetric Nash equilibrium gives a new equilibrium effort, which is a function of both a monetary value v and a non-monetary value w:

$$e_w^* = \frac{(n-1)}{n^2}(v + w). \tag{7}$$

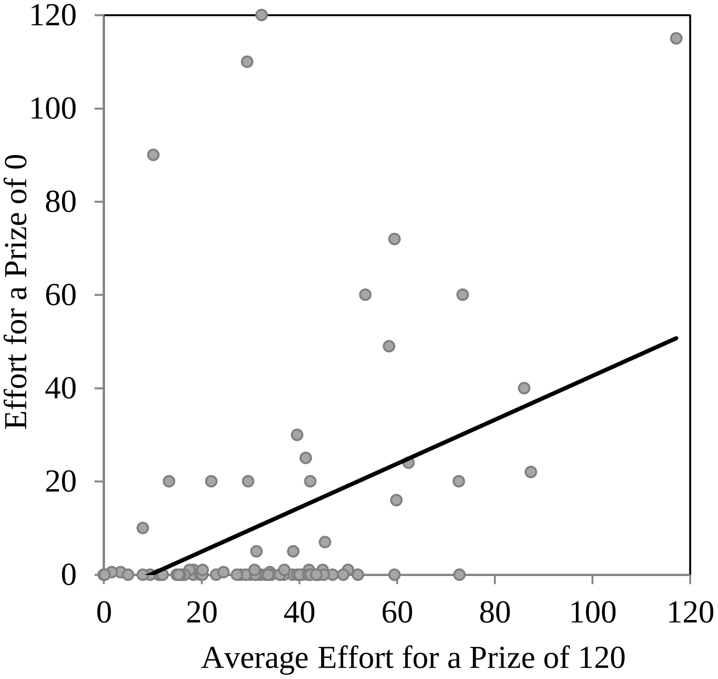
The corresponding dissipation rate is

$$d(e_w^*) = \frac{(n-1)}{n}\frac{(v+w)}{v}. \tag{8}$$

It is easy to verify that the new equilibrium effort (7) increases in the non-monetary utility of winning w, i.e., $\partial e_w^*/\partial w > 0$. Moreover, for any $w > 0$, the dissipation rate $d(e_w^*)$ described by (8) is higher than the standard dissipation rate $d(e^*)$ described by (5). Therefore, if, in addition to the prize value v, individuals indeed have a non-monetary utility of winning w, we should observe over-dissipation in rent-seeking contests.

Although the utility of winning is an appealing behavioral explanation for the over-dissipation phenomenon, it is not trivial to test whether economic agents indeed have such utility. In Sheremeta (2010), I designed a method to elicit the utility of winning by having individuals participate in the contest with a monetary prize and then in the contest with no prize. The results of the experiment showed that individuals who exert significant effort just to be recognized as winners also behave overly competitive in the contest with the monetary prize. In the experiment, students participated in 30 periods of play in a four-individual contest, i.e., $n = 4$, with a prize value of 120, i.e., $v = 120$. At the end of the experiment, participants were asked to submit their efforts for a prize value of 0, i.e., $v = 0$. Participants were explicitly told that they would have to pay for their effort and that they would not receive any monetary benefit in case they won. If participants value only monetary payoffs, they should not exert any effort when the monetary prize value is zero. However, if participants derive utility from winning, they may choose to exert positive effort even when there is no monetary prize.

Figure 2: Utility of Winning.



Note: The data are taken from Sheremeta (2010).

I found that more than 40% of economically motivated participants exerted positive effort in the contest with a prize value of zero. Moreover, effort in a contest with a zero prize was correlated with effort in contests with a strictly positive prize. Figure 2 displays the correlation between an effort for a prize of $v = 0$ and an average (over 30 periods of play) effort for a prize of $v = 120$. According to the theoretical prediction (3), the equilibrium effort is 22.5 when the prize is 120 and 0 when the prize is 0. Figure 2 shows that there is substantial heterogeneity in effort, and participants who exert higher effort for the prize of 0 also exert higher effort for the prize of 120 (Spearman's correlation coefficient is 0.31, p-value < 0.01). Therefore, it appears that, in addition to monetary utility, many participants derive non-monetary utility of winning and such utility can partially explain over-dissipation in rent-seeking contests.

The findings in Sheremeta (2010) have been replicated by other studies (Price and Sheremeta 2011, 2014; Cason, Masters, and Sheremeta 2013; Brookins and Ryvkin 2014; Mago, Samak, and Sheremeta 2014). This suggests that the utility of winning is a robust behavioral regularity that should be incorporated into theoretical models of rent-seeking. However, the exact specification of the utility of winning is still an open question. For example, it is possible that the utility of winning is not additive and is not invariant to the value of the monetary prize v, in which case, the correct specification of the utility of winning would be $w = w(v)$. It is also possible that the utility of winning may depend on the number of contestants n, in which case, the correct specification of the utility of winning would be $w = w(n)$. Disregarding the exact functional form, the utility of winning is an important behavioral factor that can help explain over-dissipation.

4.2. Relative payoff maximization

Related to the utility of winning, studies show that over-dissipation may be driven by spiteful preferences and relative payoff maximization (Fonseca 2009; Cason, Masters, and Sheremeta 2013; Eisenkopf and Teyssier 2013; Mago, Samak, and Sheremeta 2014). In Mago et al. (2014), co-authors and I propose a theoretical model in which individuals care not only about the utility of winning w but also about the weighted average payoff of other group members. In such a case, the expected utility of individual i can be written as

$$U_i(e_i, e_{-i}) = \pi_i^w(e_i, e_{-i}) + s\frac{1}{n}\sum_j \pi_j^w(e_j, e_{-j}), \tag{9}$$

where s is a relative payoff parameter representing a measure of how individuals weigh their payoffs relative to others: $s > 0$ reflects preferences of pro-social individuals seeking to increase the payoff of others, while $s < 0$ reflects preferences of status-seeking individuals striving to obtain a higher relative payoff than others. The exact origin of the relative payoff parameter s is ambiguous. First, it may be the case that individuals simply have other-regarding preferences (Fehr and Schmidt 1999). Second, evolutionary game theory would argue that individuals care about their "survival" payoff (Leininger 2003; Hehenkamp, Leininger, and Possajennikov 2004; Riechmann 2007). Finally, the quest to seek higher expected payoffs than others is also consistent with the 'spite effect' (Hamilton 1970) and status (Congleton 1989). Despite the origin of the relative payoff maximization, there is substantial research indicating that individuals care about their payoff relative to others in the group (Frey and Stutzer 2002)

Differentiating (9) with respect to e_i and accounting for the symmetric Nash equilibrium gives the equilibrium effort

$$e_{ws}^* = \frac{(n-1)}{n(n-s)}(v + w). \tag{10}$$

The corresponding dissipation rate is

$$d(e_{ws}^*) = \frac{(n-1)}{(n-s)}\frac{(v+w)}{v}. \tag{11}$$

It is easy to verify that the equilibrium effort (10) increases in the utility of winning w, i.e., $\partial e_{ws}^*/\partial w > 0$, and increases in the relative payoff parameter s, i.e., $\partial e_{ws}^*/\partial s > 0$. Moreover, for $w > 0$ and $s > 0$, the dissipation rate $d(e_{ws}^*)$ described by (11) is higher than the standard dissipation rate $d(e^*)$ described by (5).

In Mago et al. (2014), we found that 51% of participants have positive utility of winning, i.e., $w > 0$, replicating the findings in Sheremeta (2010). Moreover, we found that 67% of participants behave as status-seekers, i.e., $s > 0$. These findings suggest that over-dissipation in contests can be explained by a combination of a utility of winning and relative payoff maximization.

4.3 Bounded rationality

The two explanations discussed so far are based on the behavioral facts that individuals participating in contests care about winning itself (w) and their relative payoffs (s). Another well document behavioral fact is that people are prone to mistakes and, instead of behaving rationally, use bounded rationality (Camerer 2003).

One way to introduce bounded rationality into a contest model is to assume that participants make mistakes, which adds noise to the Nash equilibrium solution. McKelvey and Palfrey (1995) suggested an elegant method of incorporating mistakes into strategic environments, naming the corresponding solution a quantal response equilibrium (QRE). In the Nash equilibrium (3), each individual plays a pure strategy e^*, given that others are playing the equilibrium strategy e^*. In the QRE, each individual plays a mixed strategy σ^* in which the probability of playing a pure strategy e is increasing in the expected payoff $\pi(e, \sigma^*)$ of that strategy, given that others are playing the equilibrium mixed strategy σ^*. The most commonly used specification of the QRE is the logistic QRE, where the equilibrium probability of choosing e is given by:

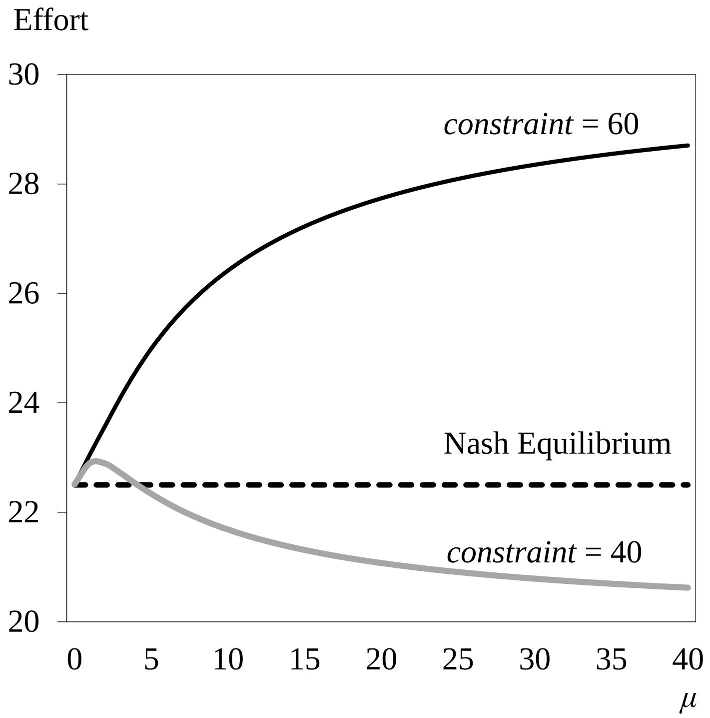
$$\sigma^*(e) = \frac{\exp(\pi(e,\sigma^*)/\mu)}{\int_x \exp(\pi(x,\sigma^*)/\mu)}, \tag{12}$$

where $\mu > 0$ is an error parameter describing the level of noise in the decision making process. If $\mu \rightarrow 0$, then the Nash equilibrium effort e^* is chosen with probability one, i.e., $\sigma^*(e^*) = 1$. If $\mu \rightarrow \infty$, then each effort e between 0 and the maximum allowed effort level is equally likely to be chosen.

One implication of the QRE is that, if individuals are unconstrained and are allowed to exert any effort between 0 and the value of the prize v, then any level of mistakes, i.e., $\mu > 0$, will lead to over-dissipation (Sheremeta 2011; Chowdhury, Turocy, and Sheremeta 2014; Lim, Matros, and Turocy 2014). The intuition is simple. Consider an individual who is completely confused and does not understand the rules of the game, i.e., $\mu \rightarrow \infty$. According to the QRE, such an individual will make his or her decision by randomly choosing any effort level e between 0 and the value of the prize v. Therefore, such an individual on average will exert an effort of $v/2$, which is higher than the Nash equilibrium effort $e^* = v(n-1)/n^2$, for any $n \geq 2$.

In Sheremeta (2011), I explicitly tested the predictions of the QRE model by conducting two experimental treatments. In each treatment, four participants, i.e., $n = 4$, competed in a lottery contest for a prize value of $v = 120$. In one treatment, participants were constrained to choose their efforts between 0 and 60 and in the other treatment participants were constrained to choose their efforts between 0 and 40. Constraining participants to choose their efforts not higher than either 60 or 40 is not binding relative to the Nash equilibrium of 22.5, i.e., $e^* = v(n-1)/n^2 = 22.5$. Figure 3 displays the expected average effort at the QRE as a function of μ and *constraint*. When $\mu \rightarrow 0$, the behavior is consistent with the Nash equilibrium. When $\mu \rightarrow \infty$, individuals move closer to a random play, and thus the average effort approaches 30 (over-dissipation) for the constraint of 60 and it approaches 20 (under-dissipation) for the constraint of 40. Therefore, if participants make substantial levels of mistakes, then the average effort should be significantly higher in the treatment with the constraint of 60. I found that the actual average effort is 29.3 when the constraint is 60 and it is 21.0 when the constraint is 40, consistent with the predictions of the QRE.

Figure 3: Expected average effort at the QRE



The findings in Sheremeta (2011) suggest that participants indeed make mistakes when participating in rent-seeking contests and the mistakes can explain over-dissipation. There are two potential explanations as to why participants make mistakes. First, it is possible that participants hold incorrect beliefs about the actions chosen by their opponents. Second, participants may simply make errors in their own actions. The first explanation is less likely to be true. The main reason is that the best-response functions in lottery contests are structured in such a way that if a participant believes that the opponent is going to either make higher or lower than equilibrium effort, his best response is to always exert lower than the equilibrium effort.

4.4 Judgmental biases

It is well documented in the behavioral economics literature that people not only make random mistakes (as in the case of the QRE), but they also exhibit systematic "judgmental biases" (Camerer et al. 2011), which can explain behavior in rent-seeking contests (Baharad and Nitzan 2008; Sheremeta and Zhang 2010; Chowdhury, Turocy, and Sheremeta 2014; Price and Sheremeta 2014).

Baharad and Nitzan (2008) apply the idea of a distorted probability weighting function from the "prospect theory" of Kahneman and Tversky (1979) to prove that over-dissipation of rents is theoretically possible. Following Tversky and Kahneman (1992), they assume that individuals assign a distorted (biased) inverse S-shaped probability weighting function $b(p)$ to the objective probability p. Thus, instead of contest success function (1), the individual's perceived probability of winning is given by

$$b(p) = \frac{p^{\beta}}{(p^{\beta}+(1-p)^{\beta})^{1/\beta}}. \tag{13}$$

Given the distortion function (13), the expected payoff for an individual i can be written as

$$\pi_i^d(e_i, e_{-i}) = b\big(p_i(e_i, e_{-i})\big)v - e_i. \tag{14}$$

Differentiating (14) with respect to e_i and accounting for the symmetric Nash equilibrium gives the equilibrium effort

$$e_b^* = \frac{(n-1)}{n^{\beta}\big(1+(n-1)^{\beta}\big)^{1/\beta}}\left(\beta - \frac{1-(n-1)^{\beta-1}}{1+(n-1)^{\beta}}\right)v. \tag{15}$$

The corresponding dissipation rate is

$$d(e_b^*) = \frac{n(n-1)}{n^{\beta}\left(1+(n-1)^{\beta}\right)^{1/\beta}}\left(\beta - \frac{1-(n-1)^{\beta-1}}{1+(n-1)^{\beta}}\right). \tag{16}$$

When comparing the dissipation rate $d(e_d^*)$ described by (16) to the standard dissipation rate $d(e^*)$ described by (5), we find that for certain configurations of parameters it is possible to observe over-dissipation, i.e., $d(e_b^*) > d(e^*)$. For example, with $n =$ 15 and $\beta =$ 0.61, the dissipation rate described by (16) is $d(e_b^*) =$ 1.05, while the standard dissipation rate described by (5) is $d(e^*) =$ 0.9. The magnitude of over-dissipation is about 16%, which is close to the magnitude of over-dissipation observed in many experimental studies (Sheremeta 2013; Dechenaux, Kovenock, and Sheremeta 2014).

Although there is substantial evidence for the distorted probability weighting function both in the laboratory and in the field (Wu and Gonzalez 1996; Bruhin, Fehr-Duda, and Epper 2010), there are currently no experimental studies directly relating the phenomenon of over-dissipation to distorted probability weighting.[3] Closely related studies have examined how the behavior of participants in rent-seeking contests changes when the contest success function (1) is replaced by a share function (Cason, Masters, and Sheremeta 2010, 2013; Fallucchi, Renner, and Sefton 2013; Shupp et al. 2013; Chowdhury, Turocy, and Sheremeta 2014). In Chowdhury et al. (2014), for example, co-authors and I designed a two-by-two experiment, by varying whether the prize is assigned probabilistically (i.e., efforts determine the probabilities of winning the prize) or proportionally (i.e., efforts determine the shares of the prize) and whether the cost function is linear or convex. Although in all treatments the risk-neutral Nash equilibrium effort level was constant, we found that, compared to the probabilistic contest success function, the proportional rule results in effort levels that are closer to the risk-neutral prediction (with almost no over-

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[3] Parco et al. (2005) and Amaldoss and Rapoport (2009) apply the distorted probability weighting function, combined with a utility of winning, to explain the pattern of the data observed in their contest experiments. However, in their experiments participants are budget constrained, making it impossible to observe over-dissipation.

dissipation).[4] Combining the proportional rule with a convex cost function further strengthens these results. Therefore, it appears that even though there is no direct evidence as to whether distorted probability weighting causes over-dissipation in rent-seeking contests, related studies show that even a slight modification to the contest success function plays a major role in determining individual behavior.

In Price and Sheremeta (2014), we applied another idea from the prospect theory of Kahneman and Tversky (1979) to explain over-dissipation in contest experiments. We designed an experiment in which some participants had to earn their income before participating in a laboratory rent-seeking contest experiment. We found that participants who earn their income exert lower effort in subsequent contests than participants who receive their income directly from the experimenter. The main reason for this result is that participants who earn their income and participants who receive their income for free have difference reference points. Participants who earn their income operate in the domain of losses, while participants who receive free income operate in the domain of gains.

In two other studies (Sheremeta and Zhang 2010; Chowdhury, Kovenock, and Sheremeta 2013), co-authors and I pointed out yet another judgmental bias that may partially explain over-dissipation in repeated contests. Specifically, we found that, participants who win in period *t*-1 are more likely to make higher effort in period *t*. In Sheremeta and Zhang (2010), we point out the similarities in correlation between winning in period *t*-1 and higher efforts in period *t* to a "hot hand" phenomenon found in the gambling literature – belief in a positive autocorrelation of a non-autocorrelated random sequence (Gilovich, Vallone, and Tversky 1985; Chau and Phillips

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[4] Note that the proportional rule eliminates the utility of winning and thus lover over-dissipation also might be due to the absence of the utility of winning,

1995; Croson and Sundali 2005). Therefore, it appears that hot hand response by participants may help in explaining over-dissipation in repeated contest settings.[5]

5. Discussion and conclusion

One of the main findings from experimental studies on contests is that participants exert effort that is significantly higher than predicted by the standard Nash equilibrium (Sheremeta 2013). This phenomenon is referred to as over-dissipation of rents, overbidding, or over-expenditure of resources. The standard rent-seeking contest model, based on the assumption of rational economic agents, cannot explain over-dissipation. The over-dissipation phenomenon can be explained by incorporating behavioral dimensions into a standard contest model, such as (1) the utility of winning, (2) relative payoff maximization, (3) bounded rationality, and (4) judgmental biases.[6]

There are several fruitful avenues for future research. First, it is still an open question as to which behavioral dimensions are the most important in explaining individual behavior in rent-seeking contests. For example, it is possible that some of the factors explaining over-dissipation are correlated, e.g., the relative payoff maximization may be driven by the utility of winning, or judgmental biases may be driven by systematic mistakes. The relative impact of these factors on individual behavior remains unknown.

Second, given the prevalence of over-dissipation in laboratory experiments, it is important to know whether over-dissipation occurs in field settings with real-effort and high

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[5] Most experimental studies use repeated designs in order to give participants enough time for learning.

[6] One may add to this list other candidates such as regret, overconfidence, and risk aversion. It is important to emphasize, however, that risk aversion cannot explain over-dissipation in contests (Dechenaux, Kovenock, and Sheremeta 2014). Although theoretically it is possible for risk aversion to cause over-dissipation (Treichm 2010; Cornes and Hartley 2012), experimental contest studies show that more risk-averse subjects choose lower efforts than less risk-averse subjects (Millner and Pratt 1991; Anderson and Freeborn 2010; Sheremeta and Zhang 2010; Sheremeta 2011; Mago, Sheremeta, and Yates 2013; Shupp et al. 2013).

stakes. Do field experiments offer insights into whether over-dissipation is a robust phenomenon? Are the explanations for over-dissipation in the field similar to the explanations for over-dissipation in the laboratory? These questions are important and answering them would significantly advance our understanding of the over-dissipation phenomenon.

Finally, given that rent-seeking behavior is unproductive and costly (even more so than predicted by the rational-behavior theory), it is important to develop and investigate mechanisms aimed at avoiding unproductive competition.[7] Since the seminal book by Schelling (1960), a number of mechanisms for avoiding conflict have been proposed, ranging from deterrence via extensive armament to contractually binding side-payments. Recent experimental studies have examined different conflict resolution mechanisms including side-payments (Kimbrough and Sheremeta 2013, 2014), random devices (Kimbrough et al. 2013; Kimbrough, Sheremeta, and Shields 2014), communication (Cason, Sheremeta, and Zhang 2012, 2014), cooperative spillovers (Savikhin and Sheremeta 2013), and social identification (Mago, Samak, and Sheremeta 2014). Whether these mechanisms are effective in the field remains an open question.

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[7] Over-dissipation is of course not desirable. In the context of R&D and labor tournaments, there may be positive externalities generated from increased research spending (Cason, Masters, and Sheremeta 2010).

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