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Quality contests

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ABSTRACT

In noisy contests where only the winner's entry will eventually be implemented, the suitable objective is to maximize the expected quality of the entry of the winner. We compare the optimal set of rules in contests under such an objective to the one under maximization of the sum of contestants' efforts, which is commonly assumed in the literature, and find that it may be beneficial to exclude weak contestants, unlevel the playing field, and weaken the underdog.

1. Introduction

What should we focus on when analyzing contestants' behavior in contests? The answer depends on the applications we want to embrace. The first and most commonly adopted view in the literature is to focus on the sum of contestants' efforts as the key outcome of the contest. This focus is particularly suitable for applications where efforts are potentially wasteful, such as arms races among countries, political campaigns, lobbying over the outcome of a public policy and, in general, rent-seeking activities. The second approach is to focus on competitive balance, interpreted as the uncertainty of the contest outcome. The organizer of a sporting event benefits from outcome uncertainty in that it thrills the interest of the audience and thus it increases the organizer's sales. The third possible focus is on contestants' participation, which is to be maximized in online communities where users contribute to the content, and minimized in military conflicts.[1] The fourth focus, and the cornerstone of this paper, is on the quality of the winner's entry. This is of particular interest in contests where contestants submit entries but only the winner's entry is eventually implemented. Five examples fit this context: (i) the body of laws of a country concerning a specific matter is found to be flawed, obsolete or simply silent, and competing bills are proposed to fix the flaws, to reform the obsolete laws or simply to legislate that matter from scratch; (ii) lobbyists write persuasive policy proposals so as to convince a policymaker to implement their proposal over that of other lobbyists; (iii) parties, politicians, and mayors propose political programs so as to win the elections; (iv) lawyers collect evidence in favor of their client to persuade the court; (v) citizens submit urban development projects to their municipality. In these five examples, contestants—i.e., legislators, lobbyists, politicians, lawyers, citizens—exert costly effort in order to increase the quality of their entries—i.e., bills, policy proposals, political programs, evidence, urban development projects.[2] The common feature of these five examples is that, to some extent, the quality of the losing entries is of no interest, and in fact we claim that the suitable focus is on the quality of the winner's entry, namely (i) the quality of the only bill which will eventually become law, (ii) the quality of the policy

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[1] A comprehensive literature review of the proposed approaches is beyond the scope of this work. Papers focusing on the sum of efforts are, for instance, Baye et al. (1993), Moldovanu and Sela (2001), Moldovanu et al. (2007), and Brown (2011). As for competitive balance, see Falconieri et al. (2004), and Vrooman (2012). Contests targeting participation are analyzed, for instance, in Azmat and Möller (2009).

[2] We claim that examples (i)–(v) are contests in that entries are in direct competition and a greater entry quality increases one's probability of winning the contest and decreases that of the rival.

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proposal of the lobbyist who will manage to persuade the policymaker, (iii) the quality of the only political program which will win and thus presumably be implemented, (iv) the quality of the evidence brought by the lawyer who will eventually win the trial, seen as a proxy of the probability of misjudgment by the court, and (v) the quality of the only urban development project which will eventually be carried out.[3]

If the quality of the entries is perfectly observable by who selects the winner (i.e., perfectly discriminatory contest), the suitable objective is to maximize the quality of the highest quality entry, which coincides with the winner's entry. If instead the quality of the entries is observable with some noise (i.e., imperfectly discriminatory contest), then a low quality entry might win the contest and thus be implemented.[4] In this realm of noisy contests, rather than the quality of the *highest quality* entry, it seems reasonable to maximize the expected quality of the entry of the *winner*, which could well *not* be the highest quality entry because of the noise. Thus, we claim that, in noisy contests, the expected quality of the entry of the winner is the natural objective in settings where only the winner's entry will eventually be implemented.[5] Throughout the paper we conform to the literature and use the conventional word "effort" to define the costly and sunk investment of contestants—here, the words "quality", "bid" and "effort" are interchangeable. We compare the optimal set of contest rules under the maximization of the expected effort of the winner and under the conventional maximization of the sum of efforts.[6]

In order to easily recall these two different objectives throughout the paper, we call an *aggregative contest* one where the objective is to maximize the sum of efforts, and we call a *quality contest* one where the objective is to maximize the expected effort of the winner. The reason why our benchmark is an aggregative contest, besides the fact that it is the most commonly adopted in the literature, is that there are real-life situations where both objectives are of interest; for instance, in a research contest, a benevolent government might want to stimulate the market of research and thus induce an aggregative contest, whereas the entity organizing the contest might probably only benefit from the quality of the winner's entry and thus induce a quality contest. From this point of view, this comparison sheds light on the government's need to impose certain policies of contest design on the entity organizing the contest.

Our model has two periods. In the first period, a set of rules which shapes the competitive environment that contestants face is chosen and publicly announced so as to maximize the objective of interest—i.e., the sum of efforts or the winner's effort. In the second period, the noisy contest is played. The way we add the noise to the winner selection process is by means of a standard lottery contest success function—see (1)—which is a tractable reduced-form corresponding to a contest where the winner is the contestant with the highest effort, multiplied by a noise following an inverse exponential distribution, see Jia (2008).[7] We cherry-pick three sets of contest rules for which the different results on how to optimally design an aggregative and a quality contest most greatly help us to grasp the intuitions behind the differences between these two types of contest. Delivering these intuitions is the main goal of the paper.

First, we study the *optimal selection of contestants*. From a given set of contestants—"applicants"—of known types (i.e., marginal cost of effort), the set of contestants—"finalists"—who are granted access to the contest is chosen. Once the choice of finalists is made and publicly announced, some of them might still drop out of the contest if better off doing so (in particular, if the other selected finalists are much stronger). In a quality contest, we find that it may be profitable to exclude some contestants, especially when types are sufficiently homogeneous. In fact, types homogeneity across contestants yields efforts homogeneity across contestants, and when efforts are homogeneous, the expected effort of the winner equals individual effort regardless of who wins. Individual effort decreases in the number of finalists, because each finalist has roughly $1/n$ probability of winning the prize, and thus as n increases, individual willingness to exert effort decreases. Therefore, if contestants are sufficiently homogeneous, excluding some applicants from the final is profitable in a quality contest.[8] However, the sum of efforts—contrary to the expected effort of the winner—decreases as contestants quit. This negative effect turns out to be stronger than any positive effect on individual efforts that exclusions may generate, and this is why Fang (2002) finds that no exclusion is profitable in aggregative contests, regardless of the heterogeneity of types. Thus, while in an aggregative contest we should not be concerned about excluding contestants, and rather be concerned about stimulating applications, we find that in a quality contest it might be optimal to exclude some applicants from the contest. In fact, for a significant set of contestants' types—which numerical analysis suggests to be large—the optimal number of finalists of a quality contest is two, and for this reason we focus on a two-contestant contest in the subsequent analysis.[9]

[3] Note that focusing exclusively on the quality of the winner's entry implicitly assumes that the winner of the contest has no role in implementing her entry once it wins; thus, the reader can either think of a completely self-implementing entry, which is the case in (i), or see the present model as part of a bigger model where the winner will be involved in the implementation process whose success arguably depends on the winner's type, which is the case in (iii).

[4] The noise could arise, for instance, when the time to analyze the details of the entries in order to select the winner is limited or costly.

[5] This idea mirrors the highest bid maximization in perfectly discriminatory contests: see, for instance, Cohen et al. (2008), Segev and Sela (2014) or Jonsson and Schmutzler (2015). Maximization of the highest bid in noisy contest would correspond to maximize the quality of the best entry, but the best entry could lose because of the noise and, if this is the case, we claim its quality is of no value. The expected quality of the winner's entry takes this into account.

[6] To the best of our knowledge, there are no works performing such an analysis. Yet, we acknowledge that, at the end of p. 345 of Andreff and Szymanski (2006), the authors mention "[.] there are also situations in sports where the aim of the contest designer is not to maximise total expected effort but expected effort of the winner." However, they do not run any analysis of it. Drugov and Ryvkin (2016) propose as the principal's objective function the expectation over types of a general function that may depend on the efforts, types, and bias of the playing field. The expected effort of the winner is thus a special case.

[7] A review of the contest success functions and their extensions is in Van Long (2013).

[8] If all contestants are *perfectly* homogeneous, the optimal number of contestants is two.

[9] Fang (2002) and the present paper adopt a lottery contest success function. In different models of contests, the no-exclusion result of Fang (2002) and our finding of profitability of exclusion " from the bottom"—that is, starting from the weakest contestants—in quality contests need not hold. For instance, Baye et al. (1993) find that in an all-pay auction excluding top contestants might be beneficial in boosting competition among weaker contestants. However, their objective function is the sum of efforts.