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# Distributional preferences in probabilistic and share contests☆

Magnus Hoffmann*, Martin Kolmar

*Institute for Business Ethics, University of St. Gallen, Girtannerstrasse 6, 9010 St. Gallen, Switzerland*

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ABSTRACT

We analyze Nash equilibria of probabilistic and share contests where players have distributional preferences. If players are sufficiently similar, distributional preferences create multiple equilibria. For the case of only mildly heterogeneous players, equilibrium effort can be lower as well as higher than effort exerted by players with selfish preferences. These findings can explain the following three anomalies observed in empirical tests of probabilistic and share contests: the large variance of effort levels (overspreading), individual spending that exceeds the Nash-equilibrium prediction (overspending), and aggregate spending that exceeds the value of the prize (overdissipation). If players are sufficiently heterogeneous, the game has a unique equilibrium that is more egalitarian than the selfish Nash equilibrium. It turns out that the less talented competitor may win the larger share of the prize if his inequality aversion is sufficiently strong. We analyze how the equilibria evolve if the number of players becomes larger and how sequential moves influence behavior. Two new insights follow from the analysis of the sequential-move game. First, sequential moves act as a coordination device in case of multiple simultaneous equilibria, and second, inequality aversion of the more egalitarian player can be used as a commitment device for low effort. This effect can reverse the conventional wisdom that the underdog should lead.



## 1. Introduction

The assumption of selfish payoff-maximizing behavior has long been the basic paradigm in the theory of contests and tournaments, starting with the seminal contributions by Tullock (1980) and Lazear and Rosen (1981).[1] Studies that test these theories in the laboratory, however, reveal several different but concurrent behavioral patterns: *overspending* (see Millner and Pratt, 1989, 1991; Davis and Reilly, 1998; Potters et al., 1998), *underspending* (see Schmitt et al., 2004; Shupp, 2004), *overdissipation* (see Davis and Reilly, 1998; Anderson and Stafford, 2003; Abbink et al., 2010; Morgan et al., 2012;

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* Corresponding author.
*E-mail address:* magnus.hoffmann@unisg.ch (M. Hoffmann).

[1] See Corchón (2007), Konrad (2009) and Corchón and Serena (2017) for excellent surveys of this literature.

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Price and Sheremeta, 2015), and *overspreading* (see Sheremeta, 2013; Chowdhury et al., 2014).[2] In case of overspending (underspending) the average investment of subjects is often higher (lower) than predicted. If the degree of overspending becomes sufficiently large, aggregate effort may even exceed the monetary value of the prize, a phenomenon that has been coined overdissipation. The fact that individual efforts are distributed over the whole strategy space has been labeled overspreading.

Moreover, recent experiments shed light on the behavioral differences between share contests, where each contestant receives a share of the prize proportional to his relative effort, and probabilistic contests, where each contestant's probability of winning the indivisible prize is determined by his relative effort. A direct comparison of probabilistic and share contests in the laboratory shows significant differences in the contestants' behavior, although both types of contests are structurally isomorphic if we assume that players are risk-neutral. In particular, players' efforts in the share contest are lower compared with their efforts in a probabilistic contest (Sheremeta et al., 2013; Shupp et al., 2013) while the incentive to enter a share contest is considerably higher (Cason et al., 2012). Moreover, unlike the probabilistic contest the share contest demonstrates less overspreading (Chowdhury et al., 2014). Furthermore, information feedbacks have different impact on the players' behavior, depending on the type of contest considered (Fallucchi et al., 2013). In particular, in share (probabilistic) contests, information about own earnings decreases (increases) effort spending, while additional feedback about the contestants' efforts and earnings increases (decreases) spending.

In the literature the above mentioned anomalies are attributed to distorted probability perceptions (Baharad and Nitzan, 2008), intention-based fairness preferences (Hoffmann and Kolmar, 2013), and distributional preferences (Mago et al., 2016), to name a few.[3] The present paper contributes to the literature on distributional preferences in contests, especially the literature on inequality-averse preferences (in the sense of Fehr and Schmidt, 1999) in contests. Our main objective is to explain the above mentioned anomalies, obtained in experimental studies, using a unified framework.[4]

The novelty of our approach comes in two parts. (i) We explicitly incorporate inequality-averse preferences in a share contest framework. We therefore seek to answer the following question: What is the impact of inequality-averse preferences on behavior in share contests? A distinction between share and probabilistic contests may appear superfluous because in the standard case of selfish and risk-neutral preferences the difference lies exclusively in the interpretation but not in the mathematical structure. However, this is no longer the case with inequality-averse preferences (Fudenberg and Levine, 2012). (ii) The formal similarity can be re-established if it is assumed that the distributional concerns of the players in a winner-take-all contest are not focused on the ex post but rather on the ex ante (expected) distribution of the prize. In a probabilistic contest it is *a priori* not clear whether individuals care for the distribution of the ex post allocation of the payoff or for the ex ante (expected) payoff, and the Fehr and Schmidt (1999) model is open to both interpretations (Herrmann and Orzen, 2008). If players are concerned about the ex post distribution of material payoff we have a form of egalitarianism that focuses exclusively on outcomes. However, there is plenty of experimental evidence that individuals also care about ex ante fairness. In a meta-study, Konow (2003) argues that the majority of studies find evidence for ex ante fairness preferences. Equality of outcomes is only seen as fair in the absence of any other variable that individuals may consider relevant for justice. Moreover, there is strong support for the hypothesis that individuals take intentions (and therefore actions as best possible proxy) into consideration when evaluating the distribution of an allocation; people seem to ask whether individuals deserve the outcome of some transaction based on individual characteristics (like ability), intentions/actions (like effort), and on characteristics of the environment (like the causal relationship between actions and outcomes).

Hence, people evaluate the extent to which an individual has contributed to the outcome of the interaction (Sebald, 2010) and individuals are held accountable only for variables that they can influence and that contribute to the outcome. For example, Charness and Levine (2003) show that the perceived intentions of an opponent as well as the final outcome matter from the point of view of each player, especially if the outcome of a game is sensitive to chance.[5] Brock et al. (2013) show that with risky outcomes in dictator games, the assumption that individuals compare outcomes exclusively on an ex post or ex ante basis cannot explain behavior. Thus, the current consensus suggests that a simple consequentialist model of distributional preferences is too simplistic to consistently explain behavior.

Consequently, different models emerged that try to capture both, ex ante fairness (sometimes coined procedural fairness) and ex post fairness (consequentialist fairness) into basic deterministic models of other-regarding preferences (Krawczyk, 2011; Borah, 2013). In particular, preferences are constructed as functions (sometimes as a weighted average) of ex ante

[2] See Sheremeta (2013) and Dechenaux et al. (2015) for comprehensive surveys of the experimental literature on contests, tournaments and all-pay auctions.

[3] See Section 4 for in-depth discussion of the predictive power of competing theories.

[4] We use the term *distributional preferences* as the generic term for the class of preferences that are sensitive to the distribution of prizes or winning probabilities, and which are an example of other-regarding preferences (see also Fehr and Schmidt, 2006 and Balafoutas et al., 2012). Other examples of inequality-averse preferences in probabilistic contests are Grund and Sliwka (2005), Herrmann and Orzen (2008), Fonseca (2009) and Lim (2010).

[5] In the same spirit, Krawczyk (2011) shows that a behavioral model where individuals are interested in the expected outcome (that can be influenced by their actions) and not in the actual outcome (that is also determined by chance moves) is a good predictor for behavior in bargaining games. van't Wout et al. (2006) have shown that identical offers are much more frequently rejected in an ultimatum game if the offer was made by a human than when it was generated by a computer. This finding shows that individuals do not necessarily care about inequality as such, but about inequality willfully induced by other individuals (Bolton et al., 2005; Bolton and Ockenfels, 2010; Charness and Rabin, 2002; Falk and Fischbacher, 2006; Kagel et al., 1996; Offerman, 2002).