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# Self-selection in tournaments: The case of chess players[☆]

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ABSTRACT

We consider a simple tournament model in which individuals auto-select into the contest on the basis of their commonly known strength levels, and privately observed strength-shocks (reflecting temporary deviations from observed levels). The model predicts that the participation rate should increase with the player's observed strength, and the total awarded prize amount. Furthermore, under certain conditions self-selection implies that participants with high observed strength levels have smaller expected strength-shocks than those with low levels. Consequently, the latter should play better than predicted and the former worse (given their observed strength). These predictions are confronted with data from a large and high-prize chess tournament held in the USA. This tournament is divided into different sections, with players being able to play in the section to which their current chess rating (observed strength) belongs. As predicted, we find that within each section the participation probability increases with chess rating and prize amounts, and players with a relatively low (resp. high) rating are indeed the ones who have a better (resp. worse) relative performance.



## 1. Introduction

Incentive pay schemes are designed to induce more effort from workers and also to attract the most productive employees. Various types of pay schemes are used in practice to achieve these two goals. In economic sectors where output is individual-specific and easily observable and measurable, firms often pay piece-rate wages to their employees. Workers' salaries are then directly linked to their realized production levels, creating the incentives for them to exert optimal effort levels. It is also thought that such a compensation arrangement is primarily attractive to the most efficient workers. Lazear (2000), for instance, analyzes data from a firm in which the management modified the method of compensating workers from hourly wages to piece-rate pay, and documents patterns of self-selection among the employees of this firm: the less productive workers left the firm after the change in payment policy, and more productive ones got hired.

The compensation structure adopted in rank-order tournaments is another example of an incentive pay scheme. In a tournament, workers are paid according to their final ranking in the competition: the best performing worker receives the first prize, the one ending second the second highest award, and so forth. They are in this case rewarded according to their

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relative performances (and not on the basis of absolute performances as in the piece-rate example). Real-life applications of rank-order tournaments abound: salesmen with the highest sales figures get end-of-year bonuses, the most prolific associate professors are promoted to full professorship, and junior lawyers who win most cases are offered a partnership in law firms.

While there is an abundant literature on the incentive effects of tournaments,[1] there are only a few papers which have studied tournament-participation decisions, and the possible consequences of self-selection on the outcomes of the competition. Stein (2002) characterizes the Nash equilibrium efforts in a contest between heterogenous players. In particular, he finds which players are active at the Nash equilibrium. Inactive players (zero effort) can thus be seen as staying out of the tournament. Myerson and Wärneryd (2006) study contests where the set of players is a random variable.[2] In an empirical paper, Brown (2011) shows that golf players perform less well when a superstar (Tiger Woods) participates in the tournament, thereby suggesting that the precise composition of the pool of participants may influence players' performances, which in turn affects the outcome of the contest itself. There are also a few papers focussing on the case where agents have the possibility to choose between multiple tournaments. Leuven et al. (2011) report the results of a field experiment in which students of microeconomics at the University of Amsterdam could auto-select themselves into one of three tournaments.[3] These data allowed the authors to disentangle the effects of prizes and self-selection on exam grades. They find that the observed increment in grades (across the three treatment groups) is not due to increased effort of students but to sorting of more able students to tournaments with higher awards. Azmat and Möller (2009) study professional road runners who can choose between contests differing in race-distance and prize structure. They find, among other things, that in long races, steeper prizes (more unequal prizes) increase the participation of top runners, while there is no such link in medium and short races. This result is compatible with the authors' theoretic model in which runners' contest choice depends on the prize structure and on how sensitive a contest's outcome is with respect to individual efforts.[4]

Our paper contributes to this literature. Using data from the World Open Chess tournament (a large chess competition held in the USA each year), we analyze which players decide to participate, and how this participation decision varies with the level of awarded prizes.[5] We also study how players, conditional on their decision to participate, perform in the contest. We find that players with higher chess ratings are more likely to participate, and this effect is magnified when prize budgets increase. More surprisingly, we also observe that highly rated participants under-perform while the lowly rated ones over-perform. Our explanation for this phenomenon follows from a simple participation model in which players self-select on their unobservable chess-strength shocks.

We have twelve years of data from the World Open chess tournament. It is open to professional and amateur players of all levels. To acknowledge the differences in strength between players, the tournament is divided into sub-tournaments, or sections. Each section is defined as an Elo-rating interval (the Elo rating system was introduced by Elo (1978) and is since the 1970s used by all chess federations throughout the world), and chess players can participate in the section to which their Elo rating belongs. Players within a given section compete with each other and the best ranked ones at the end of the tournament win prizes. The prizes awarded in the World Open are very high, and this should create the necessary incentives for the chess participants to play as well as they can. Self-selection is also expected to play a role as players with an Elo rating near the top of their section have (all other things equal) a higher chance to win than those near the bottom. Another reason to suspect self-selection in the data is that optimal chess performance requires a serious preparation (through studying openings for instance) and a 'well-rested brain'. Chess players who have prepared intensively just before the tournament and who have been through a calm and stress-less period are thus expected to participate relatively more.

The data set records all game outcomes, all scores (after each round and at the end of the tournament), the Elo rating of each player, some other player characteristics (state of origin, chess history prior to the tournament, etc.), and the prize winners. An originality of our data set is that we observe for each year the whole population of potential participants (i.e., all individuals registered with the US chess federation). This allows us to study the determinants of tournament participation.

The data are confronted with several predictions that we derive from a simple model of tournament-entry. In this model a chess player is assumed to participate in the tournament if the expected prize amount plus the net private benefit from playing exceeds the average cost of participation (registration fee plus average travel and lodging expenses). The expected prize amount depends on the commonly observed player-strength (measured by the Elo rating) and a privately observed strength-shock, which captures the fact that actual strength may slightly deviate from the Elo rating (because of a bad or good preparation, or because of having experienced a busy or calm period). Players auto-select into the tournament on the

[1] For theoretical contributions see for instance Lazear and Rosen (1981), Green and Stokey (1983), Nalebuff and Stiglitz (1983), and Moldovanu and Sela (2001), and a recent survey by Konrad (2009). For empirical contributions see Ehrenberg and Bognanno (1990), Eriksson (1999), and Coffey and Maloney (2010).

[2] That is, each player is randomly selected in (or out of) the tournament and exerts effort not knowing how many other players are in. Players are otherwise symmetric. Comparing total effort in a contest with an uncertain number of players (with $\mu$ players on average) with a contest with no uncertainty and exactly $\mu$ players, they show that aggregate effort is larger without uncertainty.

[3] Each student within a tournament was randomly allocated to a treatment and control group. Those in the treatment group of a given tournament could compete for a prize awarded (prizes differed across the three tournaments) to the student with the highest exam grade.

[4] See for other theoretical papers on optimal contest choice Damiano et al. (2010) and Damiano et al. (2012).

[5] Several recent papers have studied data on chess players and competitions: Moul and Nye (2009), Gerdes and Gränsmark (2010), Levitt et al. (2011), Gränsmark (2012), and Dreber et al. (2013). None of these papers has explicitly studied the issue of selection in tournaments and its consequences on performance.