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Strategic behavior across gender: A comparison of female and male expert chess players

Christer Gerdes *, Patrik Gränsmark

Swedish Institute for Social Research (SOFI), IZA, SULCIS, Sweden

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ABSTRACT

This paper aims to measure differences in risk behavior among expert chess players. The study employs a panel data set on international chess with 1.4 million games recorded over a period of 11 years. The structure of the data set allows us to use individual fixed-effect estimations to control for aspects such as innate ability as well as other characteristics of the players. Most notably, the data contains an objective measure of individual playing strength, the so-called Elo rating. In line with previous research, we find that women are more risk-averse than men. A novel finding is that men choose more aggressive strategies when playing against female opponents even though such strategies reduce their winning probability.

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1. Introduction

In a number of areas the underrepresentation of women is a striking reality. This applies to top positions in politics, public and government administration, the academic professions, and not least corporate management. Such diverse outcomes have been observed even in markedly equality-aware societies such as the Swedish; see Albrecht et al. (2003), Booth (2007), Jonung and Ståhlberg (2008), and references therein. As noted by Booth (2007), economists have only recently tried to amend the standard human-capital model that seeks to explain gender differences in incomes and promotion by taking into account aspects such as culture, bargaining skills and tastes or preferences.[1] If it is the case that men, on average, are more competitive and less risk-averse than women, this might in part explain why promotion to higher positions has been advantageous for male candidates. Indeed, a number of studies provide evidence of systematic gender differences in terms of risk behavior and competitiveness. One issue still open for debate is whether these are innate differences or not, i.e. whether observed differences across gender in terms of risk taking and competitiveness are biologically or socially determined.[2]

Our aim in this paper is threefold: First, we examine whether there are general gender differences in risk behavior. Second, as chess is a game between two players, it is possible to analyze the interactive risk behavior of a man playing against a woman compared to when he plays against a man and vice versa. This aspect relates to research on the importance of the composition of a group, i.e. whether individuals act differently in single-sex or mixed groups; see Gneezy et al. (2003) and Booth (2009) for a discussion on possible explanations for various outcomes found in the literature. Third, we investigate whether the behavior we have studied is rational or not in terms of winning probabilities.

The study relates to recent studies that have tried to test the supposition of differences across gender with respect to risk taking

* Corresponding author. Swedish Institute for Social Research, Stockholm University, SE-106 91, Sweden. Tel.: +46 8 6747815; fax: +46 8 15 46 70.
E-mail addresses: christer.gerdes@sofi.su.se (C. Gerdes), patrik.gransmark@sofi.su.se (P. Gränsmark).

[1] For example, Bowles et al. (2001) point at the importance of non-cognitive skills as determinants for earnings. See also Bas ter Weel (2008) on the importance of non-cognitive skills for predicting labor market outcomes.

[2] On the importance of the position of women in society for competitive behavior see Gneezy et al. (2009). In a field study of the Khasi tribe in India and the Maasai tribe in Tanzania, they found that in a society organized along matrilineal lines, like the Khasi tribe, women chose competitive schemes more often than the men in their tribe. The authors take their result as evidence of the impact of social learning on behavior, but they also point at the fact that cultural choice may alter genetic evolution through various selection mechanisms.

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and competitiveness.[3] Much of the literature has focused on experimental evidence, for example by looking at children or students competing under controlled conditions. Our study adds to that literature by providing evidence from a non-experimental setting, using comprehensive records of games played by a great number of top-level chess players. There are few other studies that have focused on differences in risk behavior and competitiveness outside the laboratory environment. For example, Bajtelsmit and Bernasek (1996) look at real-world investment decisions for non-professional investors, while Olsen and Cox (2001) look at professional female and male investors. As stressed in Bajtelsmit and Bernasek (1996), differences across gender in financial placement strategies might be caused by the fact that the access to information varies in quality, where men might systematically receive "better" advice/information than their female counterparts. This could be due to male networks, but also to discriminatory treatment. None of these studies address the importance of mixed-sex competition.

As has been noted by several scholars within the field of cognitive sciences, there is a common set of skills appropriate for people working in advanced areas of the business world and academia, as well as for top-level chess. This holds not least because successes in these areas are associated with intelligence and expertise (see Bilalić et al. 2007, p. 460), as will be discussed in more detail below. Moreover, since chess is a game between two players, it definitely constitutes a (highly) competitive setting, thereby reflecting the nature of what is the daily routine for many actors in the corporate world and the field of government, as well as in academia. Becoming an expert chess player is by no means an easy task. Those who attain the higher ranks are certainly more competitive than people in general. This may apply to a greater extent to female players, i.e. they are presumably more competitive than women in general. The latter supposition is based on experimental evidence showing that women are less prone to choose tournaments than men (see e.g. Niederle and Vesterlund, 2007). Thus, in our study we look at preferences for risk across gender for a selected group of competitive people. Our results point at significant differences in risk taking across gender. Most notably, both men and women seem to change strategy when they face a female opponent.

In Section 2 we argue why research on chess data is a suitable complement to earlier research on (non-)cognitive differences across gender. Section 3 provides a short theoretical background to our estimation approach, while Section 4 presents the data. In Section 5 we present and discuss the results of our estimations, while Section 6 concludes the study.

2. Why study chess?

This section aims to emphasize that findings based on chess can be transferred to other professions that are characterized by a high level of expertise. It thereby highlights the importance of having an accurate measure of a person's skill level, the so-called Elo rating.

For a number of years, strategic aspects involved in playing the game of chess have become an established analytical tool in cognitive psychology. In his review of the literature, Roring (2008) describes what makes chess a constructive method for the analysis of different aspects of human behavior: "Finding the best move in a chess position is a highly complex, real-world human activity, and each chess position represents a well-defined problem environment, with a fixed number of identifiable moves that can be played at any given point — perfect for studying search processes and problem solving" (p. 1).

A landmark for establishing chess as an analytical tool was the introduction of the Elo rating that made it possible to compare the strength of chess players on a metric scale. Named after its inventor, Arpad Elo, it has become the benchmark classification in chess.

> [It] provides chess researchers with a valid measurement device unrivalled in other areas of expertise research. It is a true gold standard in individual-difference research. /…/ Other frequently investigated areas such as physics expertise /…/ do not permit such fine differentiation (Charness 1992, p. 6).

Thus, with reference to Elo (1978), it has become possible to measure skills on objective grounds, i.e. there are no "subjective assessments" (Chabris and Glickman 2006, p. 1040).[4] Also, as argued by different scholars in the field, e.g. Gobet (2005), Ross (2006) or Roring (2008), chess is well-suited to address questions concerning cognitive and psychological processes, thus extending its relevance to various fields of research studying human behavior. For example, one result obtained from chess research is that it takes about ten years of intense learning and hard work to become an expert, a time frame that also fits with "arts, sports, science, and the professions" (Gobet 2005, p. 185).[5]

Anecdotal evidence maintains that there is a positive correlation between skills in chess and intellectual capacity. Indeed, some research points at the legitimacy of such views; see for example Frydman and Lynn (1992). Other studies that have looked at the correlation between chess rating and intellectual capability have not provided support for this supposition; see Waters et al. (2002). As they argue, conflicting conclusions might be due to the fact that the groups that are scrutinized differ to some extent with respect to their demographic composition. In particular, Frydman and Lynn (1992) study children, while Waters et al. (2002) look at adult chess players. As argued by Waters et al. (2002), the importance of innate intellectual capacity will fade as children mature and learn to compensate for their weaknesses through purposeful training, resulting in approved chess skills and higher Elo ratings. One influential paper in the field of cognitive research arguing along these lines is Ericsson et al. (1993). It proposes the concept of "deliberate practice", which denotes a person's commitment to persistently exercise laborious tasks. The authors see such a trait as a vital ingredient in attaining extraordinary (chess) skills. Thus, in their view, it is the capacity to direct one's attention to monotonous, repetitive tasks over a long period of time, which is decisive for the attainment of specialist knowledge, rather than innate aptitude. Recent studies suggest that advanced chess skills are the result of innate personal characteristics, as well as persistent practicing, see Gobet and Campitelli (2007) and Grabner et al. (2007).[6]

In the world of chess, information on strategic concerns is accessible to everyone, especially since the Internet has become commonplace in daily life. Moreover, the signal of a player's strength, i.e. the Elo rating, is of a similar quality irrespective of gender. In other words any incentive to invest in chess skills will not be distorted by

[3] See Booth (2009) and Croson and Gneezy (2009) for a survey and references on the issue of differences in risk preferences and competitiveness across gender in experimental studies. A related aspect addressed in the literature on gender differences regards overconfidence; see e.g. Bengtsson et al. (2005), Datta Gupta et al. (2005), and Nekby et al. (2008). Sometimes the three concepts are used interchangeably, indicating that they overlap to a certain extent.

[4] The Elo rating is calculated using an algorithm based on the assumption of a normal distribution of playing strength across chess players. See the Appendix A for a detailed description on how Elo points are estimated.

[5] So far there are only few studies in economic literature that have studied chess players. In Ariga et al. (2008), a player's Elo rating is studied as a signal for talent and as advice to invest in becoming a (professional) chess player. Another study, by Moul and Nye (2009), looks at (illegitimate) cooperation among expert players. A third study is by Levitt et al. (2009), who let top-level chess players solve different games designed for testing their backward induction skills. Their study responds to Palacios-Huerta and Volij (2009), who use a similar experimental setup.

[6] Chabris and Glickman (2006) and Bilalić et al. (2009) refute the assertion made by Howard (2005) who reads the lack of top-level female chess players as evidence for gender differences in intellectual capacity.

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