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Where to Compete?: On the Scope of the Home-Field Advantage

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Abstract

The home-field advantage — a tendency to perform better at home than away from home — has been well-documented across individual and team sports. Here, I questioned the scope of the home-field advantage, namely, to which competitive settings it applies. To do so, I analyzed the outcomes of more than 100,000 chess games played in official Israeli chess leagues. I found no support for a home-field advantage (or disadvantage), regardless of players' levels of expertise or the importance of a given game. Overall, the observed nonsignificant pattern challenges the notion that the home-field advantage is related to human territorial behavior. Apparently, location hardly matters when confounding factors such as active audiences and referees are absent. Methods for analyzing a large dataset of chess-game outcomes are discussed.

Keywords

Home advantage, home-field advantage, chess, sports, territoriality, specification curve

Introduction

The quest for competitive advantage is unceasing, at both the individual level and the group level. One crucial factor that can provide a competitive edge is the location of a competition. In sports, the home-field advantage is a well-documented phenomenon. Individuals and teams tend to perform better at home than they do away from home (e.g., Allen & Jones, 2014; Carron et al., 2005; Courneya & Carron, 1992; Gómez-Ruano et al., 2021; Schwartz & Barsky, 1977). Factors contributing to the home-field advantage include crowd support, referee decisions, familiarity with the local facilities, and travel fatigue. Most of these factors, however, are irrelevant in many competitive arenas (e.g., business, academia, and certain sports), leveling the playing field. Does location still play a significant role when parties compete on equal terms?

The home-field advantage was recently examined using data collected during the coronavirus pandemic, when many sports were affected by restrictions on travel and audiences. Overall, the findings suggest that the home-field advantage was reduced under the isolated conditions (e.g., Bilalić et al., 2021; Higgs & Stavness, 2021; for a review, see Leitner et al., in press), adding to earlier research on crowd support, referee behavior, and travel fatigue. To further understand home-field advantage, we need a better understanding of why this advantage diminished during the pandemic but did not completely disappear.

There is little evidence regarding the *scope* of the home-field advantage, namely, to which competitive settings it applies. Brown and Baer (2011) found a home-field advantage in negotiations. They found that a familiar office positively affects negotiation performance and that that effect is mediated by increased confidence levels. In another study involving the manipulation of office space, Greenaway et al. (2016) found that work-team productivity was higher in in-group and out-group spaces than in neutral spaces; however, there were no differences between the in-group and out-group spaces. Studies have also found that home and away competitors face different psychological states, which could affect performance (e.g., Bar-Eli & Simcha, 2021; Carron et al., 2005). However, on a level playing field, distinctive perceptions and expectations would not necessarily emerge (e.g., Staufenbiel et al., 2018).

Notably, studies have suggested that part of the home-field advantage in sports is attributable to human territoriality and dominance, a natural physiological and behavioral response to protect one's territory (e.g., Allen & Jones, 2014; Carré et al., 2006; Furley et al., 2018; Neave & Wolfson, 2003). Territorial behavior is long-established among animals (see the review in Kokko et al., 2006) and has also been observed in experimental social dilemmas and group decision-making (e.g., Han et al., 2009; Taylor & Lanni, 1981). Assuming territoriality applies to competitive performance, location effects should be prevalent, even on a level playing field. However, the territoriality hypothesis "has not received sufficient empirical support and is speculative at present" (Furley, 2019, p. 147).

The Present Study

The present study aimed to examine the home-field advantage in real-life competitions in which location-dependent factors are *regularly* irrelevant. Tournament chess leagues are ideal for this purpose because they involve home and away players who compete in a fairly neutral environment. The (few) audience members are silent, referees rarely make judgments, and familiarity with local facilities is not a factor. In addition, travel distances are short because clubs usually compete within their own geographic region. The present study focuses on the Israeli chess leagues, which possess all of these characteristics.

Chess is considered a paradigmatic example of cognitive skill. It has long been a pilot model for theories in cognitive science and a fruitful domain of expertise research (e.g., de Groot, 1978; Gobet, 2019; Gobet & Charness, 2018; Simon & Chase, 1973). Moreover, tournament chess constitutes an ideal high-stakes environment for studying performance. The game is inherently competitive and is played under time pressure, players place great importance on their achievements, and the Elo rating system that measures relative skill (Elo, 1978) provides an excellent research vehicle.

Social and psychological factors can affect tournament chess performance. These factors include performance goals (Anderson & Green, 2018; González-Díaz et al., in press), a competitor's group of reference (Bilen & Matros, 2022; Zak et al., 2019), being ahead or behind in score (González-Díaz & Palacios-Huerta, 2016), and the gender composition of games (e.g., Backus et al., in press; De Sousa & Hollard, in press; Smerdon et al., 2020). Issues related to the game location have also been studied in tournament chess. Künn et al. (2022) found that move-by-move performance was diminished during the coronavirus pandemic when games were played online instead of face-to-face. Zak (2021) found that players had better game outcomes when traveling abroad, presumably due to greater focus or motivation.

Most similar to the present study, Sörqvist et al. (2013) found no home-field advantage within Swedish chess leagues. The present study complements that investigation by using rich data from another country and testing further contingencies. For example, some researchers have suggested that the home environment mainly affects expert competitors (e.g., Harb-Wu & Krumer, 2019; Koning, 2011; Madrigal & James, 1999). This possibility echoes the view of expert performance as an interaction between the performer and the environment (e.g., Araújo & Davids, 2018). However, in most sports, competitors of different skill levels are nested within different leagues that involve unique home and away environments (e.g., Leite & Pollard, 2018). Here, I could focus on expert competitors without that concern because tournament chess league games are played on equal terms.

The present study aimed to provide evidence regarding the scope of the home-field advantage and shed light on human territorial behavior. The literature discussed above implies that a home-field advantage is not improbable in a domain such as chess (e.g., Brown & Baer, 2011; Leitner et al., in press; Neave & Wolfson, 2003). Studying this possibility with a large dataset is thus expected to be highly informative, even in the case of nonsignificant results (Abadie, 2020).

Method

Dataset

This study used data collected by the official Israeli chess leagues between 1998 and 2021. The dataset included seven divisions of different expertise levels played under a standard time control (allotting about 2 h of thinking time for each player per game). Each match between two club teams consisted of four to five individual games, depending on the division. The data covered 113,189 games from 27,341 matches played in 133 clubs, after excluding matches with missing games and matches for which home and away were indefinable (e.g., derby matches between teams from the same club and premier-league matches played at central locations). Players' Elo ratings, age, sex, and whether they played white or black (determining who had the first-mover advantage) were included for most games. Descriptive statistics are presented in Table 1 and further information on the regulations of the Israeli chess leagues is provided in Appendix 1.

Table 1. Descriptive statistics

Panel A. National division (*N* = 12,385)

	Mean	*SD*	Min	Max	*N*
Elo rating (home)	2211.325	109.419	1423	2587	11,997
Elo rating (away)	2210.368	110.704	1330	2582	11,992
Age (home)	40.513	16.497	10	90	12,127
Age (away)	40.584	16.444	10	85	12,161
Female (home)	.02	.141	0	1	12,385
Female (away)	.021	.144	0	1	12,385
Playing white (home)	.4	.49	0	1	12,385
Game outcome (home)	.492	.407	0	1	12,385

Panel B. Division 1 (*N* = 20,068)

	Mean	*SD*	Min	Max	*N*
Elo rating (home)	2032.031	130.928	1313	2549	19,445
Elo rating (away)	2028.325	132.242	1400	2550	19,434
Age (home)	44.852	19.246	10	92	19,412
Age (away)	44.822	19.162	9	92	19,410
Female (home)	.027	.163	0	1	20,068
Female (away)	.028	.166	0	1	20,068
Playing white (home)	.466	.499	0	1	20,068
Game outcome (home)	.501	.425	0	1	20,068

Panel C. Division 2 (*N* = 28,620)

	Mean	*SD*	Min	Max	*N*
Elo rating (home)	1800.301	170.505	1200	2434	27,419
Elo rating (away)	1798.589	172.097	1200	2456	27,351
Age (home)	44.754	21.753	5	95	27,135
Age (away)	45.021	21.695	5	95	27,155
Female (home)	.024	.152	0	1	28,620
Female (away)	.025	.156	0	1	28,620
Playing white (home)	.5	.5	0	1	28,620
Game outcome (home)	.503	.442	0	1	28,620

Continued on next page

Table 1. Descriptive statistics (continued)

Panel D. Division 3 (*N* = 33,260)

	Mean	*SD*	Min	Max	*N*
Elo rating (home)	1503.366	199.06	1200	2376	31,621
Elo rating (away)	1501.643	199.79	1200	2376	31,543
Age (home)	28.615	22.499	5	95	29,456
Age (away)	28.775	22.574	5	95	29,611
Female (home)	.057	.231	0	1	33,260
Female (away)	.057	.233	0	1	33,260
Playing white (home)	.5	.5	0	1	33,260
Game outcome (home)	.504	.469	0	1	33,256

Panel E. Division Youth-1 (*N* = 3,620)

	Mean	*SD*	Min	Max	*N*
Elo rating (home)	2039.536	201.078	1200	2618	3,593
Elo rating (away)	2042.922	204.408	1350	2613	3,593
Age (home)	15.64	2.639	7	21	3,605
Age (away)	15.672	2.632	8	21	3,609
Female (home)	.056	.231	0	1	3,620
Female (away)	.058	.233	0	1	3,620
Playing white (home)	.5	.5	0	1	3,620
Game outcome (home)	.494	.438	0	1	3,620

Panel F. Division Youth-2 (*N* = 15,236)

	Mean	*SD*	Min	Max	*N*
Elo rating (home)	1514.469	213.689	1200	2407	14,971
Elo rating (away)	1512.248	213.58	1200	2407	14,959
Age (home)	12.259	2.914	5	21	14,963
Age (away)	12.254	2.905	5	21	14,979
Female (home)	.086	.28	0	1	15,236
Female (away)	.087	.282	0	1	15,236
Playing white (home)	.5	.5	0	1	15,236
Game outcome (home)	.502	.469	0	1	15,235

Note. Descriptive statistics were calculated based on matches with no missing games. The female dummy variable indicates the player's sex, either female (the indicator equals 1) or male (the indicator equals 0). Game outcome is 1 (win), 0.5 (draw), or 0 (loss). Matches in the national division included five games (the home team played white in two out of five games; see Appendix 1 for more details). Matches in other divisions included four games (except Division 1 before 2007, which included five games; therefore, the home team played white in less than half of the games).

On average, home and away players had similar ratings and their respective game outcomes were around 50% (see Table 1). These statistics suggest no considerable home-field advantage, but any conclusion is premature until comprehensive analyses have been performed.

Data Analysis

Answering the research question involved making analytical decisions, such as how to model the analysis, which games to focus on, and which control variables to include. To address these decisions transparently and ensure the robustness of the results, I compared estimates of numerous specifications, implementing a specification-curve analysis (Simonsohn et al., 2020). This approach can moderate biases from analytical decisions and account for variability that is not reflected in standard errors. Specification-curve analysis and similar methods are becoming increasingly popular (Del Giudice & Gangestad, 2021) and are particularly useful for analyzing chess data (Backus et al., in press; Smerdon, 2022;

Smerdon et al., 2020). To explain how I defined the set of "reasonable" specifications (Simonsohn et al., 2020), I first describe a basic specification and then detail variations based on analytical decisions that I found appropriate.

A Basic Specification

The analysis was modeled linearly for a focal player i in game g:

$$Game\ outcome_{ig} = \alpha_0 + \alpha_1 Home_{ig} + \alpha_2 White_{ig} + f(Elo\ difference_{ig}) + \boldsymbol{X_{ig}\beta} + \boldsymbol{Z_g\delta} + \varepsilon_{ig}$$

where $Game\ outcome_{ig}$ is 1 (win), 0.5 (draw), or 0 (loss);[1,2] $Home_{ig}$ indicates whether player i played at home (the indicator equals 1) or away from home (the indicator equals 0), and hence α_1 is the coefficient of interest that tests the home field advantage; $White_{ig}$ indicates whether player i played white or black; and $f(\cdot)$ represents the functional form of $Elo\ difference_{ig}$ (a player i's Elo rating minus the rating of his/her opponent). The vector $\boldsymbol{X_{ig}}$ includes a set of controls, specifically, for player i and his/her opponent, age, age squared, sex indicator, and the number of league games previously played in the observed season. The vector $\boldsymbol{Z_g}$ includes division dummy variables.

Regarding the error term ε_{ig}, note that this basic specification treats every game in the dataset as a zero-sum situation (e.g., if one player wins, the other loses; if one player plays white, the other plays black). Thus, to avoid any double-counting, standard errors should be clustered within games.[3] In addition, because players are not nested within specific games (most of them played more than one game), a robust inference involves two-way clustering (Cameron et al., 2011) within a game and a player. That is how I clustered the standard errors.

Alternative Specifications

Justifying the included (and excluded) specifications in a specification-curve analysis is essential (Del Giudice & Gangestad, 2021; Simonsohn et al., 2020). Here, because game outcome is the only performance measure available, variations were based on independent variables and subsamples of the data.

I presumed that any valid specification includes controls for playing white or black and Elo difference because these variables may be confounded with playing at home (see Table 1). I also saw no reason to exclude the controls included in the vectors $\boldsymbol{X_{ig}}$ and $\boldsymbol{Z_g}$. Age, sex, and activity are important factors for chess performance (e.g., Vaci & Bilalić, 2017) and the inclusion of division dummy variables is essential. I did consider adding a dummy variable for each player or club in the dataset, to account for unobserved characteristics that are constant within the player or club. These specifications estimated the home-field advantage using only within-unit variation (fixed-effects models).

I also found it reasonable to use different functional forms of Elo difference. The Israeli rating system assumes a linear relationship between Elo difference and game outcome, regardless of level of expertise (see Appendix 1). I considered this strict form, but also relaxed its assumptions by adding either a non-linear (and symmetric) term of $Elo\ difference_{ig}$^3 or the interaction term $Elo\ difference_{ig} * Elo_{ig}$ (in addition to Elo_{ig}, allowing the Elo-difference effect to change with skill).

Regarding subsamples of the data, I included a focus on games between expert players using the conventional cutoff of 2000 Elo points (e.g., Dreber et al., 2013; Smerdon et al., 2020). Also justifiable is the omission of games that ended in a draw, as they may reflect strategical considerations rather than performance (e.g., Chassy & Gobet, 2015; Moul & Nye, 2009), especially given the competitive intergroup setting. Finally, I considered focusing on games that involve high competitive pressure. Such pressure may affect performance, in general (e.g., Klein Teeselink et al., 2020), and interact with the home-field advantage, in particular (e.g., Baumeister & Steinhilber, 1984; Harb-Wu & Krumer, 2019; McEwan & Hoffmann, 2021). I used three independent classes of high-pressure games: (1) games predicted to be close, in which the Elo difference fell between −100 and 100; (2) critical games for the match, defined as games within matches that ended in a tie or a win/loss by only half a point; and (3) critical games for the season, defined as games played within the last three rounds of a season.

Overall, the described analytical decisions induced 288 specifications for the analysis, as summarized in Table 2.

Table 2. Considered specifications

Analytical Decision	Basic Specification	Alternative Specifications
(A) Which control variables should be included?	Include controls for playing white or black, Elo difference, age, age squared, sex, previous league games, and division dummy variables	Add a dummy variable for each player **or** each club (fixed-effects models)
(B) What functional form of Elo difference should be used?	Linear, according to the Israeli Elo formula (see Appendix 1)	Add either a non-linear term **or** an interaction term
(C) Which levels of expertise should be included?	Include all levels	Focus on expert players by excluding games in which the average Elo is below 2000
(D) Should games that ended in a draw be omitted?	No	Yes
(E) How should competitive pressure be addressed?	Include all games	Focus on predicted close games, **and/or** critical games for the match, **and/or** critical games for the season
Number of overall specifications: 3 (A) * 3 (B) * 2 (C) * 2 (D) * 8 (E) = 288		

Results

I found no home-field advantage in the Israeli chess leagues. Across the different specifications, the coefficient of playing at home versus away from home was typically equivalent to zero (see Figure 1, next page). For example, the median estimated coefficient was −0.005 and none of the 288 specifications yielded a statistically significant home coefficient at the 1% level. Given the large dataset involved, this nonsignificant pattern could be even more informative than significant results (Abadie, 2020).

Note that the estimates of the other control variables included in the analysis were significant and reasonable. For example, in the basic specification, the coefficient of playing at home was insignificant and negligible in size ($B = -0.002$, $t = -0.99$, $p = 0.321$). However, the coefficient of playing white was positive ($B = 0.039$, $t = 15.12$, $p < 0.0001$), indicating white's first-mover advantage, and the coefficient of Elo difference was positive and consistent in size with the Israeli Elo formula ($B = 0.001$, $t = 158.94$, $p < 0.0001$). An example of a corresponding specification-curve analysis for the (significant) effect of playing white is provided in Appendix 2. In addition, detailed estimates of all of the coefficients of the 288 specifications are provided in the online appendix (http://doi.org/10.17605/OSF.IO/ZFCXB).

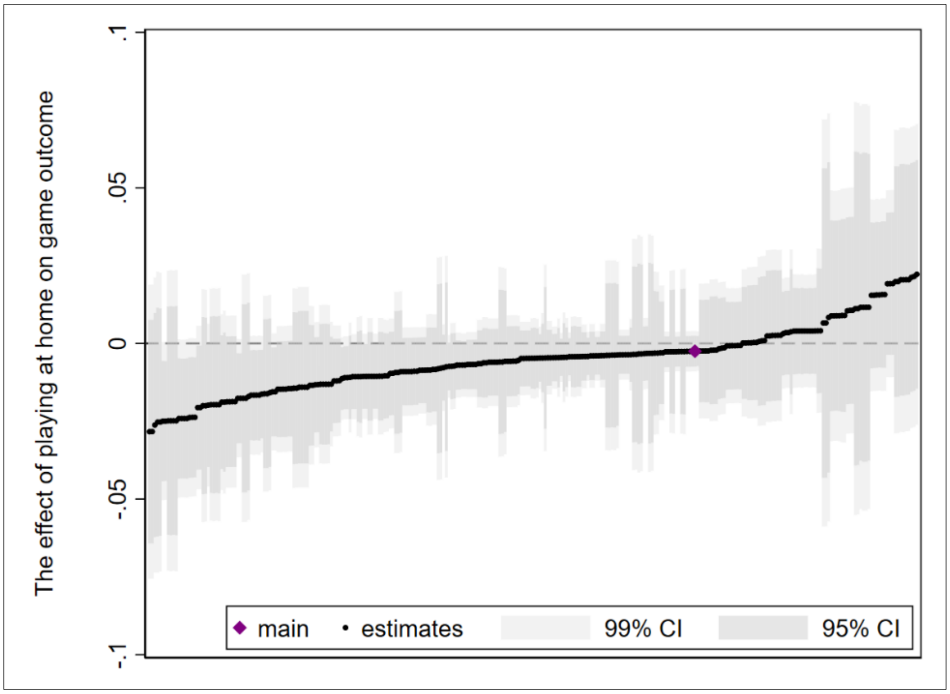

Figure 1. Specification-curve analysis for the effect of playing at home on game outcome. On the x-axis, each dot denotes the estimated home coefficient of one specification, ordered by size, with 95% and 99% confidence intervals. The analytical decisions leading to the 288 depicted specifications are described in the Method section. (The purple dot represents the basic specification.) In addition, detailed estimates of all of the coefficients of the 288 specifications and Stata code to reproduce Figure 1 are provided at http://doi.org/10.17605/OSF.IO/ZFCXB.

Discussion

Tournament chess provides a suitable setting for studying the human territoriality aspect of the home-field advantage. Chess clubs are territories in which many players feel that they belong. But at the same time, because players focus on the 64 chess board squares, familiarity with the territory is unlikely to provide any informational or visuospatial advantages (see Meagher, 2020). In addition, the audiences and referees are inactive, providing a level playing field. Accordingly, finding a home-field advantage in tournament chess could indicate territorial behavior, but the findings of the current investigation challenge that premise.

I did not find any indication of a home-field advantage in the Israeli chess leagues. This observation is conceptually similar to that of Sörqvist et al. (2013), who found no home-field advantage in Swedish chess leagues (after controlling for Elo differences). Moreover, the performed analyses demonstrate that the absence of a home-field advantage is robust to different analytical decisions. For example, playing at home versus away from home remained insignificant regardless of players' levels of expertise or the importance of a given game, although psychological effects on chess performance can vary with those factors (e.g., Smerdon, 2022).

The present study has several limitations. One is its exclusive focus on game outcome as the measure of performance. Future research could study home and away chess players' move-by-move decisions or hormonal responses. Such data could indicate behaviors not necessarily reflected in the game outcomes, such as aggressiveness, risk-taking, and motivation to compete (e.g., Backus et al., in press; Chassy & Gobet, 2020; Dilmaghani, 2022; Mazur et al., 1992). Such research could also help to reconcile the disparity between the current findings and previous ones supporting human territoriality effects in competitive contexts (e.g., Brown & Baer, 2011; Furley et al., 2018; Neave & Wolfson, 2003). Finally, acknowledging the differences between tournament chess and other competitive domains is essential. For example, future research could study domains involving teamwork (e.g., bridge), motor requirements (e.g., darts, billiards), or a meaningful element of chance (e.g., poker), in which playing at home is unlikely to coincide with practical advantages.

Mikhail Tal, the former world chess champion, speculated about the home-field advantage in his autobiography: “For footballers it is without doubt an advantage. Everything is familiar, and they have the support of the fans, but in chess it is by no means certain.” (Tal, 1997, p. 67). His intuition provides a fitting summary of the current investigation.

Endnotes

1. To include more observations, the data were analyzed at the game level, not the match level. This approach does not rule out team effects (see Bisbey et al., 2021), but assumes that such effects are reflected in the outcomes of individual games.

2. For simplicity of interpretation, all of the regressions were estimated by ordinary least squares; fitting a fractional-response model (probit or logit) yielded materially the same results.

3. An alternative approach is to choose a focal player randomly from each game (e.g., Koning, 2011; Smerdon et al., 2020; Zak, 2021). This approach yielded materially the same results, but reduced the number of effective observations in estimations using player fixed effects (due to a larger number of singleton observations).

Supplemental Material

Supplements are available at http://doi.org/10.17605/OSF.IO/ZFCXB. They include a subset of the data used here, a code for reproducing the analyses, and an online appendix.

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Author’s Declarations

The author declares that there are no personal or financial conflicts of interest regarding the research in this article.

The author declares that he conducted the research reported in this article in accordance with the Ethical Principles of the *Journal of Expertise.*

The author declares that he is not able to make the dataset publicly available. A subset of the data is available at http://doi.org/10.17605/OSF.IO/ZFCXB. The full dataset was assembled by the Israeli Chess Federation (https://chess.org.il).

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Appendix 1: Israeli Chess League Regulations

Each player registered in the Israeli Chess Federation can represent a single club team each season. Teams are free to choose in what order to list their players, regardless of Elo rating or other parameters. Once submitted, lists are fixed and changes are not allowed during a season. (Some flexibility regarding the listed order is allowed in the premier league, which was not analyzed here because players in that league compete at central locations.) In each match, the participating players are paired according to the teams' lists: The highest-listed home player plays black against the highest-listed away player; the second-highest-listed home player plays white against the second-highest-listed away player; and so on. Thus, in matches with an odd number of games, the home team plays black more often than it plays white.

Matches should be played only at the registered location of the home team's club. All games in a match should begin simultaneously, according to the schedule predetermined by the Israeli Chess Federation. Games are individual and players are not allowed to communicate with each other.

The Israeli Chess Rating System

The Israeli chess rating system rates any player who has participated in more than one Israeli tournament or league. The system calculates relative skill levels dynamically, considering game outcome and Elo difference (see the equations below). Players are usually given an initial rating of 1400; a candidate master should reach a rating of 2070 and a master should reach a rating of 2290. Players' ratings do not change after every game, but are updated on specific, pre-announced dates based on all the games that have ended since the preceding update (usually once a month).

In Israel (as well as in other countries), the formula is linear. For a focal player i:

$$Elo\ Change_i = K_i * \left[(2 * Game\ Outcome_i - 1) - \frac{Elo\ Difference_i}{400}\right] + A_i,$$

where $Game\ Outcome_i$ is 1 (win), 0.5 (draw), or 0 (loss); external parameters K (game's weight) and A (show-up bonus) depend on the game's time control; and $Elo\ Difference_i$ is a player i's Elo rating minus the rating of his/her opponent. The implied expected game outcome is:

$$Game\ Outcome_i = \frac{1}{2} + \frac{Elo\ Difference_i}{800}.$$

For example, if player i faces an opponent with a rating that is 200 points lower than his/her own, the expected game outcome for player i is 0.75. Elo differences larger than 400 are calculated as if they were 400, so that the expected game outcome is within the unit interval.

Note that the rating system is scaled based on Elo differences, not absolute Elo ratings. For example, the difference between 1400 and 1500 is treated the same as the difference between 1900 and 2000. An active player with a stable skill level is unlikely to be under-rated or over-rated because the rating system is adaptive. As the formula shows, players' ratings increase when they win games and decrease when they lose games. For this reason, ratings are considered highly objective and reliable.

Appendix 2: The Effect of Playing White on Game Outcome

Playing the white (versus black) pieces provides an advantage because white moves first. As expected, across the different specifications, the coefficient of playing white was positive and significant (see Figure A1). For example, the median estimated coefficient was 0.076 and all 288 specifications obtained a statistically significant white coefficient at the 1% level. This pattern contrasts with the insignificant pattern of the effect of playing at home (see the Results section).

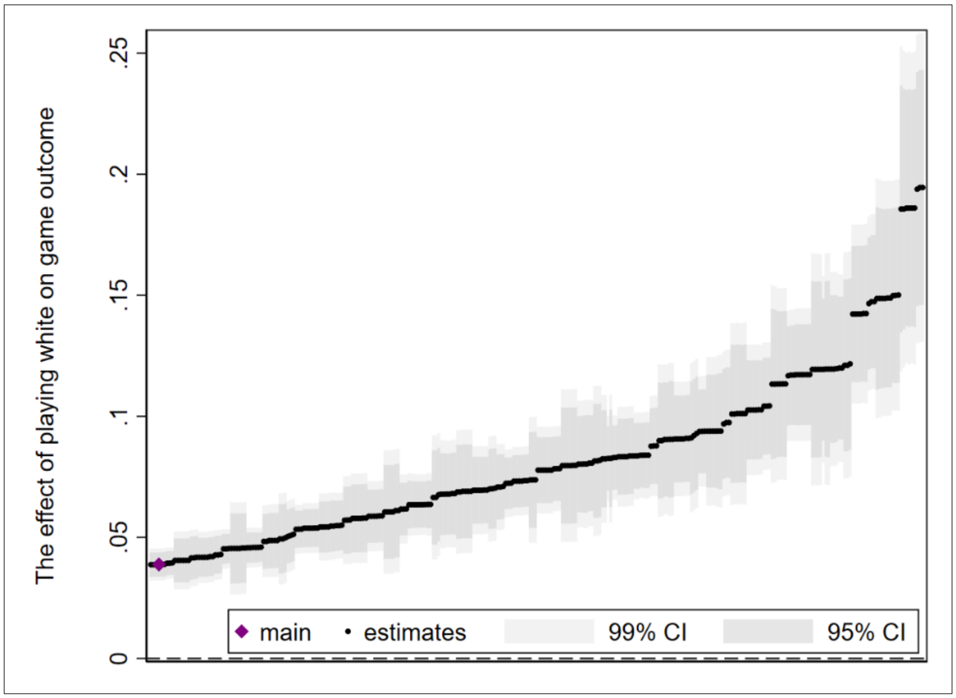

Figure A1. Specification-curve analysis for the effect of playing white on game outcome.

On the x-axis, each dot denotes the estimated white coefficient of one specification, ordered by size, with 95% and 99% confidence intervals. The analytical decisions leading to the 288 depicted specifications are described in the Method section. (The purple dot represents the basic specification.) In addition, detailed estimates of all of the coefficients of the 288 specifications and Stata code to reproduce Figure A1 are provided at http://doi.org/10.17605/OSF.IO/ZFCXB.