Joint Discussion Paper
Series in Economics

by the Universities of

Aachen · Gießen · Göttingen
Kassel · Marburg · Siegen

ISSN 1867-3678

No. 05-2017

Christoph Bühren and Philip J. Steinberg

The impact of psychological traits on performance in sequential tournaments: Evidence from a tennis field experiment

Coordination: Bernd Hayo • Philipps-University Marburg
School of Business and Economics • Universitätsstraße 24, D-35032 Marburg
Tel: +49-6421-2823091, Fax: +49-6421-2823088, e-mail: hayo@wiwi.uni-marburg.de

The impact of psychological traits on performance in sequential tournaments: Evidence from a tennis field experiment

CHRISTOPH BÜHREN*

University of Kassel

Address: Nora-Platiel-Straße 4, 34127 Kassel, Germany

Telephone: +49 561 804-7267

Email: buehren@uni-kassel.de

PHILIP J. STEINBERG[ß]*

Jackstädt Center of Entrepreneurship and Innovation Research, University of Wuppertal

Schumpeter School of Business and Economics, University of Wuppertal

Address: Gaussstrasse 20, 42119 Wuppertal, Germany

Telephone: +49 202 439-3108

Email: steinberg@uni-wuppertal.de

*Both authors contributed equally to this paper and are listed in alphabetical order.

β Corresponding author.

Note: This discussion paper is a preliminary version of the published paper in the Journal of Economic Psychology: https://doi.org/10.1016/j.joep.2018.12.010

The impact of psychological traits on performance in sequential tournaments: Evidence from a tennis field experiment

Abstract

In order to analyze if heterogeneity in psychological traits affects individual performance in sequential tournaments, we conducted a tennis field experiment. In the experiment, we also varied the payment schemes (individual, team, competition) to control for moderating effects of different incentives. Team incentives, risk taking, and self-esteem reduced performance whereas a preference towards competition enhanced it. On average, we observe a second mover advantage. However, individuals' psychological traits, such as self-esteem or self-efficacy, can turn a second mover into a first mover advantage. Our results shed new light on the discussion of first vs. second mover advantages and performance under pressure. Study findings have implications for psychological requirements of competitive and team tasks in business settings.

Keywords: Performance under pressure; experiment; psychological traits; second mover advantage; tennis; sequential tournaments

JEL: C93, D81, Z20, M52

PsychInfo: 3020, 3630, 3720, 2360

Highlights

We conducted a tennis experiment with various degrees of teamwork and competition

Psychological traits influence individuals' performance in sequential tournaments

Psychological traits determine whether first or second mover advantages exist

Individual´s performance is lower when they are not paid individually but as a team

We discuss the sports economics and business implications of our results

1. Introduction

Economic agents face pressure in their markets; their competitions frequently take the form of tournaments. For instance, previous research addresses labor market competition on the individual level (e.g. Kocher et al., 2012). While sequentially observing their competitor's performance, individuals need to perform at their best in such tournaments in order to prevail. Whereas some agents thrive in a competitive environment and perform at their best, others "choke"[1] and underperform (González-Díaz et al., 2012 vs. Otten, 2009). In a wide debate on individuals' performance in competitive environments, findings are contradictory. Some studies suggest that first movers in sequential tournaments perform better (Klaasen and Magnus, 2014), while other studies find the opposite (Feri et al., 2013). Further findings from a third group, indicate that there is no evidence for or against a first mover advantage (Kocher et al., 2012). A possible explanation for contradictory findings in the literature lies in the unobserved heterogeneity of individuals in tournament settings. For instance, individuals' psychological traits may determine whether they thrive or choke in competitive environments. Most assessment centers acknowledge this and make use of psychological tests in order to analyze if candidates are able to perform well under pressure. However, after being hired it is difficult to evaluate which personality trait triggers success in competitive environments.

We conducted an experiment in a setting where individuals could earn monetary payoffs in sequential tournaments while performing a task familiar to them – similar to individuals in real market settings. In the experiment, we use three incentive schemes (treatments): individual payment, team payment, and competition (winner takes all). Not all types of tournaments need to explicate in their incentive scheme that two individuals compete against each other. For example, many companies use an incentive scheme that rewards individuals based on their group's performance, although, at the end of the day, employees compete for promotion.

The experimental subjects are non-professional tennis players that participate in a tennis serve-task organized during an official tennis tournament. We go beyond prior sport tasks observing performance in competitive environments. First, we observe the heterogeneity of individuals in competitive settings by taking into account information on individuals' psychological traits. Second, to broaden the narrow view of competitive environments, we vary the incentive schemes, thereby changing the competitive (and social) pressure in the sequential tournaments. As a result, we offer new insights on how different levels of inter-subject competitive pressure in sequential tournaments influence individual performance. Third, in many real-life settings – such as two employees competing for a promotion inside the same team – individuals may alternate roles, being first mover (with their own performance being observed by their

[1] We follow Hill et al., 2009, p.206 and define choking as "a process whereby the individual perceives its resources as insufficient to meet the demands of the situation, and concludes with a significant drop in performance".

competitor) or second mover (observing their competitor's performance). We acknowledge this fact by alternating the first and second mover within the same competition. This alternating scheme is typical for tennis players since it replicates a tennis tiebreak situation with the player serve pattern ABBAABBAA and so forth.

We find that in the group incentive scheme (teamwork), player performance is in general worse than in the individual incentive scheme, whereas no significant performance difference occurs between the competitive and the individual incentive scheme.

Having a look at the impact of heterogeneity in psychological traits, we observe that individuals with high self-esteem and high preferences towards risks perform worse in sequential tournaments. In contrast, individuals with high preferences for competition perform better. Moreover, we find that individuals' self-esteem, self-efficacy, risk-preference and locus of control have a fundamental impact on the relationship between player position (first vs. second mover) and individual performance. Depending on their psychological traits, individuals can either experience a first or a second mover advantage within the same (experimental) setting. This finding is able to explain contradictory results of earlier studies on the effect of player position on performance in sequential tournaments.

Our paper is organized as follows: Section 2 shortly summarizes related literature on psychological pressure in competitive environments. Section 3 describes our study design, specifically the experiment and questionnaire design, as well as additional data from a national tennis database. Section 4 provides descriptive statistics and results from our econometric models including robustness checks. Section 5 concludes and discusses the possible implications of our study.

2. Related literature

2.1. First vs. second mover advantage under psychological pressure

A recent line of research has analyzed psychological pressure in competitive environments, focusing on whether player position (first vs. second mover) has an influence on performance. Considering possible advantages that arise from player position (first vs. second mover), a first mover advantage may lie in putting pressure on the second player after scoring (Apesteguia and Palacios-Huerta, 2010). Possible second mover advantages can arise if the first mover scores, as well as if s/he does not. If the first player did not score, the other one gets the opportunity to put pressure on him or her. Furthermore, the second mover can be more relaxed if the first player did not score; something especially relevant with score probability below 50% (e.g. Kolev et al., 2010). On the other hand, if the first player did score, this might motivate the second mover and foster his or her motivation (Berger and Pope, 2011).

Apesteguia and Palacios-Huerta (2010) made the economic analysis of psychological pressure in sports popular among economists. Analyzing 129 penalty shoot-outs in soccer from 1976 until 2003, they found a strong first mover advantage: 60.5 % of teams who started the shoot-out won it. The authors argue that psychological pressure on the second team is high because they are in most cases, one goal behind the first team. However, Kocher et al. (2012) revealed that Apesteguia and Palacios-Huerta (2010) used a biased sample. Kocher et al. (2012) could not replicate the first mover advantage in a data set containing all penalty shoot-outs from 1976 until 2003, in which the order of kicks is known (=540 shoot-outs). They found a 53.3% winning probability for the team who kicked first, which was not significantly different from 50%.

Until 2003, in soccer, the team who won the coin toss was the first to start penalty shoot-outs. After July 2003, the winner of the coin toss could decide whether to start or not. In 20 shoot-outs after July 2003, Apesteguia and Palacios-Huerta (2010) observed 19 choices to kick first. Their short additional survey revealed that among 242 amateur and professional soccer players and coaches, no one wanted to kick second and less than 5% were indifferent; 96% stated that they wanted to put pressure on the second team.

Kolev et al. (2010) found a similar pattern among National Hockey League (NHL) teams. Before the 2006/2007 Season, home teams had to start second in penalty shoot-outs. From the 2006/2007 Season onwards, home teams have been able to decide if they want to start first or second. Kolev et al. (2010) observed that most home teams decided to start first (64% in 2006/2007, 65% in 2007/2008, 80% in 2008/2009, and 82% in 2009/2010). However, home teams´ winning probability was significantly lower after the rule-change than before, indicating a second mover advantage and overconfidence of home teams. A survey among 233 hockey fans discovered that fans were more aware of the second mover advantage than the professional players, 76% thinking that home teams should start second.

Klaassen and Magnus (2014) find a first mover advantage in Wimbledon tennis singles matches from 1992 until 1995, but only for the first game in the first set. Irrespective of quality and gender of a player, the server of the first game in the first set had a 6 to 8 percentage point higher probability to win the game compared to his or her other service games in the match. They also get that weaker players, and especially women, performed worse at important points (e.g. break points). González-Díaz et al. (2012) observe in US open men´s singles from 1994 until 2006, that successful players perform better than unsuccessful players at important points.[2] González-Díaz et al. (2012) measure the importance of a point, calculating the product of the probabilities that the outcome of the point determines the outcome of the current game, set, and match. For example, the point at 15:15 in the very beginning of the first set is not as important as a break point (30:40) at 3:4 in the final set.

[2] This sounds tautological. But note that due to the rules of tennis, a player can win the match although his or her opponent won more points.

The subjects in the studies previously discussed are among the highest paid professionals in the world and their success or failure in their tasks (e.g. kicking the penalty) most likely has large monetary consequences. Apesteguia and Palacios-Huerta (2010) argue that for this reason findings of their natural experiment can be generalized to business settings. We do not fully agree with their argument. The highest paid soccer players are preselected professionals with a very high level of mental strength who are very familiar with highly competitive situations. We think that this subject pool can be compared to highly paid managers in top positions. However, what about "normal" employees with a greater variance of mental strength who also find themselves in competitive environments? To gain a broader understanding on the effect of psychological differences, we add insights of amateur players to the literature of pressure in competitive surroundings.

Feri et al. (2013) conducted a basketball free throw shootout with 57 amateur basketball players. Two players shot five free throws each. If the score was tied, they alternatingly shot one free throw each until there was a winner. Feri et al. (2013) could not find a first mover advantage. In contrast, the second movers performed slightly better than the first movers, especially in the tiebreak. We extended the field experiment of Feri et al. (2013) by paying our subjects according to their performance in three different treatments - Individual (baseline), Team, and Competition. The advantage of being first or second mover is likely to vary in different incentive schemes. Apesteguia and Palacios-Huerta (2010) list psychological reasons for a possible first mover advantage in a competitive framework; however, a team setting could reverse their reasoning in favor of a second mover advantage: Whereas one may feel pressure after seeing the opponent score, one could be encouraged by seeing the teammate score.

2.2. Incentive schemes

Individual vs. tournament incentives (Competition)

The seminal work of Lazear and Rosen (1981) theoretically shows that the effort of risk neutral agents should be equal under individual vs. tournament incentive schemes. In the lab experiment of Hannan et al. (2008) with a cognitive task, performance in tournaments was, in general, better than individually paid performance. However, their participants performed, on average, worse in tournaments compared to the individual incentive scheme if they obtained precise feedback on their relative performance. Bull et al. (1987) find in two person guessing games that the variance of effort levels under tournament incentives is much larger than under piece-rate incentives. Similarly, van Dijk et al. (2001) observed in their cognitive real effort experiment, that performance is higher but more variable in tournaments than with individual payment. High variance of tournament performance indicates that personal characteristics seem to influence performance. The often replicated result of Niederle and Vesterlund (2011) is that men´s performance but not women´s, reacts positively to competition. They attribute this disparity to gender differences in overconfidence and attitudes toward competition. However, even within the same gender these personal traits differ. Our sports economics field study complements the literature by analyzing how personal traits influences performance under competitive sequential tournaments.

Empirical work in sports economics usually finds that the amount and difference of prize-money assigned to tournament ranks positively impact individual performance (see e.g. Frick, 2003, for an overview). However, according to Lynch and Zax (2000) better performer self-select into tournaments with higher prize money. Furthermore, such studies usually cannot compare individuals´ tournament performance to their performance under individual incentives.

Individual vs. group incentives (Team)

In a lab experiment with a perceptual motor task, London and Oldham (1977) found that subjects perform better when they are individually paid compared to a payment according to the average performance of two subjects. In contrast, the results of Ladley et al. (2015) indicate that team performance is better under group vs. individual incentives in an agent-based model simulation. In a real effort task, van Dijk et al. (2001) find evidence of free riding in teams but also increased effort by the majority of team members. Differences between individuals´ and teams´ average performance were not statistically significant. The interesting question is which personal traits trigger free riding vs. higher motivation in teams? The results of the real effort experiment of Ivanova-Stenzel and Kübler (2011) suggest that there are gender differences in team performance. While they found no gender gap in single sex teams, results suggest that men perform better in mixed teams. However, when team competitions were introduced, men were found to perform better than women in single sex teams and not in mixed teams. In our tennis experiment, we only analyze single sex teams (without competition between teams), and still find that personal traits influence individual performance in teams.

In a sports economics context, Frick (2003) finds that team bonuses increase team performances in the German Bundesliga. However, this result indicates that variable payment induces more effort/better performance than a fixed payment and does not compare variable individual vs. variable team incentives.

The discussed incentive schemes are likely to affect the performance and first vs. second mover advantages of heterogeneous subjects differently according to their psychological traits. Previous sport economics studies did not or could not take into account the impact of psychological traits on performance. We try to fill this gap by measuring subject´s psychological traits that are likely to influence performance under pressure.

2.3. Psychological traits and coping with pressure

Scholars in various fields have analyzed the relationship between psychological traits and individual performance. We concentrate on:

1. The self-evaluation traits from theory of core self-evaluation (Judge et al. (1997))
2. Risk preferences
3. Competitive preferences

Based on the theory of core self-evaluation, we selected the three psychological traits that have been found to have the strongest impact on job performance (see meta-analysis by Judge and Bono, 2001): self-esteem, self-efficacy and locus of control[3]. Self-esteem indicates the overall subjective value that individuals place on themselves as a person (Judge and Bono, 2001). Wallace and Baumeister (2002) do not observe any effect of self-esteem on students' performance in arithmetic problem-solving tasks. Yet applied to job performance, Baumeister et al. (2003) suggest that individuals who feel better about themselves perform better. Although Judge and Bono (2001) find a positive relationship of self-esteem and job performance in their meta-analysis, it is important to mention that potential reverse causality may be an issue in many purely correlational and non-experimental studies.

Self-efficacy relates to Bandura's (1977, 1997) concept of perceived self-efficacy and the social-cognitive theory with the underlying notion that individuals are heterogeneous in the extent to which they associate success and failure with their own abilities and competencies. Individuals with high self-efficacy are theorized to set higher objectives, create discrepancies and outperform individuals with low self-efficacy (Bandura, 1997; Sitzmann and Yeo, 2013). Findings of meta-analyses on the direct effect of self-efficacy on individual performance are mixed. While Judge and Bono (2001) find a positive effect of self-efficacy on job performance, Sitzmann and Yeo (2013) find no or – at best – weak evidence for such a relationship when taking into account linear trajectories. Apart from the direct impact on individual performance, there is evidence that self-efficacy is an important moderator in contexts with individual performance as a dependent variable. Raub and Liao (2012) find a positive effect of the interaction of initiative climate at the establishment level and self-efficacy on employee performance; Lu et al. (2016) also find a positive moderation effect of self-efficacy on the relationship between challenge stressors and job performance.

Locus of control displays the extent to which individuals believe to have control over outcomes (e.g. Rotter, 1966). Low values indicate an individual's external locus of control (control over task outcomes

[3] Judge et al. (1997) have shown that the self-evaluation traits can be grouped together as higher order construct. We therefore decided that it is not necessary to display all of them, nevertheless keeping some variation by selecting more than one.

depends very much on external factors), while high values indicate an individual's internal locus of control (control over task outcomes depends very much on own ability and performance). Spector (1982) suggests that an internal locus of control is associated with individual success in organizations. Chen and Silverthorne (2008) find that a high internal locus of control predicts high levels of individuals' job performance.

Risk taking is widely studied in economics in settings with high uncertainties, among others in sports economics (e.g. Grund et al., 2013; Lehman and Hahn, 2013). Nevertheless, the impact of risk propensity on individual performance remains unresolved. Fairlie and Holleran (2012) find that individuals who are more prone towards risk benefit more from entrepreneurship training than more risk-averse individuals. However, this is a limited, possible implication for the impact of risk-preference on job performance.

Lastly, individuals' competitive preferences may be decisive for their performance in sequential tournaments. An individual's competitive preference somewhat describes an individual's "enjoyment of interpersonal competition" (Spence and Helmreich, 1983, p. 41). While some individuals enjoy competition, others shy away from it. The preference for competition is very likely to affect performance within competitions. Since individuals with strong competitive preference enjoy being in a competition, they are likely to feel more comfortable in inter-personal competition and perform better than individuals with low competitive preference. E.g., Lam (2012) finds a positive relationship between high competitive preference and individual performance.

To our knowledge, we are the first to control for psychological traits in a field experiment with different degrees of pressure.

3. Design of the study

In order to enrich the evidence of individual performance in sequential tournaments and under competitive pressure, we derive our sample from a rich database, consisting of three single data sets from different sources. We surveyed participants of an official tennis tournament in advance of the event, on their psychological traits, more precisely self-esteem, self-efficacy, risk and competitive preferences, as well as locus of control. We matched the data of the well-established psychological scales with career performance data from a national information database of the German Tennis Association, and data from a tennis experiment with three different incentive schemes that we conducted during the tournament.

3.1. Questionnaire

Prior to competing in the tournament and participating in the experiments, players were asked to complete a questionnaire on a voluntary basis[4]. Participants in the questionnaire were informed that the

[4] All participants of the questionnaire received a 2€-discount on the tournament fee.

questionnaire contained their player's ID to allow us to match questionnaire data with data from the experiments and from the national information database of the German Tennis Association (from mybigpoint.tennis.de). Participants were aware that after merging the data sets we were going to de-identify all data. Out of 47 players who competed in the tournament, 43 completed the questionnaire. Due to missing values, we are able to use 36 questionnaires in the final sample. The questionnaire contains information on demographic characteristics (job position, education) as well as measures of psychological traits, which are outlined in the following.

Self-esteem was measured using the Self-Esteem Scale by Robins et al. (2001) translated to German. The single-item scale is designed as an alternative measure to the Rosenberg self-esteem scale (Rosenberg, 1965) and measures respondents' global self-esteem. The predictive validity is very similar to the Rosenberg scale (Robins et al., 2001). The scale in the questionnaire was presented on a 7-point Likert-scale (De Cremer et al., 2005).

Self-efficacy was measured using the German version of the general perceived self-efficacy scale (Schwarzer and Jerusalem, 1995, 1999). It measures the optimistic self-efficacy: An individual's belief in its own competencies to cope with difficult situations and achieve goals. Although Bandura (1997) has argued for contextualizing self-efficacy, general beliefs are useful when intending to reflect personality differences (Urbig and Monsen, 2012). The multi-item variable consists of ten single items and factor analysis revealing high scale reliability ($\alpha = 0.8534$). The mean (30.91) and standard deviation (3.82) of self-efficacy in our sample is comparable to those of most samples in the literature (mean approx. 29, sd. approx. 4) (Schwarzer and Jerusalem, 1999; Schwarzer, et al., 1999), indicating reliability of our questionnaire data.

Risk preferences were assessed following questions from the German Socio-Economic Panel (SOEP) (e.g., wave 31, year 2014). Using these questions is useful because the survey instruments have been validated in experiments (Dohmen et al., 2011). We surveyed participants on their risk preferences in various domains of life (driving, leisure and sports, professional career, health and trust in other people). We used a 7-point Likert scale for all six items, ranging from 1 (completely disagree) to 7 (completely agree), reaching $\alpha = 0.6523$ for our multi-item construct.

We assessed participants' competitive preferences (*competitiveness*) expanding the single-item of the Flash Eurobarometer Survey on Entrepreneurship 2009 (No. 283) of the European Commission ("*I like situations in which I compete with others")* (e.g. Bönte, 2015) to a multi-item variable. Factor analysis reveals the highest scale reliability ($\alpha = 0.7021$) for the following three domains: "…in *general*", *"… in personal life*" and *"… in leisure and sports"*. The items on competitive preferences were constructed with a 7-point Likert scale from 1 (completely disagree) to 7 (completely agree).

Lastly, locus of control (*LOC*) was measured using a scale with ten items, which has been used in the SOEP survey waves of 2005 and 2010 and is based on a scale by Rotter (1966) and Krampen (1981). The scale used in the SOEP has been the basis for numerous literature on locus of control (e.g. Caliendo et al., 2015; Piatek and Pinger, 2010). Each item was measured on a 7-point Likert scale, ranging from 1 (completely disagree) to 7 (completely agree). We constructed a single uni-dimensional factor capturing the participants' internal locus of control with nine of these ten items. Due to small factor loadings we leave out social and political commitment, resulting in a scale reliability of α=0.6394, which is relatively high for Rotter's locus of control scale.

3.2. Tournament and data from the information database of the German Tennis Association

The tennis tournament was an official tournament certified by the Westfälischer Tennisverband e.V., a regional sub association of the German Tennis Federation (Deutscher Tennisbund e.V.- DTB). Players competed in tournaments split by gender.

The German Tennis Federation categorizes all tennis players that participate in official tennis tournaments and/or official league matches into one of 23 levels (called Leistungsklasse - LK) depending on their level of performance in the past year. LK1 stands for the best performing players, LK23 is the lowest level. Players who are categorized with LK1 are part of the German Top 700 tennis ranking of the German Tennis Federation. (See http://wtv.de/lk-systemlk-turniere for a detailed description in German.)

Playing ability, indicating players' performance measures and *gender*, were taken from the information database of the German Tennis Federation (mybigpoint.tennis.de), which provides information on players' profiles and match statistics for all official matches (tournament and league matches). For our analysis we transformed the playing ability, so that the highest variable value (23) relates to the highest performance level (LK1). This way the coefficient of playing ability can intuitively be interpreted without in-depth knowledge of the German Tennis LK-system.

3.3. Experiment

After each tournament match, players were asked to participate in one of the three "service exercises" described below. This means, we have observations of the same player in different treatments and with different opponents. Thus, our experimental data allows for between- and within-subject comparisons. The task was to hit serves from the deuce side in a 1.5 m^2 big field on the backhand side of a right-handed opponent. The second bounce of the ball had to be behind the baseline in order to demand an appropriate speed of the service. The player who won the toss of a coin could decide to start the experiment first or second (*Coin toss* captures if the focal player had won the coin toss and whether he decided to start or not.). Every player had 10 serves (*Shot number* indicates the number of the service from the focal player within one experiment (game)); we applied the same alternation as in tennis (match-)tiebreaks, see Figure

1). Thus, a possible first mover advantage is alternating from player to player after each “round” (pair of services). Player A has one single first move and one single last move. Players might evaluate this as an advantage, however it can also be regarded as a disadvantage as most players’ believe it is easier to hit more serves in a row than single serve. All other pairs of serves contain a second move followed by a first move (see Figure 1).

>> Insert Figure 1 about here <<

The alternation of a possible first mover advantage used in our experiment seems to fit real life business situations better than a strict setting where the second mover is able to screen the first mover’s overall performance before having to perform in the competition herself. In real life situations, like competing for a promotion in a job, it is more likely that being first or second mover is alternating from time-to-time. This implies that strictly having one individual perform a task before the other individual does, like in soccer shoot-outs, or basketball free throws (e.g. Kocher et al., 2012; Feri et al., 2013), may not be comparable to real life situations. Likewise, possible psychological pressure does not only affect the second player, but both players in alternating ways. For these reasons, we believe that our experimental setting better suits the given real-life examples frequently used in literature on psychological pressure (Apesteguia and Palacios-Huerta, 2010) than prior experimental settings. In the following, we describe our treatments:

Individual

In the individual treatment, players received an individual incentive. Every subject got 0.50 € per scored shot. This treatment serves as a baseline and can be regarded as the treatment with a medium competition level.

Team

In the team treatment, players received payments according to a team incentive scheme. Competition was reduced by means of team incentives. Both players formed a team and the team payoff was divided equally. For every scored shot of a player, the team got 0.50 €. The team treatment has the lowest competition level. (Yet it can be argued that players might feel more peer pressure in comparison to the individual treatment.)

Competition

In the competition treatment, players received a competitive incentive scheme. The incentives induced a highly competitive environment: The player who managed to score most was rewarded with 5 €, the other player received no reward. In the case of a tie after 10 serves each, we conducted a tiebreaker in which the players alternatively served once until there was a winner. Based on our tennis specific alternation described above, the second player would start the tiebreak. The competition treatment clearly has the highest competition level in our experiment.

In our analysis we distinguish between shots that were still relevant for the monetary payoff of the participants (worthy shots) and shots that were no longer related to the potential outcome. We capture this through a dummy variable *worthy*. *Opponent's previous shot* and *player's previous shot* are variables that indicate whether the respective previous shot has been successful or not (0 if there has been no previous shot; -1 if it was unsuccessful, 1 if it was successful).

4. Results

4.1. Descriptive analysis and univariate analysis

Our sample consists of 1192 observations in three treatments, observed in 60 games with 38 participants. Some of the participants competed in more than one game.

As a preceding step to our analysis of player position and psychological traits, we analyze the effect of incentive schemes in univariate analysis to give a broad overview of the data. Figure 2 illustrates the score rates in percent by incentive scheme, player position, and gender. The solid red line illustrates first movers, while the dotted blue line illustrates second movers. As can be seen in this figure, male tennis players performed better in Competition than in Team (taking together first and second movers 36.83% vs. 29.56% on average, two-sided Fisher exact test: p=0.072). For men with high playing ability (LK 1 – LK 14, see Section 3.2), we observe the largest discrepancy between these two treatments: In Competition 43.33% shots were successful and in Team 33.00% (p=0.099). There are two possible explanations for this finding: 1. Competition enhances performance for (good) male players and 2. There are free-riding tendencies in teams, especially among men. We did not find any significant differences between Individual and Competition or between Individual and Team. Having a look at the players´ position when taking the shot, our data indicates that bad performance in the team treatment is caused by first movers. However, the second mover advantage is not significant for men in univariate analysis.

>> Insert Figure 2 about here <<

On average, woman performed worse than men in our experiment. This is not surprising since women in our sample had on average a lower playing ability (LK 20) than men (LK 12). This difference in gender performance is driven by the competition treatment (on average 36.83% of men vs. 22.95% of women, two sided Fisher exact test: p=0.004) and especially by first movers in the competition treatment (36.10% vs. 13.11%, p<0.001). Competition seems to improve male performance and worsen female performance, which is consistent with previous research.[5] For female players, we do not observe any significant effects of the different incentive schemes on average. However, our findings indicate a strong first mover disadvantage for women, especially in the competition scheme (13.11% vs. 32.79%, p=0.008). As a result, the shot success of female first movers in the individual incentive scheme (26.00%) is higher than in the competition treatment (13.11%, p=0.095). This could be explained by psychological pressure women feel as a first mover in our competition treatment.

Performance in our experiment is influenced by psychological traits: For instance, a two-sided Mann-Whitney U test finds that players´ self-esteem was lower for serves that hit the target than for serves that missed the target (p=0.003). In contrast, players´ risk taking of successful (vs. unsuccessful) serves is on average higher, but only significantly higher in the competition treatment (p=0.016).

Table 1 contains mean values, standard deviation, minimum and maximum values and the correlation matrix for all variables of the final sample used for the econometric analysis.[6]

>> Insert Table 1 about here <<

4.2. Multivariate analysis

When controlling for psychological traits in multivariate methods, we find clear evidence that sheds new light on the issue of individual performance under psychological pressure in sequential tournaments.

To ensure the robustness of our findings, we apply a set of different estimation and test procedures. To account for the hierarchical structure of our data and the fact that we have repeated measurements for the same statistical unit (i.e. average of 20 shots per game and 10 shots per subject, with individuals participating in several games and treatments), we estimate a multilevel mixed-effects linear model[7] (Graubard and Korn, 1996) with a random intercept at the individual and game level and a random intercept at the individual level. Although the repeated measurements for the same statistical unit do not allow us to estimate fixed effects models, the use of a mixed-effects model allows us to account for the fact that multiple repetitions (in our case shots) from the same subject should not be regarded as independent observations by adding, e.g., a random effect for subject (Winter, 2013). Additionally, we add past shot performance to our models, more specifically the players' and the opponents' previous shot

[5] See e.g., Niederle and Vesterlund (2011) for an overview on gender and competition.

[6] As we had to exclude two subjects because they did not answer the questionnaire, our final sample for the multivariate analysis consists of 965 observations.

[7] In a mixed-effects model, both fixed effects as well as random effects for the unobserved heterogeneity (e.g. of individuals) are estimated. These models are also known as multilevel models or hierarchical linear models.

success, which can be interpreted as adding additional dynamic fixed effects to our model[8]. This accounts for additional heterogeneity among individuals and controls for potential effects caused by momentum (Lehman and Hahn, 2013). Furthermore, one benefit of using experimental data is that in our multivariate analysis we do not need to use fixed effects to control for heterogeneity caused by, e.g., the course or stadium played in, or the year an event took place, which often needs to be done in analyses with professional sports data (cf. e.g. Hickman and Metz, 2015). In our experiment, we held such parameters constant. Our dependent variable *Shot success* is binary. In order to ensure the simplicity of interpreting our results, especially the interaction effects, we decided to estimate linear models as our main models in the paper (Tables 2 and 3). Nevertheless, we estimate multilevel mixed-effects probit models (Table 4) and multilevel mixed-effects logistic models (results upon request) to check the robustness of our results with the best-fitting models possible. Lastly, we apply various measurements of individuals' playing (performance) levels.

Model 1 (in Table 2) includes all control variables, the experimental treatments and the psychological traits. As expected, players' playing level has a statistically significant influence on shot success. Players with higher tennis skills perform better in the experiment (an increase of one skill level, ranging from 1 to 23, increases the success probability by 3%, all else equal). There is also a positive and statistically significant effect of shot number on shot success, suggesting that individuals increase the likelihood of successful shots over time and within one game - for example due to learning effects. The variables measuring individuals' self-esteem, self-efficacy, risk- and competitive preference, as well as internal locus of control, allow us to observe heterogeneity in the players' psychological traits. Surprisingly, individuals with high levels of self-esteem perform worse in the experiment than individuals with lower levels (p=0.001). The finding is not uncommon. Literature lacks clear evidence that high self-esteem leads to better performance (Baumeister et al., 2003; Wallace and Baumeister, 2002). One explanation is that individuals with high self-esteem tend to be overconfident, which can decrease performance (Bühren and Krabel, 2015). Likewise, individuals with high-risk preferences also perform worse in the experiment, its coefficient being statistically significant (p=0.069). Since success in the experiment requires a high level of accuracy, individuals that served with less risk seem to have performed better in this specific situation of psychological pressure. Lastly, individuals with high levels of competitive preferences performed better in the experiment (p=0.062). Keeping all else equal, the probability of scoring increases by almost 15% when competitive preferences increase by one standard deviation. Since such individuals have a positive attitude towards competitive environments, their superior performance in the experiment is not surprising. These individuals are less likely to choke under competitive pressure since they enjoy being in a competitive environment. Bönte (2015) even argues that these individuals obtain a positive utility for just

[8] Including past performance as dynamic fixed effects is for example done in research on firm performance (Grimpe and Sofka, 2016).

being in the competition, independent from winning or losing. Players' self-efficacy and locus of control do not significantly affect shot success. In regards to self-efficacy, this is not surprising since meta-studies also fail to find a significant relation between self-efficacy and individual performance (Sitzmann and Yeo, 2013).

Regarding the incentive schemes, we observe a significantly negative team treatment effect (p=0.063). Tennis players in teams had a lower probability to score than tennis players in the individual incentive scheme. Keeping all else equal, individuals in the team treatment had a 24% lower probability of scoring. Our findings suggest that individuals who – at least to some extent – enjoy individual competition, such as tennis players, perform worse in a setting where they are evaluated depending on group performance. In this sense, group incentive schemes may lower players' motivation to perform at their best. Furthermore, the negative team treatment effect can be explained by free riding. Nevertheless, there is an alternative explanation: Players may feel more pressure when their individual performance constitutes to other individuals' payoffs. They may choke when trying to give their best performance for the group.

>> Insert Table 2 about here <<

In the following models, we keep the treatment dummies in order to control for the effects of teamwork and competition. Nevertheless, we concentrate our analysis on the (main and) interaction effects of psychological traits with player position on performance. Model 2 (in Table 2) adds the effect of a player's position (first versus second mover) to our analysis. The effect is negative and statistically significant (p=0.087)[9], indicating a tendency towards a second mover advantage. Being a second mover ceteris paribus increases the probability of shot success by almost 15%. When considering that hitting consecutive serves could allow players to adjust their serve, one would expect that the second serve (in our experiment this is the first mover's serve) would indicate higher scoring probabilities. As a result, we might have even underestimated a possible second-mover advantage for our setting.

Model 3 (in Table 3) additionally includes the interaction effect of player position (First mover) and self-esteem on shot success. The coefficient of First mover is statistically significant (p=0.017) and negative. The coefficient of self-esteem is also statistically significant (p=0.000) and negative. The coefficient of their interaction term is positive and statistically significant (p=0.036). Figure 3 graphically illustrates the interaction effect at predictive margins, with low self-esteem plotted in a range between minimum and maximum value. The vertical (light grey, dotted) lines indicate the mean value of self-esteem minus/plus

[9] In an additional analysis we tested the interaction effect of player position (first-versus second-mover) with the score-difference within the experiment. We find a positive interaction of score-difference on player position (β=-.04; .04; p= 0.040), indicating that the second mover advantage is even stronger, when the focal player is in the lead. Results are available upon request.

one standard deviation (Aiken and West, 1991). First movers are represented as a solid red line and second movers as dashed blue line. As previously discussed, individuals with high self-esteem performed worse in our experiment. This is consistent for both player positions (first as well as second mover). While individuals with low self-esteem perform better as second movers, individuals with high self-esteem values perform better as first movers. Since our experiment has an average success rate below 50%, individuals with low self-esteem are especially motivated as second movers to perform better than the opponent (which is the first mover), as it may push their levels of self-worth. The figure (as well as the following figures) illustrates that depending on the level of a psychological trait, individuals experience either a first or a second mover advantage. This implies that when analyzing a sample only consisting of individuals with a certain dimensional peculiarity in a psychological trait (e.g. professional sport athletes), one might find a significant impact of player position, which is biased by the sample selection.

>> Insert Table 3 about here <<

>> Insert Figure 3 about here <<

Model 4 (Table 3) contains the interaction effects of participants' self-efficacy and player position. The coefficient of First mover is negative and statistically significant (p=0.031) and the coefficient of self-efficacy is negative but not statistically significant. The coefficient of the interaction effect of First mover and self-efficacy is positive (p=0.049). Our results are in line with prior studies that have found self-efficacy to be an important moderator for performance-relationships (cf. Raub and Liao, 2012). Figure 4 graphically illustrates the interaction effect[10]. While we witness a second mover advantage for individuals with low self-efficacy, individuals with high self-efficacy seem to have a small first mover advantage. Since they do not observe instantaneous past performance from their opponent, outside influences for first movers in the competition are low. Thus, the extent to which first movers believe in their own ability to reach goals has a stronger and positive influence on their scoring probability. For second movers this belief in one's own ability may be overshadowed by outside influences in the competition, such as the opponent's performance. Consequently, the second movers´ self-efficacy only has a minor influence on scoring probability. In general, individuals with high self-efficacy - players who believe in their ability to reach goals and complete tasks - perform better in our experiment and their player position (first versus second mover) was less influential.

[10] Procedures of illustration for this and the following figures are identical to the procedure for Figure 3.

>> Insert Figure 4 about here <<

Model 5 (Table 3) contains the interaction effects of individual's risk preferences and player position (First mover) on shot success. The coefficient of the interaction term is negative and statistically significant (p=0.020). Figure 5 illustrates the relationship. Only individuals with extreme risk-averse preferences exhibit a first mover advantage, while the majority of participants who are somewhat more prepared to take risks exhibit a second mover advantage. While player position has a small influence on individuals who are less willing to take risks, more risk affine individuals perform better as second movers. One possible explanation is that as first movers they lack the comparison with the opponent and fail to accurately determine the level of risk needed (and risk too much). As second movers they have an anchoring point which may help them to more efficiently estimate the amount of risk needed to perform well.

>> Insert Figure 5 about here <<

Model 7 (Table 3) estimates the interaction effect of individual's locus of control and player position on shot success. The coefficient of the interaction term is positive and statistically significant (p=0.046), and the interaction is graphically illustrated in Figure 6. High values of the locus of control variable indicate an internal locus of control (players who believe that the outcome of a task very much depends on their own actions), while low values indicate an external locus of control (players who believe that the outcome of a task depends on external factors rather than on themselves). In our task, first movers with an internal locus of control perform better: No matter what will happen apart from a player's own action, they believe in the impact of their performance. Second movers perform better when they have an external locus of control. Keeping in mind the low average scoring probability of the experiment (below 50%), they may feel that the external factors favor them winning and perform with stronger belief in their own success as second movers. Furthermore, the theory of "choking under pressure" because of high concentration levels on task execution may explain why it could be better for players to believe that external factors influence success more than internal factors in highly competitive surroundings (Beilock and Gray, 2007; Hill et al. 2010). Model 6 (Table 3) shows that there is no significant interaction effect between competitive-preferences of individuals and player position on shot success. An individual's competitive preference does not seem to have an effect on the relationship between player position and individual performance in a competitive environment.

>> Insert Figure 6 about here <<

Besides exploring the interaction effects of psychological traits, respectively incentive schemes with player position, we also explored if the incentive scheme has an effect on the relationship between certain traits, player position and performance (e.g. is the effect of risk-preference on player position and performance especially relevant under certain incentive schemes?). However, we find no clear indication for such interaction effects (results available upon request). This might be explained partly by the weak effect we find for incentive schemes in our specific setting. In sequential tournaments in which the incentive scheme plays a more decisive role, such effects might nevertheless be present and should be explored in future research.

We perform several robustness checks to ensure the reliability of our findings. First, since our dependent variable is binary (which ultimately indicates the probability of shot success), a linear model may not provide an optimal fit. We therefore estimate a multilevel mixed effects probit model (Table 4), as well as a multilevel mixed effects logit model (results available upon request). As becomes apparent from the log-likelihood comparison, the models from the probit and logistic estimation provide the best fit, and all the estimated models fully support our findings from the linear model. Our findings are fully supported by the probit and logistic models. Since the interaction effects of the linear mixed model can be easily interpreted, we report the linear mixed models as our main models and estimate probit and logistic regressions as robustness checks[11].

>> Insert Table 4 about here <<

Second, there are several ways of estimating the players' skill levels (general playing ability levels), and deciding which one to use might influence our results. In Table 5 (appendix), we estimate our main models (Model 2 from Table 2 with all main effects and Models 3 to 7 from Table 3 with the interaction effects) with different measures of individual playing ability. We add the playing level of the opponent in the experiment, since the opponent's playing ability (which is in most cases known to the focal player) might influence the focal player's performance. In Model 14, we use a different measure instead of the focal player's ability level and add the difference between playing level of the focal player and the

[11] In a multilevel mixed effects probit and logistic model the Inteff-command (cf. Ai and Norton, 2003) to investigate interaction effects in non-linear models, cannot be used.

opponent, capturing the gap between both players' ability levels. We also use this measure in Models 15 to 19 with the interaction effects. All the estimated models corroborate our findings.[12]

5. Conclusion and discussion

This paper has analyzed individual performance in sequential tournaments. We conducted an experiment that allowed us to analyze the effects of player position (first versus second mover) and individuals' psychological traits on individual performance under different incentive schemes (individual, team, and competitive). The impact of heterogeneity in psychological traits on the performance as a first vs. second mover under competition vs. teamwork has been neglected by previous studies. In our study, we combine methods used in economics, psychology, and sports science. We find that individuals with high levels of competitive preferences, low self-esteem and high-risk aversion perform better. Team incentives compared to individual payment induced worse performance, and on average we observe a second mover advantage.

We observe interesting relationships between psychological traits and player position (first vs. second mover). Whereas individuals with high self-esteem have a first mover advantage, individuals with low self-esteem experience a second mover advantage. Our findings help to better understand contradictory results from earlier studies on the effect of player position on performance in sequential tournaments (e.g. Feri et al., 2013; Klaasen and Magnus, 2014; Kocher et al., 2012). Depending on the peculiarities and variance of individuals' psychological traits in a study sample, one may find either first or second mover advantages. For instance, psychological traits of professional sport athletes and amateurs may systematically differ.

Since the performed task as well as the size of the stakes in our experiment were not uncommon to the participants, we believe that our findings have broader empirical implications. This first step towards understanding the impact of psychological traits on performance in sequential tournaments will hopefully stimulate future research on performance under psychological pressure.

Our experimental design distinguishes between peer (team) and monetary pressure. In our sample we find that team incentives reduce individual performance. However, we cannot distinguish if this result stems from free riding of individual athletes or from peer pressure. Tennis (or similar sports) is a good test object for these questions as it is an individual sport that is also played in a team. Based on our findings, we believe that more research is fruitful to investigate the role of teamwork in individual sport. We also find that in the competitive setting (monetary pressure) women are especially prone to experience a second

[12] Results for the models with main and interaction effects and adding the control for opponent's playing level (total) instead of the difference to the focal player also corroborate our findings and are available upon request.

mover advantage. Future studies could focus on this gender effect. As usual for non-professional tournaments, women are underrepresented in our study.

We think that our results are not just relevant in the context of sports but deliver insights for the individual and team performance in business settings. Individual and competitive payments seem to better fit to sequential tasks than team payment. Our findings further suggest that it makes sense to take into account psychological traits of employees before designing incentive schemes and before assigning tasks to individuals or teams. Employees should self-select for competitive versus non-competitive task-forces because their self-assessment (of whether they like competition or not) seems to be a good predictor of success in competitions. In competition between workers, individuals with internal locus of control, high self-efficacy, and self-esteem should be encouraged to start first.

Acknowledgements:

We thank the board members of Tennisclub Einsal e.V. for allowing us to conduct the experiment during their tournament. Furthermore, we thank participants of the ESEA 2016 conference in Groningen as well as Björn Frank, Werner Bönte, Diemo Urbig, and Matthias Schulz for helpful comments. Philip Steinberg is grateful for the financial support from the Dr. Werner Jackstädt-Stiftung.

References

Ai, C., Norton, E.C., 2003. Interaction terms in logit and probit models. Economics letters 80(1), 123-129.

Aiken, L.S., West, S.G., 1991. Multiple regression: Testing and interpreting interactions. Newbury Park, London: Sage.

Apesteguia, J., Palacios-Huerta, I., 2010. Psychological pressure in competitive environments: evidence from a randomized natural experiment. The American Economic Review 100(5), 2548-2564.

Bandura, A., 1977. Self-efficacy: toward a unifying theory of behavioral change. Psychological Review 84(2), 191-215.

Bandura, A., 1997. Self-efficacy: The exercise of control. New York: Freeman.

Baumeister, R.F., Campbell, J.D., Krueger, J.I., Vohs, K.D., 2003. Does high self-esteem cause better performance, interpersonal success, happiness, or healthier lifestyles?. Psychological science in the public interest 4(1), 1-44.

Beilock, S.L., Gray, R. 2007. Why do athletes choke under pressure? In: Tenenbaum, G., Eklund, R.C. (Eds.). Handbook of Sport Psychology, Third Edition Hoboken, NJ: Wiley, 425-444.

Berger, J., Pope, D., 2011. Can losing lead to winning?. Management Science 57(5), 817-827.

Bönte, W., 2015. Gender differences in competitive preferences: new cross-country empirical evidence. Applied Economics Letters 22(1), 71-75.

Bühren, C., Krabel, S., 2015. Individual performance after success and failure: A natural experiment. MAGKS Joint Discussion Paper Series in Economics No. 05-2015, Marburg.

Bull, C., Schotter, A., Weigelt, K., 1987. Tournaments and piece rates: An experimental study. Journal of political Economy 95(1), 1-33.

Caliendo, M., Cobb-Clark, D.A., Uhlendorff, A., 2015. Locus of Control and Job Search Strategies. The Review of Economics and Statistics 97(1), 88-103.

Chen, J.C., Silverthorne, C., 2008. The impact of locus of control on job stress, job performance and job satisfaction in Taiwan. Leadership & Organization Development Journal 29(7), 572-582.

De Cremer, D., van Knippenberg, B., van Knippenberg, D., Mullenders, D., Stinglhamber, F., 2005. Rewarding leadership and fair procedures as determinants of self-esteem. Journal of Applied Psychology 90(1), 3-12.

Dohmen, T.J., Falk, A., Huffman, D., Sunde, U., Schupp, J., Wagner, G.G., 2011. Individual Risk Attitudes: Measurement, Determinants, and Behavioral consequences. Journal of the European Economic Association 9(3), 522-550.

Fairlie, R.W., Holleran, W., 2012. Entrepreneurship training, risk aversion and other personality traits: Evidence from a random experiment. Journal of Economic Psychology 33(2), 366-378.

Feri, F., Innocenti, A., Pin, P., 2013. Is there psychological pressure in competitive environments?. Journal of Economic Psychology 39, 249-256.

Frick, B., 2003. Contest theory and sport. Oxford Review of Economic Policy 19(4), 512-529.

González-Díaz, J., Gossner, O., Rogers, B.W., 2012. Performing best when it matters most: Evidence from professional tennis. Journal of Economic Behavior & Organization 84(3), 767-781.

Graubard, B.I., Korn, E.L., 1996. Modelling the sampling design in the analysis of health surveys. Statistical Methods in Medical Research 5(3), 263-281.

Grimpe, C., Sofka, W., 2016. Complementarities in the search for innovation—Managing markets and relationships. Research Policy 45(10), 2036-2053.

Grund, C., Höcker, J., Zimmermann, S., 2013. Incidence and consequences of risk- taking behavior in tournaments—evidence from the NBA. Economic Inquiry 51(2), 1489-1501.

Hannan, R.L., Krishnan, R., Newman, A.H., 2008. The effects of disseminating relative performance feedback in tournament and individual performance compensation plans. The Accounting Review 83(4), 893-913.

Hickman, D.C., Metz, N.E., 2015. The impact of pressure on performance: Evidence from the PGA TOUR. Journal of Economic Behavior & Organization 116, 319-330.

Hill, D.M., Hanton, S., Fleming, S., Matthews, N., 2009. A re-examination of choking under pressure. European Journal of Sport Science 9(4), 203–212.

Hill, D.M., Hanton, S., Matthews, N., Fleming, S., 2010. `Choking in sport: A review', International Review of Sport and Exercise Psychology 3(1), 24-39.

Ivanova-Stenzel, R., Kübler, D., 2011. Gender differences in team work and team competition. Journal of Economic Psychology 32(5), 797-808.

Judge, T.A., Locke, E.A., Durham, C.C., 1997. The dispositional causes of job satisfaction: A core evaluations approach. Research in Organizational Behaviour 19, 151-188.

Judge, T.A., Bono, J.E., 2001. Relationship of core self-evaluations traits—self-esteem, generalized self-efficacy, locus of control, and emotional stability—with job satisfaction and job performance: A meta-analysis. Journal of applied Psychology 86(1), 80

Klaassen, F., Magnus, J.R., 2014. Analyzing Wimbledon: The power of statistics. Oxford University Press, USA.

Kocher, M.G., Lenz, M.V., Sutter, M., 2012. Psychological pressure in competitive environments: New evidence from randomized natural experiments. Management Science 58(8), 1585-1591.

Kolev, G.I., Pina, G., Todeschini, F., 2010. Overconfidence in competitive environments: evidence from a quasi-natural experiment. mimeo.

Krampen, G., 1981. IPC-Fragebogen zur Kontrollüberzeugung. Göttingen: Hogrefe.

Ladley, D., Wilkinson, I., Young, L., 2015. The impact of individual versus group rewards on work group performance and cooperation: A computational social science approach. Journal of Business Research 68(11), 2412-2425.

Lam, L. W., 2012. Impact of competitiveness on salespeople's commitment and performance. Journal of Business Research 65(9), 1328-1334.

Lazear, E.P., Rosen, S., 1981. Rank-Order Tournaments as Optimum Labor Contracts. The Journal of Political Economy 89(5), 841-864.

Lehman, D.W., Hahn, J., 2013. Momentum and organizational risk taking: Evidence from the National Football League. Management Science 59(4), 852-868.

London, M., Oldham, G.R., 1977. A comparison of group and individual incentive plans. Academy of Management Journal 20(1), 34-41.

Lu, C.Q., Du, D.Y., Xu, X.M., 2016. What Differentiates Employees' Job Performance Under Stressful Situations: The Role of General Self-Efficacy. The Journal of Psychology 150(7), 837-848.

Lynch, J.G., Zax, J.S., 2000. The rewards to running prize structure and performance in professional road racing. Journal of Sports Economics 1(4), 323-340.

Niederle, M., Vesterlund, L., 2011. Gender and competition. Annual Review of Economics 3(1), 601-630.

Otten, Mark, 2009. Choking vs. clutch performance: A study of sport performance under pressure, Journal of Sport and Exercise Psychology 31, 583-601.

Piatek, R., Pinger, P., 2010. Maintaining (Locus of) Control? Assessing the Impact of Locus of Control on Education Decisions and Wages (No. 5289). Institute for the Study of Labor (IZA).

Raub, S., Liao, H., 2012. Doing the right thing without being told: joint effects of initiative climate and general self-efficacy on employee proactive customer service performance. Journal of Applied Psychology 97(3), 651.

Robins, R.W., Hendin, H.M., Trzesniewski, K.H., 2001. Measuring Global Self-Esteem: Construct Validation of a Single-Item Measure and the Rosenberg Self-Esteem Scale. Personality and Social Psychology Bulletin 27(2), 151-161.

Rosenberg, M., 1965. Society and the adolescent self-image. Princeton, NJ: Princeton University Press.

Rotter, J.B., 1966. Generalized Expectancies for Internal Versus External Control of Reinforcement. Psychol Monographs: General & Applied 80(1), 1-28.

Schwarzer, R., Jerusalem, M., 1995. Generalized Self-Efficacy scale. In: Weinman, J., Wright, S., Johnston, M. (Eds.). Measures in health psychology: A user’s portfolio. Causal and control beliefs. Windsor, England: NFER-NELSON, 35-37.

Schwarzer, R., Jerusalem, M. (Eds.)., 1999. Skalen zur Erfassung von Lehrer- und Schülermerkmalen: Dokumentation der psychometrischen Verfahren im Rahmen der Wissenschaftlichen Begleitung des Modellversuchs Selbstwirksame Schulen. Berlin: Freie Universität Berlin.

Schwarzer, R., Mueller, J., Greenglass, E., 1999. Assessment of perceived general self-efficacy on the Internet: Data collection in cyberspace. Anxiety, Stress, and Coping 12(2), 145-161.

Sitzmann, T., Yeo, G., 2013. A Meta- Analytic Investigation of the Within- Person Self- Efficacy Domain: Is Self- Efficacy a Product of Past Performance or a Driver of Future Performance?. Personnel Psychology 66(3), 531-568.

Spector, P.E., 1982. Behavior in organizations as a function of employee's locus of control. Psychological Bulletin 91(3), 482-497.

Spence J.T., Helmreich R.L., 1983. Achievement motives and behavior. In: Spence, J.T. (Ed.).Achievement and achievement motives: psychological and sociological dimensions. San Francisco, CA: Freeman, 10-74.

Urbig, D., Monsen, E., 2012. The structure of optimism:“Controllability affects the extent to which efficacy beliefs shape outcome expectancies”. Journal of Economic Psychology 33(4), 854-867.

Van Dijk, F., Sonnemans, J., Van Winden, F., 2001. Incentive systems in a real effort experiment. European Economic Review 45(2), 187-214.

Wallace, H.M., Baumeister, R.F., 2002. The performance of narcissists rises and falls with perceived opportunity for glory. Journal of Personality and Social Psychology 82(5), 819-834.

Winter, B., 2013. A very basic tutorial for performing linear mixed effects analyses. arXiv preprint arXiv:1308.5499. Retrieved December 29, 2016, from http://arxiv.org/pdf/1308.5499.pdf

Tables

Table 1

Descriptive statistics for regression sample (N=965).

	Variables	Mean	sd	Min	Max	1	2	3	4	5	6	7	8
1	Shot Success	0.33	0.47	0	1	1							
2	Gender (female)	0.29	0.45	0	1	-0.09*	1						
3	Playing level	11.19	8.20	1	23	0.17*	-0.56*	1					
4	Shot number	5.53	2.91	1	14	0.10*	0.00	-0.01	1				
5	OPS	-0.37	0.90	-1	1	0.04	-0.14*	0.18*	0.1*	1			
6	PPS	-0.33	0.89	-1	1	0.08*	-0.09*	0.17*	0.00	0.04	1		
7	Coin toss	0.20	0.65	-1	1	-0.01	-0.05	0.15*	0.00	0.06	0.01	1	
8	Worthy	0.96	0.19	0	1	-0.05	0.06	-0.08*	-0.28*	-0.01	-0	-0.01	1
9	First_mover	0.50	0.50	0	1	-0.05	0.00	0.00	0.01	0.00	0.05	-0	0.04
10	Self-esteem	4.68	0.93	3	7	-0.10*	-0.15*	0.05	0.00	0.01	-0.08*	-0.07*	0.03
11	Self-efficacy	3.11	0.37	2.5	3.8	0.01	-0.06	0.03	0.00	0.03	0.02	-0.12*	0.01
12	Risk	3.90	0.76	2.6	5.8	0.03	-0.10*	0.41*	-0.01*	0.07*	0.01	0.12*	0.01
13	Competitiveness	4.68	0.95	3	7	0.07*	-0.38*	0.38*	-0.01*	0.15*	0.07*	0.06	-0.03
14	LOC	4.59	0.35	3.9	5.3	0.01	-0.41*	0.19*	0.01	0.11*	0.02	0.00	-0.08*

	Variables	9	10	11	12	13	14
9	First_mover	1					
10	Self-esteem	0.00	1				
11	Self-efficacy	0.00	0.39*	1			
12	Risk	-0.00	-0.14*	-0.25*	1		
13	Competitiveness	0.00	0.31*	-0.11*	0.35*	1	
14	LOC	0.01	0.14*	0.24*	-0.05	0.20*	1

Notes: n=965; * Indicates significant correlations at $p<0.05$. *OPS=Opponent's previous shot; PPS=Player's previous shot.*

Table 2

The effects of player position (first versus second mover) and psychological traits on individual performance.

Independent variables:	Dependent variable: Shot Success	
	Model 1	Model 2
Fixed effects		
Gender (female)	-0.00	-0.01
	(0.06)	(0.06)
Playing level	0.01***	0.01***
	(0.00)	(0.00)
Shot number player	0.02***	0.02***
	(0.01)	(0.01)
Opponent's previous shot	-0.01	-0.01
	(0.02)	(0.02)
Player's previous shot	-0.00	-0.00
	(0.02)	(0.02)
Coin toss	-0.02	-0.02
	(0.03)	(0.03)
Worthy	-0.00	0.01
	(0.08)	(0.08)
Group Incentive Scheme	-0.08*	-0.08*
	(0.04)	(0.04)
Comepetitive Incentive Scheme	-0.02	-0.02
	(0.04)	(0.04)
Self-esteem	-0.09***	-0.09***
	(0.03)	(0.03)
Self-efficacy	0.09	0.09
	(0.06)	(0.06)
Risk	-0.06*	-0.06*
	(0.03)	(0.03)
Competitiveness	0.05*	0.05*
	(0.03)	(0.03)
LOC	-0.04	-0.04
	(0.07)	(0.07)
First mover		-0.05*
		(0.03)
Constant	0.43	0.44
	(0.38)	(0.38)
Random effects		
sd (player)	0.08***	0.08***
	(0.02)	(0.02)
sd (experiment)	0.00***	0.00***
	(0.00)	(0.00)
sd (res)	0.45***	0.45***
	(0.01)	(0.01)
Statistics		
Wald chi2 (p)	44.49***	47.66***
Log likelihood	-601.5	-600
LR test vs. linear model, chi2 (p)	7.98***	7.87**
N of clusters (player)	36	36
N of clusters (experiment)	96	96
N of observations	965	965

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; base group for treatment is the individual incentive scheme.

Table 3

The interaction effects of player position (first versus second mover) and psychological traits on individual performance.

Independent variables:	Dependent variable: Shot Success				
	Model 3	Model 4	Model 5	Model 6	Model 7
Fixed effects					
Gender (female)	-0.00	-0.01	-0.00	-0.01	-0.00
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Playing level	0.01***	0.01***	0.01***	0.01***	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Shot number player	0.02***	0.02***	0.02***	0.02***	0.02***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Opponent's previous shot	-0.01	-0.01	-0.01	-0.01	-0.01
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Player's previous shot	0.00	-0.00	-0.00	-0.00	-0.00
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Coin toss	-0.02	-0.02	-0.02	-0.02	-0.02
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Worthy	0.01	0.00	0.01	0.00	0.00
	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
Group Incentive Scheme	-0.08*	-0.08*	-0.08*	-0.08*	-0.08*
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Competitive Incentive Scheme	-0.02	-0.02	-0.02	-0.02	-0.02
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Self-esteem	-0.12***	-0.09***	-0.09***	-0.09***	-0.09***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Self-efficacy	0.09	0.02	0.09	0.09	0.09
	(0.06)	(0.07)	(0.06)	(0.06)	(0.06)
Risk	-0.06*	-0.06*	-0.01	-0.06*	-0.06*
	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)
Competitiveness	0.05*	0.05*	0.05*	0.03	0.05*
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
LOC	-0.04	-0.04	-0.04	-0.04	-0.12
	(0.06)	(0.06)	(0.06)	(0.07)	(0.08)
Group Incentive Scheme	-0.08*	-0.08*	-0.08*	-0.08*	-0.08*
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Competitive Incentive Scheme	-0.02	-0.02	-0.02	-0.02	-0.02
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
First mover	-0.35**	-0.52**	0.30**	-0.20	-0.79**
	(0.15)	(0.24)	(0.15)	(0.14)	(0.37)
First mover * Self-esteem	0.06**				
	(0.03)				
First mover * Self-efficacy		0.15**			
		(0.08)			
First mover * Risk			-0.09**		

			(0.04)		
First mover * Competitiveness				0.03	
				(0.03)	
First mover * LOC					0.16**
					(0.08)
Constant	0.60	0.69*	0.27	0.52	0.82*
	(0.39)	(0.40)	(0.39)	(0.39)	(0.42)
Random effects					
sd (player)	0.08***	0.08***	0.08***	0.08***	0.08***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
sd (experiment)	0.00***	0.00***	0.00***	0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
sd (res)	0.44***	0.44***	0.44***	0.45***	0.44***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Statistics					
Wald chi2 (p)	52.51***	51.92***	53.49***	48.92***	51.92***
Log likelihood	-597.8	-598.1	-597.3	-599.5	-598.1
LR test vs. linear model, chi2(p)	7.65**	7.69**	7.75**	7.81**	7.78**
N of clusters (player)	36	36	36	36	36
N of clusters (experiment)	96	96	96	96	96
N of observations	965	965	965	965	965

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; base group for treatment is the individual incentive scheme.

Table 4

Robustness Checks for main models with multilevel mixed effects probit estimations.

Independent variables:	Dependent variable: Shot Success					
	Multilevel mixed-effects probit model					
	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13
Fixed effects						
Gender (female)	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09
	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)
Playing level	0.03***	0.03***	0.03***	0.03***	0.03***	0.03***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Shot number player	0.05***	0.05***	0.05***	0.05***	0.05***	0.05***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Opponent's previous shot	-0.03	-0.03	-0.02	-0.03	-0.03	-0.03
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Player's previous shot	-0.01	-0.00	-0.00	-0.01	-0.01	-0.01
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Coin toss	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06
	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
Worthy	0.03	0.02	0.02	0.03	0.03	0.03
	(0.23)	(0.23)	(0.23)	(0.23)	(0.23)	(0.23)
Group Incentive Scheme	-0.23*	-0.23*	-0.23*	-0.23*	-0.23*	-0.23*
	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)
Competitive Incentive Scheme	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06
	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
Self-esteem	-0.27***	-0.37***	-0.27***	-0.27***	-0.27***	-0.27***
	(0.08)	(0.10)	(0.08)	(0.08)	(0.08)	(0.08)
Self-efficacy	0.27	0.26	0.04	0.27	0.27	0.27
	(0.20)	(0.20)	(0.23)	(0.20)	(0.20)	(0.20)
Risk	-0.18*	-0.17*	-0.18*	-0.05	-0.18*	-0.18*
	(0.10)	(0.10)	(0.10)	(0.11)	(0.10)	(0.10)
Competitiveness	0.14*	0.14*	0.14*	0.14*	0.10	0.14*
	(0.08)	(0.08)	(0.08)	(0.08)	(0.09)	(0.08)
LOC	-0.12	-0.12	-0.12	-0.12	-0.12	-0.36
	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.24)
First mover	-0.15*	-1.06**	-1.58**	0.87*	-0.57	-2.35**
	(0.09)	(0.46)	(0.74)	(0.45)	(0.42)	(1.13)
First mover * Self-esteem		0.20**				
		(0.10)				
First mover * Self-efficacy			0.46*			
			(0.24)			
First mover * Risk				-0.26**		
				(0.11)		
First mover * Competitiveness					0.09	
					(0.09)	
First mover * LOC						0.48*

						(0.24)
Constant	0.02	0.49	0.75	-0.47	0.24	1.11
	(1.19)	(1.21)	(1.24)	(1.21)	(1.20)	(1.31)
Random effects						
var (player)	0.06***	0.06***	0.06***	0.06***	0.06***	0.06***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
var (player>experiment)	0.00	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Statistics						
Wald chi2 (p)	44.66***	48.70***	48.50***	49.55***	45.80***	48.32***
Log likelihood	-570.6	-568.5	-568.7	-567.9	-570.1	-568.7
LR test vs. probit model, chi2 (p)	7.65***	7.48***	7.26***	7.55***	7.52***	7.46***
N of clusters (player)	36	36	36	36	36	36
N of clusters (experiment)	96	96	96	96	96	96
N of observations	965	965	965	965	965	965

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; base group for treatment is the individual incentive scheme.

Figures

Figure 1

Alternating first and second mover advantage.

Figure 2

Score rates in percent by incentive scheme, player position, and gender.

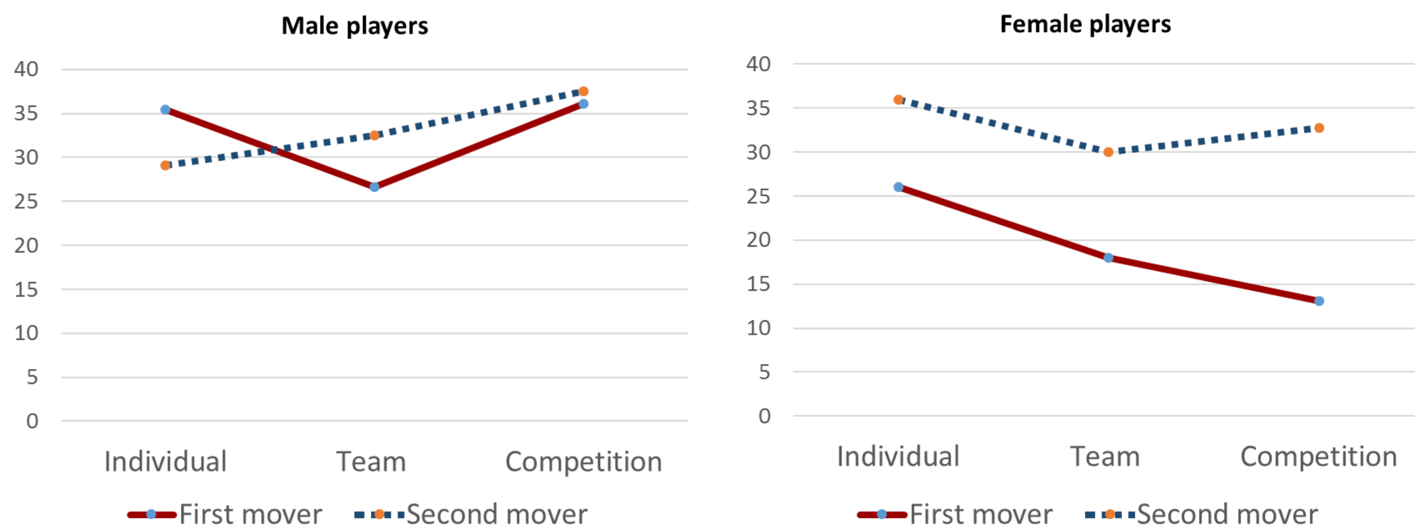
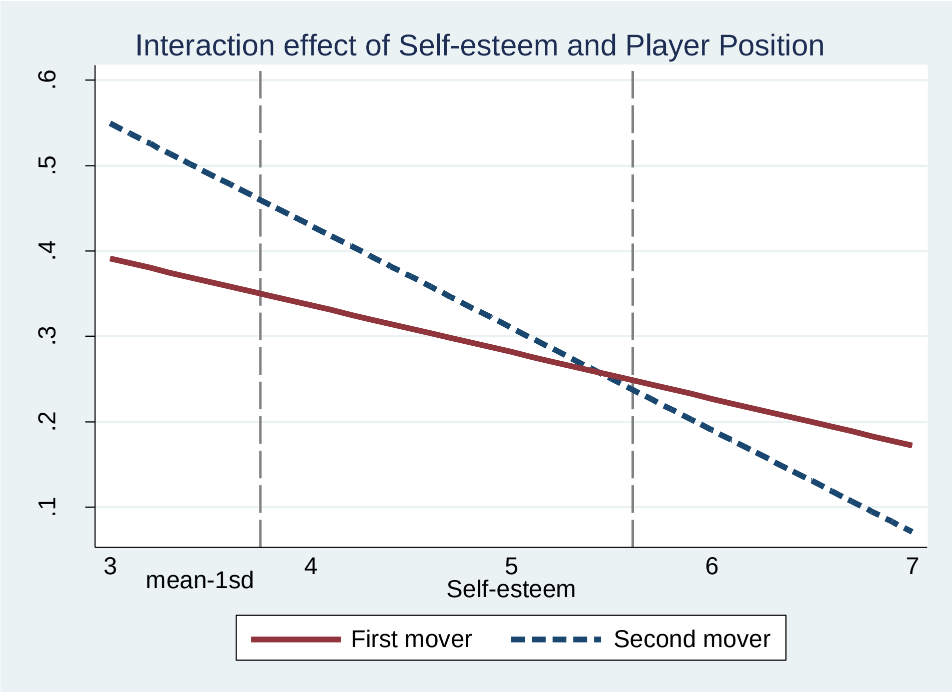


Figure 3

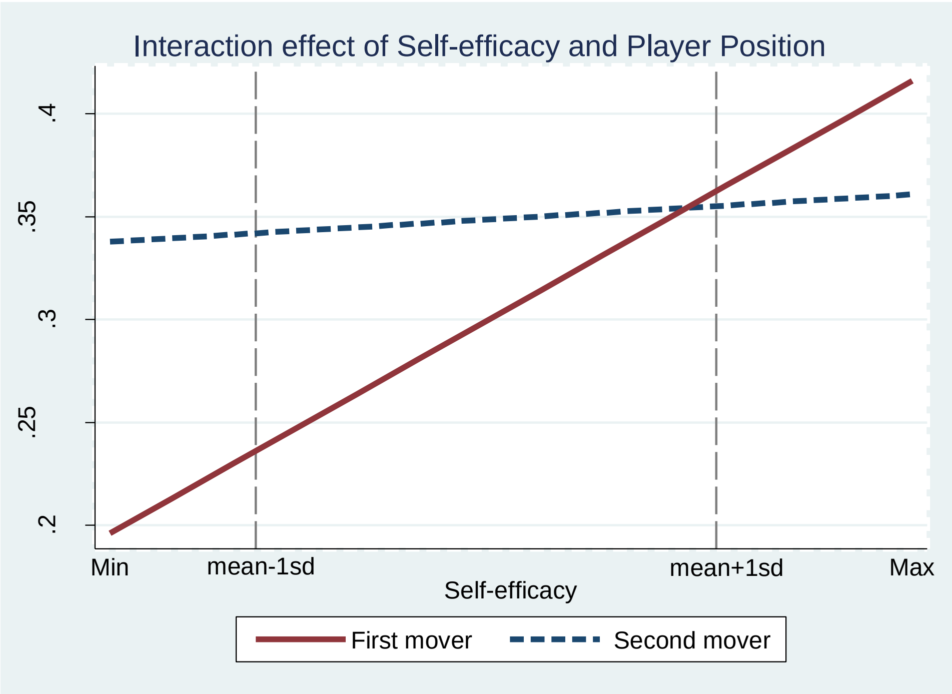
Interaction of Player Position (First mover) and Self-esteem.



Note: Interaction effects calculated on basis of the multilevel mixed-effects linear model (Table 3) and predictive margins. Dependent (Shot success) is displayed at the fixed portion of its linear prediction.

Figure 4.

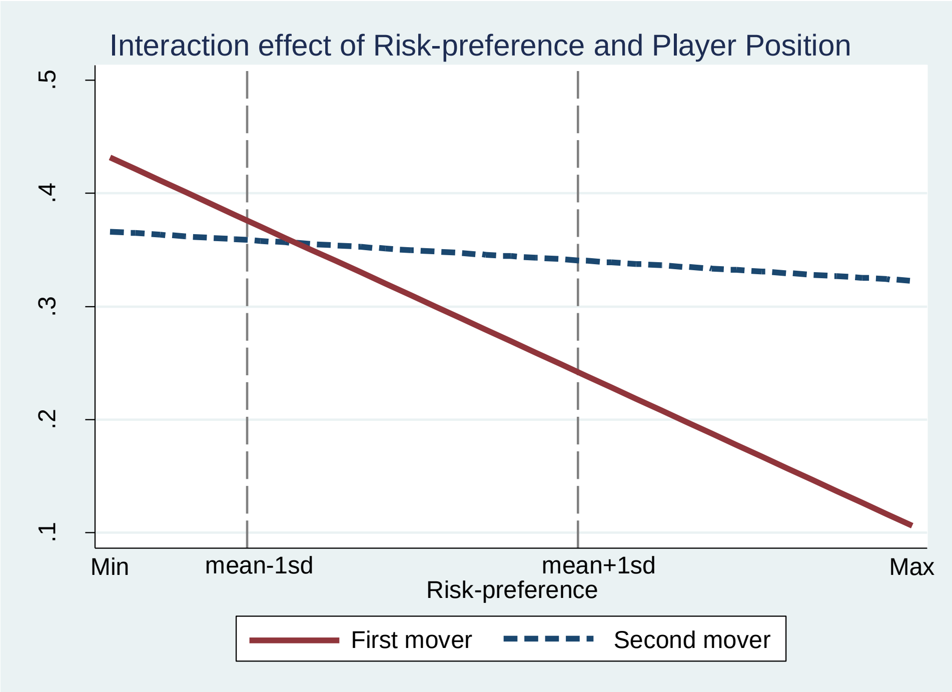
Interaction of Player Position (First mover) and Self-efficacy.



Note: Interaction effects calculated on basis of the multilevel mixed-effects linear model (Table 3) and predictive margins. Dependent (Shot success) is displayed at the fixed portion of its linear prediction.

Figure 5.

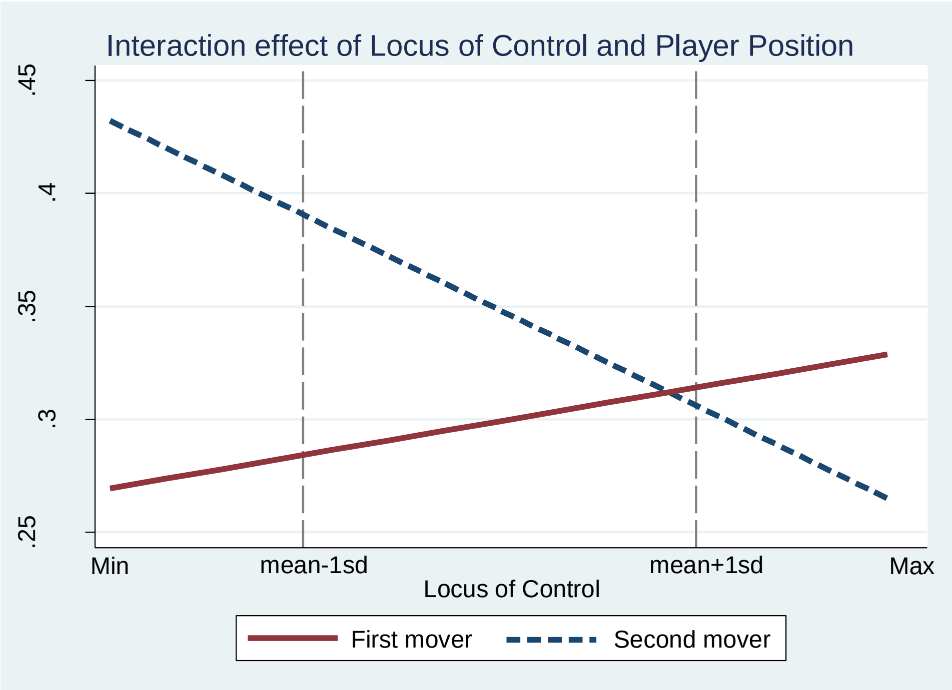
Interaction of Player Position (First mover) and Risk-preference.



Note: Interaction effects calculated on basis of the multilevel mixed-effects linear model (Table 3) and predictive margins. Dependent (Shot success) is displayed at the fixed portion of its linear prediction.

Figure 6.

Interaction of Player Position (First mover) and Locus of Control.



Note: Interaction effects calculated on basis of the multilevel mixed-effects linear model (Table 3) and predictive margins. Dependent (Shot success) is displayed at the fixed portion of its linear prediction.

Appendix

Table 5. Robustness Checks for main models with alternative playing ability measures.

Independent variables:	Dependent variable: Shot Success					
	Model 14	Model 15	Model 16	Model 17	Model 18	Model 19
Fixed effects						
Gender (female)	-0.11*	-0.11*	-0.11*	-0.11*	-0.11*	-0.11*
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Playing level difference	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Shot number player	0.02***	0.02***	0.02***	0.02***	0.02***	0.02***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Opponent's previous shot	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Player's previous shot	-0.00	0.00	0.00	0.00	-0.00	-0.00
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Coin toss	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Worthy	-0.00	-0.00	-0.01	-0.00	-0.00	-0.00
	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
Group Incentive Scheme	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Competitive Incentive Scheme	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Self-esteem	-0.09***	-0.12***	-0.09***	-0.09***	-0.09***	-0.09***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Self-efficacy	0.12*	0.12*	0.04	0.12*	0.12*	0.12*
	(0.07)	(0.07)	(0.08)	(0.07)	(0.07)	(0.07)
Risk	-0.02	-0.02	-0.02	0.02	-0.02	-0.02
	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)
Competitiveness	0.06**	0.06**	0.06**	0.06**	0.04	0.06**
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
LOC	-0.04	-0.04	-0.04	-0.04	-0.04	-0.13
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.08)
First mover	-0.05*	-0.35**	-0.52**	0.29*	-0.20	-0.79**
	(0.03)	(0.15)	(0.24)	(0.15)	(0.14)	(0.37)
c.self_est#c.first_mover		0.07**				
		(0.03)				
c.self_eff_new#c.first_mover			0.15**			
			(0.08)			
c.risk_all_n#c.first_mover				-0.09**		
				(0.04)		
c.comp_all#c.first_mover					0.03	
					(0.03)	
c.loc9_new#c.first_mover						0.16**

						(0.08)
Constant	0.34	0.49	0.58	0.17	0.42	0.71
	(0.43)	(0.43)	(0.44)	(0.43)	(0.43)	(0.47)
Random effects						
sd (player)	0.10***	0.10***	0.10***	0.10***	0.10***	0.10***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
sd (experiment)	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
sd (res)	0.45***	0.44***	0.45***	0.44***	0.45***	0.44***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Statistics						
Wald chi2 (p)	32.37***	37.05***	36.51***	37.99***	33.64***	36.43***
Log likelihood	-604.8	-602.7	-602.9	-602.2	-604.3	-602.9
LR test vs. linear model, chi2 (p)	13.91***	13.59***	13.63***	13.79***	13.78***	13.85***
N of clusters (player)	36	36	36	36	36	36
N of clusters (experiment)	96	96	96	96	96	96
N of observations	965	965	965	965	965	965

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; base group for treatment is the individual incentive scheme.