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Game Over:
Empirical Support for Soccer Bets Regulation[†]

Emanuel Towfigh / Andreas Glöckner*

Abstract

In many countries, betting in sports is highly regulated. In Germany, however, there are current debates whether regulation should be loosened. A crucial part of the argument is that sport bets could be qualified as 'games of skill' that are considered to be less dangerous by German Law than 'games of chance', and are thus assumed to need less regulation. We explore this hypothesis in three incentivized online studies on soccer betting (N=214) and provide evidence against two crucial parts of this argument. First, we show that there are no overall effects of skill on accuracy in soccer bets and monetary earnings do not increase with skill. Hence, soccer betting cannot be considered a game of skill. Second, we show that soccer betting induces strong overconfidence and illusion of control, particularly for people who assume they have high skill, and that these biases lead to increased betting. Cognitive biases that might cause financial harm for bettors or even lead to problematic or pathological gambling behavior are even stronger for soccer bets compared to bets on the outcome of lotteries. Concerning the main aims of legal regulation for gambling in German law, our results strongly speak for regulation of soccer bets.

Keywords: Betting, Judgments, Overconfidence, Illusion of Control, Expertise

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Introduction

Considering media coverage and active membership, soccer is the most important sport in Germany. The German Soccer Association (*Deutscher Fußball-Bund*) has more than 6 million active members. Many people consider themselves to be knowledgeable in soccer, many of them—including the authors before conducting the reported studies—probably assume to forecast winning teams, for instance in the *1. Bundesliga* (premier soccer league), better than chance and lay people. Sport bets, and online betting in particular, have become increasingly popular in Germany, which has lead to intense debates on legal regulation of betting (e.g., Brüning, 2009; Voßkuhle & Bumke, 2002) and they are traditionally even more popular in other countries, such as Great Britain.

Different countries have adopted quite different legal rules concerning the regulation of betting. In Canada and Germany, for example, sports betting is legal in all States, but is monopolized by state lotteries.[1] However, the European Court of Justice has repealed the current regulation in Germany because of its lack of consistency (EuGH, Sep 8th 2010, C-316/07, C-358/07 to C 360/07, 409/07 and 410/07; see Glöckner & Towfigh, 2010). In the US, by contrast, sports betting is legal in very few states (Cantinotti, Ladouceur, & Jacques, 2004). In German law, the regulation of gambling mainly rests on the differentiation between *games of skill* and *games of chance* (cf. Section 1 of the Federal States' Treaty on Gambling, *Glücksspielstaatsvertrag*, and Section 284 of the Criminal Code). The former are considered games for which the winning outcome can be predominantly influenced by skill elements rather than by chance (Fiedler & Rock, 2009). Games of chance are rigorously regulated, whereas games of skill do not fall under this strict set of laws. In German law, sport bets—including soccer bets—are usually considered games of chance (Bahr, 2007). However, this state of affairs has been questioned. It has been advocated using doctrinal arguments (Holznagel, 2008; Schmidt & Wittig, 2009), but also empirical analyses (Fiedler & Rock, 2009) that some games under specific circumstances should be considered games of skill (e.g., the poker variant *Texas Hold'em* when played in tournaments).

In the legal debate, one crucial question remains about the nature of sports betting. There are controversial views on this issue in psychology, too. In line with the view mentioned above, for instance, it has been argued that "[aside from lotteries m]any other gambles allow the possibility for skill to increase the player's chances of success. […] In horse racing or football pools, a close study of form may offer the student a greater chance of winning than a player betting on an outsider, although of course, this is not always guaranteed" (P. Rogers, 1998, p. 125). Empirical evidence on this issue is relatively scarce, but the available results speak against this assertion. It has been shown that skill and knowledge of those involved are of no help for winning money in horse races (Ladouceur, Giroux, & Jacques, 1998) and hockey bets (Cantinotti, et al., 2004).

The major contribution of this work is twofold. First, we explore whether betting on soccer is a game of skill by investigating individuals' accuracy in soccer bets, and the dependence of accu-

1 Note that the availability of online betting from other countries has, however, somewhat undermined this state monopoly in Germany.

racy and monetary gains on skill. Second, we explore the danger of soccer bets by measuring the prevalence of cognitive distortions (i.e., biases; see Kahneman, Slovic, & Tversky, 1982; Tversky & Kahneman, 1974) that are known as risk factors related to problematic betting (i.e., illusion of control and overconfidence; see below) and can impose harm on bettors that might be avoided by legal intervention (Jolls & Sunstein, 2006).

Considering that problem betting and pathological betting have a considerable prevalence rate, the issue of regulation has a high practical relevance. Survey studies have been summarized in a recent review, and the estimations of the number of problem bettors in Germany is between 149,000 and 347,000 persons (of a population of 82 million); and for pathological bettors between another 103,000 to 300,000 persons (Meyer & Hayer, 2010). The authors argue that the development of prevalence rates over time and international comparisons suggest that problematic and pathological gambling increase with the number of possibilities to bet. They suggest that stricter regulation might be an efficient measure to reduce the problem.

Besides getting additional insights into the processes underlying gambling, the central aim of this interdisciplinary research project[2] is to provide additional data for the debate on gambling regulation of soccer bets under German Law. We thereby compare different kinds of bets within-subjects to assess the relative size of biases. Our investigation focuses on soccer bets, although we also compare these to state Lotto, which is a pure game of chance, and to stock-market bets (similar to trading in futures), which—although available in practice—are not considered to be ‘games’; stock-market bets are therefore also not regulated by gambling law.

Cognitive Distortions Related to Gambling Involvement

Illusion of Control

Illusion of control (Langer, 1975)—an exaggerated belief in one’s own ability to influence the outcome of an uncertain event—has been suggested as an explanation of gambling involvement. The existence of illusion of control in gambling has been repeatedly demonstrated using think-aloud methodologies (e.g., Toneatto, Blitz-Miller, Calderwood, Dragonetti, & Tsanos, 1997) and standardized questionnaires (e.g., Myrseth, Brunborg, & Eidem, in press; Steenbergh, Meyers, May, & Whelan, 2002). Furthermore, it could be shown that (for events with the same success probability) perceived control over the outcome of a bet (e.g., that persons think they can influence the outcome by their skill) increases persons’ willingness to accept bets (Goodie, 2003). Consequently, one might hypothesize that illusion of control and excessive betting might even be more prevalent in sport bets than in pure games of chance. First support for this assertion comes from studies indicating higher prevalence rates of problem gambling and pathological gambling for soccer bets, compared to Lotto (Gotestam & Johansson, 2003; for a review of studies in Germany all indicating this difference see Meyer & Hayer, 2010).

2 The first author is a lawyer; the second author is a psychologist.

Overconfidence

Gambling behavior is also closely related to overconfidence, meaning that gamblers exaggerate the correctness of their judgments,[3] which has been demonstrated repeatedly in different kinds of judgments (e.g., Dunning, Griffin, Milojkovic, & Ross, 1990; Moore & Cain, 2007). Not only lay people, but also experts in many domains tend to be overconfident (Koehler, Brenner, & Griffin, 2002) with some noteworthy exceptions (e.g., expert weather forecaster, Murphy & Winkler, 1984). However, overconfidence also seems to be highly dependent on the characteristics of the task. The opposite phenomenon of underconfidence has, for instance, been shown in tasks for which subjects knew that judgments are skill-based and hard (Moore & Cain, 2007; see also Moore & Healy, 2008). In line with these findings and the Bayesian model suggested by Moore and Healy, evidence for sports forecasting indicates that individuals with expertise in soccer are overconfident, whereas the opposite tendency was found for naïve people (Andersson, Edman, & Ekman, 2005). Concerning probabilistic forecasts of stock-prices, knowledgeable and naïve people tend to be overconfident (Önkal & Muradolu, 1994; see also Yates, Mcdaniel, & Brown, 1991). In a study investigating inter-individual differences, pathological gamblers showed stronger overconfidence in their bets compared to controls (Goodie, 2005).

Accuracy in Sports Predictions and Skill Level

Several studies have investigated the accuracy of prediction in sports and its relation to skill in the domain.[4] The studies on hockey (Cantinotti, et al., 2004) and horse races (Ladouceur, et al., 1998), mentioned above, show that experienced bettors are better than chance in predicting game results and winning horses, although on average they do not beat the bookmakers, meaning that they do not earn money from betting. Newspaper tipsters for soccer matches also predict results better than chance, although information weighting seems to be inappropriate in some cases (Forrest & Simmons, 2000). Nevertheless, people with considerable knowledge in the domain of soccer (i.e., sports journalists, coaches, and supporters) were found to perform with similar results, compared to less knowledgeable people, in predicting which 16 of the 32 teams would advance to the playoff round of the 2002 World Cup tournament; both groups performed better than chance (Andersson, et al., 2005). On the other hand, Pachur and Biele (2007) showed some effect of skill level: sports journalists were better than less knowledgeable people at foreseeing which team would win during the first round of matches at the 2004 European Cup tournament. Further results indicate that the difference might be due to the difference in difficulty of the

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3 For the sake of clarity, we clearly differentiate between illusion of control (i.e., exaggerated estimation of influence) and overconfidence (i.e., exaggerated estimation of correctness); although overconfidence might also be understood as a sub-aspect of illusion of control (cf. Goodie, 2005, p. 482). More specifically, we investigate the overestimation aspect of overconfidence in this paper (Moore & Healy, 2008).

4 Following Ladouceur et al. (1998), we use the terms *skill* instead of expertise or knowledge because participants of many previous studies, including the ones reported in this paper, would not be considered experts according to standard definitions of expertise (Ericsson, 2006). We operationalize the term "skill" as knowledge about and experience in the respective domain.

tasks, in that experts are particularly better at harder tasks, such as predicting specific outcomes of games (Andersson, Memmert, & Popowicz, 2009).[5]

Methodological Preliminaries and Hypotheses

In our studies, participants bet on real events that took place either three weeks (Experiments 1 & 3) or three days later (Experiments 2 & 3). In Experiment 1, all bets were offered as two-outcome bets with the option yes / no according to the following examples:

Soccer: On the 26th game day of the 1. Bundesliga, Arminia Bielefeld will play against Schalke 04 in Bielefeld. Will Schalke win against Bielefeld?

Lotto: Concerning the Lotto result of *Spiel 77* in three weeks: Will the first two digits of the drawn number form a number larger than 49? [*Spiel 77* draws a 7-digit number from an equal distribution of all 7-digit numbers]

Stocks: The stock of Bayer AG today has the value of 37.22 Euro. How will the stock develop in the next three weeks? Will the value of the stock on 2 April 2009 be between 35.75 Euro and 39.12 Euro?

To make bets in the different domains comparable, we determined base-rates for the specific events based on their history. For soccer bets, the base-rate was determined by the frequency of previous wins/draws/losses in pairings of both teams in the history of the *1. Bundesliga* (e.g., Schalke beat Bielefeld 7 out of 14 times, resulting in a base-rate of 50% for the above-mentioned soccer bet).[6] For each stock bet, we first analyzed the three-week volatility of each stock (in percent) in the last 10 years. From this distribution, we determined the intervals that matched the base-rates of the soccer matches, using the respective percentiles (e.g., in 50% of the cases, the price of Bayer stocks after 3 weeks was in the interval ranging from -4% to +5% of the starting price). Boundaries for the prediction corridor were set around the (opening) stock price on the day on which the prediction was made. For lotteries we matched difficulty by using the respective range of numbers (e.g., for a two-digit number, the range larger than 49 refers to 50%). Participants were asked to give a prediction for all bets, indicating their confidence and the degree to which the possibility of winning the bet depends on their skill or on luck (i.e., measure of perceived control). Participants were given one day to complete the online questionnaire that included predictions from all three prediction domains.

German gambling law refers to the "average potential player". We therefore intentionally did not select extreme groups with (assumed) particularly high or low skill levels in the different domains. Instead, we measured skill level by using self-report (which was validated by objective measures in later studies; see Experiments 2 and 3). We also measured the effort that participants

5 Note that Pachur and Biele (2007) showed the effect for win/lose decisions, whereas Anderson et al. (2009) used specific outcomes of games (i.e., the game ends 1:3 for the home team).

6 We differentiated between home and away matches (e.g., in the base-rate calculation, we took into account only home games for Bielefeld against Schalke). We retrieved the data from: www.bundesliga.de

made to answer the questions as a control factor. To assure external validity, participants could use any source of information they liked. Participants knew that they would be paid according to the accuracy of their bets. In Experiments 2 and 3, we used three-alternative choices and the base-rates were not matched anymore (see below).

In light of the reviewed literature, we started with the following hypotheses for soccer bets:

H1: Accuracy in bets is better than chance (*performance hypothesis*).

H2: Accuracy in bets increases with skill level (*skill-game hypothesis*).

H3: Confidence increases with increasing skill level, even when controlling for accuracy (*overconfidence hypothesis*).

H4: Perceived control increases with increasing skill level, even when controlling for accuracy (*illusion of control hypothesis*).

For the legal debate, two more complex comparative hypotheses are relevant:

H5: Overconfidence and illusion of control are higher for soccer bets than for pure games of chance, such as Lotto (*increased danger of sport bets hypothesis*).

H6: Accuracy rate, the influence of skill on accuracy, overconfidence, and illusion of control are not better in bets on stocks compared to soccer bets (*danger of stock trading hypothesis*).

Experiment 1

Method

Participants

One hundred persons were recruited from the MPI Decision Lab subject pool using the online recruitment system ORSEE (Greiner, 2004) and signed up for participation in an online study. Ninety-five of them completed the questionnaire and were included in the analysis; 78% of them were students; they were between 19 and 64 years old (M = 25 years) and 59% were female. Participants received on average 17.45 Euro (approximately 26 USD) for their participation, with a range from 9.8 Euro to 23 Euro dependent on their decisions, including a flat fee of 5 Euro that everyone received. One bet of each domain (i.e., soccer, stocks, lotto) was randomly selected and people were paid 5 Euro if they were correct in this bet and could earn or lose money in voluntary additional bets to this main bet (see below). Completing the questionnaire took on average 28 minutes, which does not include the time for information search, as participants were allowed to interrupt completion of the questionnaire.

Materials

Participants made bets for five soccer matches of the *1. Bundesliga*, for four stocks, and for two outcomes of the lotto game *Spiel 77*.[7] According to base-rates of previous games in the history of the 1. Bundesliga, three games were hard games with 50:50 base-rates, whereas two games were supposedly easier with base-rates of 70:30. Stocks involved large German companies and the German Stock Exchange Index (*DAX*).[8] Half of them were implemented with 50:50 base-rates and half with 70:30 base-rates. The two Lotto bets included a 50:50 (i.e., first two digits of the *Spiel 77* number being a number larger than 49) and a 70:30 (i.e., last two digits of the *Spiel 77* number being equal or larger than 30) base-rate, respectively.

Procedure

For each of the bets, participants first indicated their bet. Then they could decide whether they wanted to place additional bets on top of this main bet. People could accept or reject 6 additional bets of winning 1 Euro if they were correct and losing 0.10, 0.50, 1, 1.50, 2, or 3 Euros if they were wrong in their main bet.[9] Only participants who are very uncertain in their main bet (e.g., whether Schalke will win against Bielefeld or not) would reject the 1 Euro win vs. 0.10 Euro loss bets, whereas people will only accept the 1 Euro win vs. 3 Euro loss bets if they are very certain.

Afterwards, participants rated their confidence in this bet on a scale from 50% (*guessing*) to 100% (*certain*), and finally they indicated to which degree the correctness of their bet depends on chance (or luck) vs. their skill on the scale of -100 (*100% luck/chance*) to 100 (*100% skill*). Participants first worked on the stock bets, then the sport bets, and finally the Lotto bets. After each section, participants were asked to indicate their skill and knowledge level in the respective domain on a scale from 0 (*no skill*) to 100 (*expert*), the effort in placing the bets 0 (*no effort*) to 4 (*extensive information search*). They also indicated the sources of information used in free text format and whether they had been involved in soccer betting before. Participants could go back and forth in the online questionnaire until they finalized it. As previous studies found no effects of task order (Pachur & Hertwig, 2006), and to avoid further complexity, we used the same order of questions for all participants (cf. Pachur & Biele, 2007).

Results

We determined the true realizations of all real-world events and calculated dichotomous correct scores for each bet and each person. As intended, there was considerable variance in soccer skills (M = 36, SD = 31) in the sample.

The results for the different kinds of bets each of them split by skill level for the respective domain (median split: high vs. low skill) are shown in Figure 1 (left). In line with the performance

7 Differences in numbers of tasks for the different bets are due to pragmatic reasons, for instance in getting sufficient information for calculating base-rates.

8 Note that stock developments are certainly not independent from each other and, hence, results concerning stocks should be interpreted cautiously. Remember also that stocks are used for comparative reasons only.

9 This measure is an extension of a gamble-based measure of loss aversion (Gächter, Johnson, & Herrmann, 2007). To ensure incentive compatible preference elicitation, one of the bets was randomly selected and incentivized according to the participants' decisions (Becker, DeGroot, & Marschak, 1964).

hypothesis (H1), participants were clearly better than chance in selecting the winning teams ($F(1, 94) = 94.94$, $p < .001$)[10] and even better than the respective average base-rate, assuming that people choose the gamble by relying on the higher base-rate ($F(1,94) = 26.46$, $p < .001$).

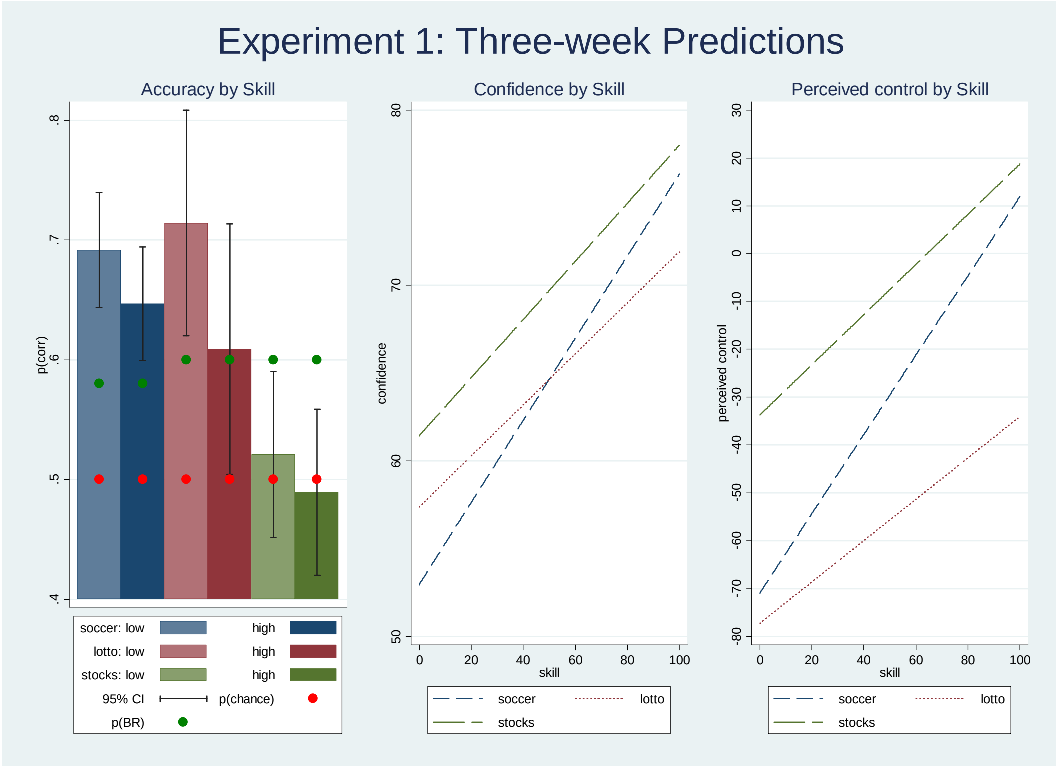

Figure 1. Accuracy, confidence, and perceived control by skill in Experiment 1. In the accuracy diagram (left), p(corr) refers to the percentage correct predictions and a median split for skill (low / high) is used. In the diagrams for confidence and perceived control, the relation with skill is indicated by the slope of the regression lines that result from the regression analyses reported in Table 2 (setting effort and task dummies to zero). Steeper slopes indicate a stronger influence of skill on the respective dependent variable after controlling for all other factors.

Figure 1 also indicated that accuracy in soccer bets does not increase with skill. To investigate this effect statistically, we conducted a cluster corrected (clustering per subject) logistic regression predicting correct choices by skill, controlling for effort and task differences (by including task dummies) and using the STATA option *cluster* (W. H. Rogers, 1993). In contrast to the skill-game hypothesis (H2), self assessed skill did not influence accuracy in soccer bets (Table 1, model 1). The coefficient was even negative, hence pointing in the opposite direction.

10 Here and in the following analysis, standard errors were corrected for clusters in observations due to repeated measurement (W. H. Rogers, 1993). We used a Wald-test to test against chance (0.50) and base-rate (0.58; i.e., (3*.5 + 2*.7)/5) level. All regression coefficients *b* reported in this paper are unstandardized raw coefficients.

Table 1: Six logistic regression models for predicting correct choices by skill and effort in Experiments 1 and 2.

	Exp. 1: 3-week predictions			Exp. 2: 3-day predictions		
	(1) Soccer	(2) Lotto	(3) Stocks	(4) Soccer	(5) Lotto	(6) Stocks
Skill	-0.00452	-0.0151*	0.00185	0.0126***	-0.0120	0.0121*
	(0.00351)	(0.00678)	(0.00508)	(0.00322)	(0.0113)	(0.00536)
Effort	-0.118	.	-0.0685	0.248*	.	0.0959
	(0.106)	.	(0.102)	(0.100)	.	(0.134)
_cons	1.737***	1.780***	-0.652*	0.733	-3.356***	-1.138**
	(0.361)	(0.342)	(0.317)	(0.389)	(0.739)	(0.418)
N	475	190	380	666	148	296
pseudo R^2	0.182	0.081	0.051	0.217	0.158	0.023

Note. The table reports results from six logistic regression models for the three different domains and separated by experiments. Reported are raw coefficients. Positive coefficients indicate that the probability for correct predictions increases when the respective predictor increases. Standard errors in parentheses are corrected for 95 (Exp. 2: 74) clusters in observations. Task dummies are omitted. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

We tested the overconfidence hypothesis (H3) by regressing confidence on skill, controlling for accuracy (i.e., whether the person made a correct choice or not), effort (measured by self-report), and for task differences by including task dummies (Table 2, model 1). We found that confidence increases with increasing skill level even when controlling for accuracy indicating *overconfidence*. Figure 1 (middle) visualizes the development of confidence dependent on skill according to the estimated coefficients.

Table 2: Six regression models for predicting confidence ratings in Experiments 1 and 2.

	Exp. 1: 3-week predictions			Exp. 2: 3-day predictions		
	(1) Soccer	(2) Lotto	(3) Stocks	(4) Soccer	(5) Lotto	(6) Stocks
Correct	2.720**	2.516	-0.601	0.0894	-0.502	2.466*
(1=yes)	(1.020)	(1.844)	(1.118)	(0.921)	(2.253)	(1.190)
Skill	0.234***	0.146**	0.166**	0.200***	0.190*	0.123*
	(0.0285)	(0.0444)	(0.0510)	(0.0328)	(0.0752)	(0.0588)
Effort	3.395***	.	1.760	3.480**	.	4.149**
	(0.990)	.	(1.176)	(1.033)	.	(1.221)
Constant	52.95***	57.37***	61.43***	56.84***	55.41***	50.70***
	(2.765)	(2.228)	(3.370)	(2.912)	(1.746)	(2.980)
Observations	475	190	380	666	148	296
Adjusted R^2	0.301	0.109	0.113	0.272	0.122	0.141

Note. The table reports results from six OLS regression models for the three different domains and separated by experiments. Reported are raw coefficients. Positive coefficients indicate that confidence increases when the respective predictor increases. Standard errors in parentheses are corrected for 95 (Exp. 2: 74) clusters in observations. Task dummies are omitted. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

To test the illusion of control hypothesis (H4), we regressed perceived control on skill controlling for accuracy, effort and task differences (Table 3, model 1). In support of the hypothesis, we found that perceived control increases with skill, although skill did not influence performance (see above), indicating an illusion of control.

Table 3: Six regression models predicting perceived control in Experiments 1 and 2.

	Exp. 1: 3-week predictions			Exp. 2: 3-day predictions		
	(1) Soccer	(2) Lotto	(3) Stocks	(4) Soccer	(5) Lotto	(6) Stocks
Correct	3.819	1.869	0.110	5.250	-0.191	6.419
(1=yes)	(5.268)	(8.852)	(3.449)	(4.304)	(8.951)	(4.957)
Skill	0.829***	0.432*	0.525**	0.547***	0.735*	0.301
	(0.139)	(0.187)	(0.162)	(0.149)	(0.328)	(0.185)
Effort	5.826	.	-4.183	12.69*	.	11.22*
	(3.883)	.	(3.532)	(5.465)	.	(4.833)
Constant	-70.95***	-77.28***	-33.74**	-67.66***	-79.46***	-72.62***
	(11.20)	(11.25)	(10.23)	(14.82)	(7.580)	(13.15)
Observations	475	190	380	666	148	296
Adjusted R^2	0.216	0.061	0.065	0.159	0.095	0.071

Note. The table reports results from six OLS regression models for the three different domains and separated by experiments. Reported are raw coefficients. Positive coefficients indicate that perceived control increases when the respective predictor increases. Standard errors in parentheses are corrected for 95 (Exp. 2: 74) clusters in observations. Task dummies are omitted. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The *increased danger of sport-bets hypothesis* (H5) states that soccer bets might lead to stronger illusions of control and overconfidence than pure games of chance (i.e., Lotto), due to the fact that people believe they can influence the result more. To investigate these effects, we first calculated regressions for Lotto and stock bets concerning accuracy (Table 1, model 2), confidence (Table 2, model 2) and perceived control (Table 3, model 2) in exactly the same manner as for soccer bets. A graphic representation of the result can be seen in Figure 1. It provides initial evidence for parts of H5, in that confidence and perceived control increase more strongly with skill for soccer, as compared to Lotto bets (see also the respective coefficients), although skill did not influence accuracy in any domain. To test H5 more directly, we rerun the regressions, including all bets and adding two interaction terms between domain of bet and skill. The respective interaction terms between domain of bet (soccer=0 vs. Lotto=1) and skill turned out to be marginally significant for confidence (b = -.09, t = -1.98, p = 0.051) and for perceived control (b = -.38, t = -1.96, p = 0.054) supporting H5.

Finally, we investigated whether *stock bets* are in any respect better than soccer bets concerning accuracy rate, influence of skill, overconfidence and illusion of control (H6) (see also Figure 1). In stock predictions, we find worse performance compared to soccer bets with equal base-rates ($F(1, 94) = 31.71$, $p < .001$). Subjects performed essentially at chance level. There was no relation between skill and performance (Table 1, model 3). The influence of skill on confidence and perceived control is somewhat higher for stocks (see Figure 1). However, the respective interaction terms between domain of bet (soccer=0, stock=1) and skill in an additional analysis did not reach conventional levels of significance for confidence (b = -.07, t = -1.34, p = 0.182), but the effect was marginally significant for perceived control (b = -.33, t = -1.83, p = 0.070). Hence, the data support the assertion that, in terms of accuracy, skill influence on performance, overconfidence, and illusion of control, stock bets that might be involved in real future-trades are no better, and sometimes even worse, than soccer bets for the population represented by our sample. However, the results should be interpreted cautiously, because our (mainly student) participants are probably more likely to have "skills" in soccer bets than in stock market predictions (for another critical issue, see Footnote 8, above).

Finally, we analyzed the additional bets in which persons had the possibility to accept further bets if they were certain in their choice. We expected that skill ratings and perceived control increase betting, which would strengthen the claim that both cognitive biases indeed lead to increased betting. This was the case for soccer bets, as indicated by significant correlations between persons' average amount of additional bets accepted with skill (r = .22, p < .05). This correlation was lower for Lotto (r = .18, p = .08) and stocks (r = .07, p = .50).

Discussion

The results confirm our hypotheses, except for the skill-game hypothesis (H2), and are in line with previous findings. Accuracy in three-week sport bets was better than chance and even better than the mere base-rates. Nevertheless, skill did not influence accuracy, but had a significant effect on confidence and perceived control, indicating overconfidence and illusion of control. Note, however, that the confidence results can only be interpreted in a relative manner and it is not quite clear whether low-skilled people are underconfident, high-skilled people are overconfident, or both (Andersson, et al., 2005). We address this question with an improved measure in the third experiment. We furthermore confirm that soccer bets might be more problematic than Lotto, because there is a stronger increase of confidence and perceived control with skill for soccer bets. Stock trading was not better and sometimes even worse than soccer bets in every respect. Finally, we show that for soccer bets in particular there was a tendency that self-assessed skill increases additional betting, although it does not increase betting success.

Although the results are clear-cut, they should be interpreted cautiously for multiple reasons. First, with three weeks the prediction horizon in the first study was relatively long. For such long prediction horizons, skilled people might lack informative cues that go beyond the cues that less skilled people can use as well (i.e., current position in the league). There are of course long-term bets (e.g., who will be World Champion?), but many bets are made in the week before the game. It is possible that skill has a higher influence in short-term predictions since more informed persons might have a specific information advantage concerning the current form of the team from watching last week's game. On the other hand, even people with fewer skills might use the odds from online betting agencies to make their bets, which might reduce informational advantages of skilled people. Second, as in most previous studies (e.g., Andersson, et al., 2005; Andersson, et al., 2009; Pachur & Biele, 2007) we used questions concerning a fixed and relatively small set of games which were the same for all people. Hence, although we control for fixed effects of specific games by using task dummies, remaining specifics of the game day might have a large influence on the results. It might be possible that just on this one day the cues that more skilled people usually use led to majorly wrong results. Third, our selection of games (five games of the nine in one game day) mainly included relatively hard tasks and excluded very easy games with more extreme base-rates / odds. It might be possible that including all games of a day changes results. Fourth, in regular sport bets, people mainly have three-outcome decisions (win/draw/lose), whereas we used two-outcome response formats. Fifth, participants' performance should not be evaluated in predictive accuracy only, but also in their monetary win (Cantinotti, et al., 2004; Ladouceur, et al., 1998), taking into account odds from betting companies (e.g., betting a win by Bielefeld pays 2 Euro for 1 Euro betted). Finally, the results should be validated with an objective measure for skills in the domain of soccer, operationalized as knowledge about professional soccer.

To overcome all six potential points of criticism, we conducted a second study that investigated behavior in short-term predictions (three-day forecasts) using all games of a day in the *1. Bundesliga*, a three-outcome response format; we recorded odds from an online betting company to investigate whether participants would earn or lose money; and we additionally used a soccer quiz as an objective measure for soccer skills.

Experiment 2

Method

Participants

Eighty persons were recruited from the MPI Decision Lab subject pool and signed up for participation in the online study. Seventy-four of them completed the questionnaire and were included in the analysis; 89% of them were students; they were between 18 and 59 years old (M = 24 years) and 51% were female. Participants received on average 8.50 Euro (approximately 12.60 USD) for their participation, with a range from 4.9 Euro to 20 Euro. Completing the questionnaire again took on average 28 min.

Materials and Procedure

We used predictions for all nine games of a day in the *1. Bundesliga* and people indicated whether the home team would win, the other team would win, or whether there would be a draw. Predictions were made on Wednesday for games on the following Saturday. We additionally used predictions for the same four stocks as before, but this time inquired whether their price in three days would be above, below or within a certain interval. For two of the stocks, the intervals had all equal base-rate probability (i.e., 1/3; considering their 3-day volatility over 10-years). For the two other stocks, the middle interval had a 50% base-rate probability and the other two had

25% each. For the Lotto bet, again we used the first and the last two digits of the number of *Spiel 77* to implement intervals with the same base-rates as for stocks (i.e., 33:33:33 and 25:50:25). Note, however, that base-rates are not matched with soccer, possibly leading to differences in difficulty. After making all predictions, participants completed a soccer-knowledge quiz, for which they were instructed not to use additional sources of information. The quiz consisted of questions that were constructed such that a true soccer expert would be able to answer all of them.[11] It consisted of 10 multiple-choice questions with four alternatives and including the possibility to check "don't know" (to avoid chance hits of the correct answer), for example: Who was the top scorer in the 1. Bundesliga in the season 2008/2009? What was the name of the official ball at the World-Championship 2006? In which game between Germany and England did the so-called Wembley goal happen? The remaining procedure was essentially the same as in Experiment 1.

Results

The soccer quiz was found to be an effective measure for skills in the domain of soccer (as defined in the current study). The number of correct answers in the soccer quiz had a considerable variance (M = 2.26, SD = 2.27; Max = 8). The quiz had acceptable reliability (Cronbach's α = .77; coding the correct answer one and zero otherwise) and correlated at a high level with the self-assessment of skill (r = .70, p < .001) which also validates the subjective measure of skill. Self-evaluated soccer skills were considerably lower in this sample as compared to Experiment 1 (M = 24, SD = 26).

Again, we found support for the performance hypothesis (H1). Soccer bets were better than chance ($F(1, 73) = 23.84$, p < .001) and they were not different from stock predictions ($F(1, 73) = 2.01$, p = .16) (Figure 2). Participants' performance in the Lotto bets was relatively bad because the actual Lotto draws were in the less likely intervals.

We found an influence of skill on accuracy. Figure 2 shows the accuracy for all types of bets by subjective skill level (according to median split). A logistic regression revealed that skill influenced accuracy in three-day bets for soccer as well as for stocks (Table 1, models 4 to 6). Persons with high soccer skills predicted 10% of the gambles more correctly, compared to persons with low skills ($F(1, 73) = 9.18$, p < .01). This result did also hold when replacing the subjective by the objective skill measure (i.e., sport quiz score) in the regression (i.e., b = .123, z = 2.74, p = 0.006). Hence, for three-day predictions, we found support for the skill-game hypothesis (H2).

To test the overconfidence hypothesis (H3), we regressed confidence on self-assessed skill, controlling for accuracy, effort and task specifics (Table 2, models 4 to 6). For all kinds of bets, confidence again increased significantly with subjective skill, even when controlling for accuracy. We conducted an equivalent regression on perceived control for testing the illusion of control

11 We thank Dr. Philipp Weinschenk for providing the questions. He qualified as an expert by reaching the second place out of 200.000 participants in a prominent German soccer manager simulation (www.kicker.de).

hypothesis (H4). For soccer and lotto bets, perceived control again increased with skill, even when controlling for accuracy (Table 3, models 4 to 6). The results supporting H3 and H4 did also hold when using the objective skill measure instead of the subjective ones in the respective regressions.

We found no support for the *increased danger of sport-bets hypothesis* (H5) for three-day predictions. There was no stronger influence of skill on confidence and perceived control for soccer compared to Lotto bets after controlling for accuracy (all interactions $p > .25$).

For a more differentiated analysis of the influence of skill on performance, we calculated potential wins and losses if our participants had betted for real. We calculated the wins of each person, assuming that he or she betted 1 Euro on each game. We thereby took into account the official betting odds of an online betting provider (i.e., bwin) on the day the bets were made (e.g., bwin paid 1.40 Euro against 1 Euro betted on a win by Leverkusen against Frankfurt). The results were somewhat surprising, indicating that on average our participants would have beaten the bookmaker! They earned 1.10 Euro for each Euro they would have invested. Low-skilled people (according to a median split) earned 0.95 Euro (i.e., effectively losing 5%) and high-skilled people won 1.26 Euro (i.e., win of 25%) and the difference was significant ($F(1, 73) = 8.80$, $p < .01$).

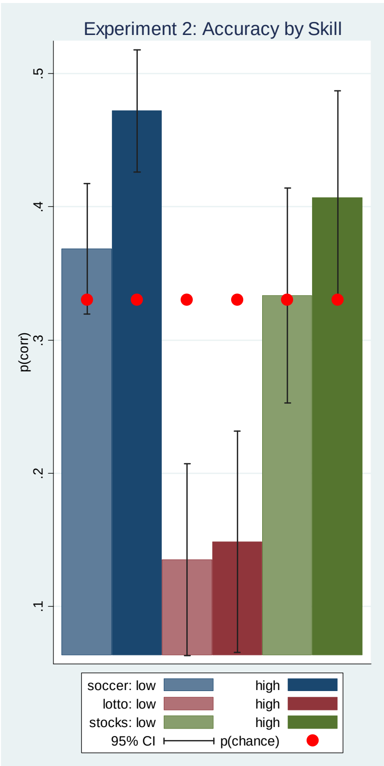

Figure 2. Accuracy by Skill level in Experiment 2, with p(corr) indicating the percentage correct predictions and data split on the median of subjective skill (low / high).

Discussion

In the second experiment, using a three-day prediction horizon, we replicate the finding that persons are better than chance in predicting soccer results. Furthermore, we replicate that confidence and perceived control increase with skill level, even when controlling for the accuracy of predictions which might indicate overconfidence and illusion of control in high-skilled people. These results also hold for an objective instead of a subjective measure of skill (i.e., a soccer quiz). In contrast to the results for three-week predictions in Experiment 1, for the three-day prediction horizon we unexpectedly found that skill increases accuracy. We could not replicate the effect that soccer bets lead to a significantly stronger influence of skill on confidence and perceived control (after controlling for accuracy), which would indicate an increased danger of soccer bets compared to lotto.

The skill level of our participants was relatively low in absolute terms with an average score of 24 being much closer to the 'no knowledge' end of the scale (0) than to the expert end (100) (see also comparison to the previous study). Eighty-three percent of the participants indicated a score below 50. Furthermore, we had nobody who could answer all 10 questions and the average score was much closer to zero (i.e., no knowledge) than to ten correct answers (i.e., expert). It seems highly likely that persons' playing soccer bets will usually have higher skills than the persons in our sample. It is therefore even more surprising that our participants on average beat the online broker. One might speculate that for this particular day some cues that are used by persons with a medium level of skills were particularly helpful. At least in the long run, it is not possible that the average player beats the broker, because the broker constantly adjusts the odds to reflect bettors' beliefs about winning to avoid exactly this and to make betting a zero-sum game (minus his commission/fee). Somebody must have bet differently than our participants, and in this case must have been less successful with his or her bets. Considering that our participants are mainly from the lower and medium end of the scale, one might speculate that this could have been the higher-skilled people and "experts".

The results of the second experiment were to a certain degree unexpected, which might be partially driven by specifics of the game day. To double-check the findings and to implement methodological improvements, we conducted a third experiment, in which we manipulate the prediction horizon (three-day vs. three-weeks) within participants. We again used the soccer-knowledge quiz as an objective measure of knowledge about soccer (i.e., skill). We added questions how many bets of each kind the participants deem to be correct, to be able to directly capture overconfidence (in the sense of overestimation; Moore & Healy, 2008).

Experiment 3

Method

Participants

We recruited 50 participants from the MPI Decision Lab subject pool; 45 (66% female) of them completed the questionnaire. The sample consisted mainly of students (96%) that were between 19 and 28 years old (M = 22 years). Participants received on average 10.26 Euro (approximately 15.30 USD) for their participation, with a range from 4.4 Euro to 16 Euro. Completing the questionnaire took on average 47 minutes, essentially doubling the time that participants used in Experiments 1 and 2, as the number of questions doubled because of the within-design.

Materials and Procedure

We used essentially the same procedure as in Experiment 2 except for adding a second part, in which participants made three-week predictions for soccer, stocks and Lotto. Hence, participants predicted the outcomes of all nine games of the game day at the end of the week and in three weeks. Participants also made predictions for the same four stocks and lotteries as in the previous experiments, but each for two time horizons. For stocks, the intervals for three weeks were adapted, so that the base-rates were the same as for the short predictions (i.e., two stocks 33:33:33; two stocks 25:50:25; considering their 3-day / 3-week volatility over 10-years). For the lotto bets, again we used the first and the last part of the number of *Spiel 77* for both forecasting horizons. To rule out the objection that answering the bets might influence one's own skill assessment, we asked for the self-assessments of skill in the respective domain before the first bets were made. As an improved measure of overconfidence, we asked participants to estimate how many of the bets they made for each domain (and prediction horizon) were correct.

Results

The number of correct answers in the soccer quiz was lower than in the previous experiment (M = 1.51, SD = 1.75; Max = 7), whereas the self-assessment of skills were comparable with Experiment 2 (M = 23, SD = 26) (but lower than in Experiment 1). The quiz had acceptable reliability (Cronbach's α = .68) and correlated at a sufficient level with the self-assessment of skill (r = .42, p < .01).

Accuracy in soccer bets was significantly better than chance in three-day predictions ($F(1, 44) = 6.68$, $p < .05$) and marginally significantly better in three-week predictions ($F(1, 44) = 3.37$, p = .08) supporting the performance hypothesis (Figure 3). There was no influence of skill on accuracy: neither in the three-day ($F(1, 44) = 0.10$, p = .75) nor in the three-week ($F(1, 44) = 0.03$, p = .85) predictions (see Figure 3). Using the objective soccer quiz scores instead of the self-assessed skill leads to the same results. We also tested whether people with a higher skill level would earn more money considering real odds. This was not the case. Highly-skilled persons even tended to perform slightly worse (0.90 Euro return for 1 Euro betted) than the low-skilled persons (0.98 Euro return for 1 Euro betted) considering the objective skill measure ($F(1, 44) = 0.33$, $p = .57$). The same result was found for the three-week predictions (considering the final odds). Hence, the data do not support the skill-game hypothesis for either prediction horizon (H2).

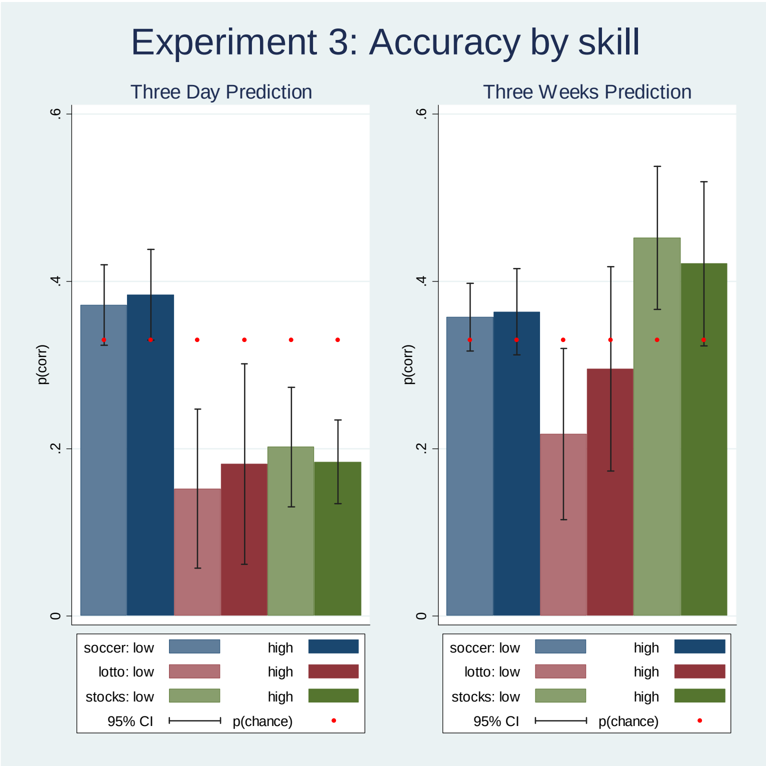

Figure 3. Accuracy by skill level and prediction horizon in Experiment 3, with p(corr) indicating the percentage correct predictions and data split on the median of subjective skill (low / high).

Confidence in soccer bets again increased significantly with skill, although skill had no influence on performance (Table 4, models 1 and 4) for both prediction horizons. Hence, the data support the overconfidence hypothesis (H3). Note that the coefficients seem to be very robust and are very similar to the ones obtained in Experiments 1 and 2 (see Table 2). For a direct test of overconfidence, we calculate an *overconfidence score* by subtracting the number of correct bets from persons' estimation of their number of correct bets. We find clear evidence for overconfidence in soccer-bets of high-skilled persons and that the overconfidence increases with skill (Figure 4, left two graphs). To rule out that this finding is due to the fact that some persons overestimate their skills and their correct bets at the same time, we also analyzed overconfidence by objective skill scores from the soccer quiz, which led to the same results (Figure 4, right two graphs). Hence, data from Experiment 3 confirm that increased skill leads to increased overconfidence, but particularly for high-skilled people (H3), whereas people with low skills seem to be better calibrated.

Table 4: Six regression models for predicting confidence in Experiment 3.

	3-day predictions			3-week predictions		
	(1) Soccer	(2) Lotto	(3) Stocks	(4) Soccer	(5) Lotto	(6) Stocks
Correct (1=yes)	-0.345	-7.047^{**}	-3.079	-0.285	-3.894	0.153
	(0.802)	(2.450)	(1.908)	(1.095)	(2.392)	(1.511)
Skill	0.245^{***}	0.115	0.201^{*}	0.209^{***}	0.128^{*}	0.152
	(0.0381)	(0.0656)	(0.0885)	(0.0321)	(0.0633)	(0.0821)
Effort	4.168^{***}	.	5.180^{**}	4.218^{***}	.	4.838^{**}
	(1.170)	.	(1.523)	(1.089)	.	(1.389)
Constant	52.84^{***}	60.91^{***}	49.45^{***}	53.28^{***}	57.91^{***}	47.88^{***}
	(3.244)	(2.649)	(3.267)	(2.560)	(2.203)	(3.190)
Observations	405	90	180	405	90	180
Adjusted R^2	0.414	0.101	0.282	0.390	0.060	0.220

Note. The table reports results from six OLS regression models for the three different domains and separated by prediction horizon. Reported are raw coefficients. Positive coefficients indicate that confidence increases when the respective predictor increases. Standard errors in parentheses are corrected for 45 clusters in observations. Task dummies are omitted. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

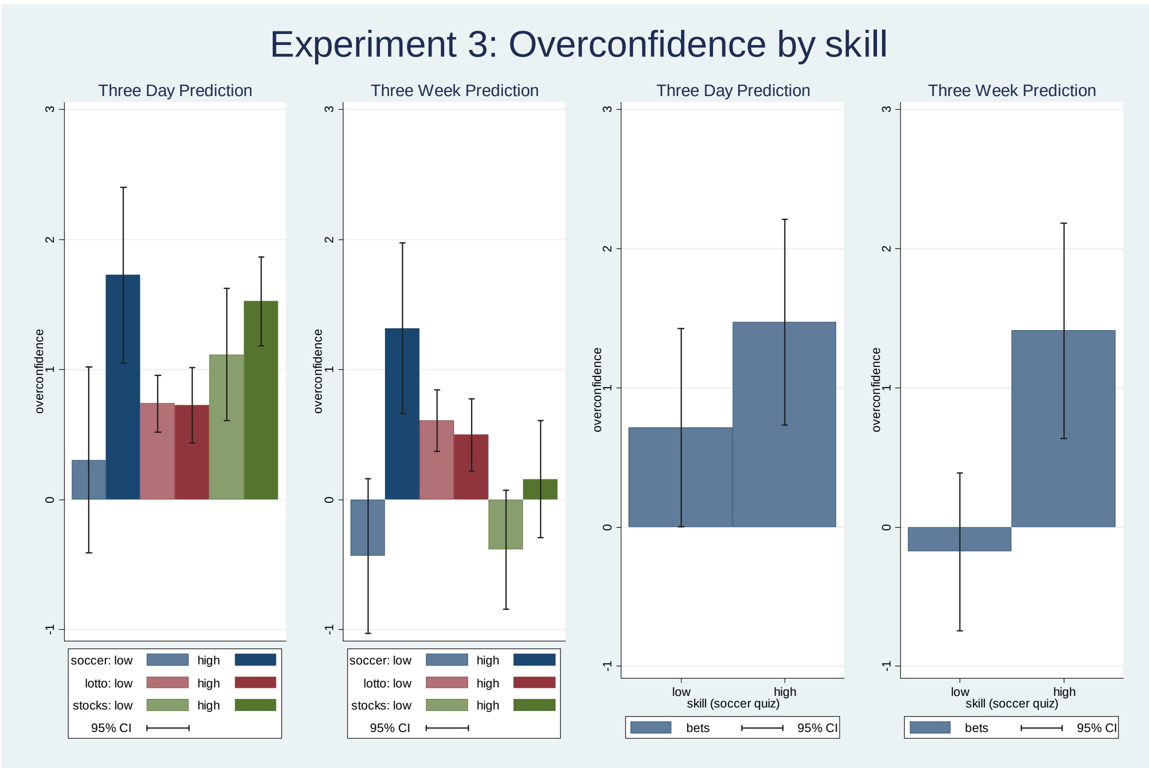

Figure 4. Overconfidence scores by skill and prediction horizon in Experiment 3. Overconfidence scores indicate the difference between the estimation of the number of correct predictions minus the number of correct predictions that were realized. Positive scores indicate overconfidence. The left two graphs show overconfidence scores for all three domains, using a median split on the subjective skill measure (low / high). The right two graphs show overconfidence scores for soccer by a median split on the objective skill measure (i.e., number of correct answers in the soccer quiz).

To test the illusion of control hypothesis (H4), again we regressed perceived control on skill (Table 5, models 1 and 4). The influence of skill on perceived control in both prediction horizon conditions could be replicated. We additionally validated these findings in soccer bets with the objective skill score. There was a significant overall effect of objective skill on perceived control after correcting for accuracy as well.

Table 5: Six regression models for predicting perceived control in Experiment 3.

	3-day predictions			3-week predictions		
	(1) Soccer	(2) Lotto	(3) Stocks	(4) Soccer	(5) Lotto	(6) Stocks
Correct (1=yes)	-0.977 (3.511)	-12.11 (9.510)	-2.071 (10.02)	2.741 (4.124)	-5.627 (7.247)	0.640 (7.950)
Skill	0.674*** (0.178)	0.594* (0.256)	0.191 (0.262)	0.595** (0.192)	0.673** (0.215)	-0.422 (0.313)
Effort	14.61** (5.217)	. .	21.65*** (5.411)	21.59** (6.775)	. .	25.59*** (5.942)
Constant	-89.90*** (11.68)	-85.92*** (7.268)	-84.86*** (15.62)	-114.8*** (12.28)	-92.68*** (4.913)	-99.14*** (15.95)
Observations	405	90	180	405	90	180
Adjusted R^2	0.304	0.076	0.153	0.358	0.176	0.164

Note. The table reports results from six OLS regression models for the three different domains and separated by prediction horizon. Reported are raw coefficients. Positive coefficients indicate that perceived control increases when the respective predictor increases. Standard errors in parentheses are corrected for 45 clusters in observations. Task dummies are omitted. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

In the third experiment, the *increased danger of the sport bets hypothesis* (H5) is only partially supported by the data. The effect of skill on confidence estimation was again stronger for soccer bets than for Lotto. The respective interaction effect, however, did not reach conventional significance levels in the regression on confidence (b = -.10, t = -1.58, p = 0.122). The effect was far from significant in the equivalent regression on perceived control (p = .94).

We again investigated the *danger of stock-trading hypothesis* (H6) by comparing the influence of skill on confidence and perceived control in soccer bets and stock bets. The relation between skill and confidence was slightly higher for soccer, compared to stocks, but the respective interaction term between domain (soccer vs. stock) and skill was far from significant (p = .61; see also Table 5, models 1 vs. 3 and 4 vs. 6). But there was a significantly lower effect of skill on perceived control for stocks compared to soccer bets, b = -.68, z = -2.48, p = 0.017. As can also be seen in Table 5 (models 1 vs. 3 and models 4 vs. 6), for both prediction horizons the effect of skill on perceived control was lower for stocks, as compared to soccer. The last finding indicates that under some conditions soccer bets are indeed worse than stock marked predictions concerning illusion of control.

Discussion

The third experiment was conducted to double-check findings from Experiments 1 and 2 and to use an improved methodology to rule out alternative explanations. The overall results are very much in line with the results of the first study, and the additional measures for overconfidence and the objective measure for skill confirm previous results. As in the previous studies, we find a clear effect of increasing confidence in soccer bets with increasing skill even when controlling for accuracy. As mentioned before, this effect might have been due to low-skilled people being underconfident, high-skilled people being overconfident, or both. The direct measure of overconfidence supports the second interpretation: low-skilled people are relatively well calibrated, whereas high-skilled people are overconfident. Furthermore, we can rule out that this effect is only due to persons overestimating accuracy and their skill at the same time. The effect also holds if the soccer quiz used as an objective measure of skill is included in the analysis instead of the subjective measure. For soccer bets, we also replicate the effect of skill on perceived control, indicating illusion of control.

In line with Experiment 1, we find better than chance performance in soccer bets, but no influence of skill on predictive accuracy and monetary earnings. The null-effect of skill for three-day predictions stands in contrast to the results from Experiment 2. Note, however, that there is a slight tendency towards the previously observed direction in this study also.

In line with our general methodological concerns, this indicated that for relatively small samples of games, the relation between accuracy and skill is highly volatile. This might be due to a general low reliability in soccer results (which might be partially caused by the low number of goals), a lack of cues that work under all circumstances or even other factors. For occasional gamblers (i.e., from a one-shot perspective), this in itself turns soccer bets into a game of chance. For persons who gamble very often, however, the long-term average is more important. To get such an estimate and to summarize the partially contradicting findings, we collapsed findings from all three experiments in an overall analysis.

Overall Analysis of Pooled Data

Skill and Accuracy

To summarize the findings of all three studies, we pooled the results from all three studies. To get an overall result concerning the influence of skill on accuracy, we conducted logistic regressions with accuracy as dependent variable and (subjective) skill as predictor controlling for effort and task differences (i.e., dummies for each task) for the complete soccer bets data. The total effect of skill over both prediction horizons was not significant (b = .0028, z = 1.47, p = 0.14), and the effect was even weaker when using the objective instead of the subjective skill measure (p = .70). There was, however, an effect of subjective skill for three-day predictions (b = .0075, z = 3.13, p = 0.002) but not for three-week predictions (b = -.00178, z = -0.62, p = 0.533) of soccer games. Hence, considering all three studies together, there seems to be an influence of self-assessed skill on accuracy only in short-term predictions, but not in long-term predictions. Taking into account real odds, the advantage in accuracy in short-term predictions that comes with higher skill does, however, overall not result in significantly higher payoffs (three-days: $F(1, 118) = 1.68$, $p = .20$; three-weeks: $F(1, 45) = 0.00$, $p = .99$). As a caveat, to all analyses including odds, however, it has to be considered that participants' incentive scheme was independent of odds. We therefore by design excluded classic effects of over-betting long-shots (i.e., horses / teams with high odds and low probabilities; Griffith, 1949), and any other strategic consideration (e.g., hedging of risks). The only rational strategy was to bet on the most likely winner. We have to acknowledge that this might reduce the external validity of our payoff results (for a discussion of this and further limitations, see also below).

Skill and Overconfidence

In the overall analysis of confidence, we found a strong effect of subjective skill on confidence in soccer bets even after controlling for accuracy, effort and task differences (i.e., dummies for each task), $b = .22$, $t = 12.83$, $p < 0.001$, indicating overconfidence particularly for people with high self-assessment of skills. However, the effect is not only driven by overestimating one's own skills, because it remains when using the objective skill measure, $b = 1.95$, $t = 5.44$, $p < 0.001$. Considering the interactions between skill and domain in a regression including all bets, the overconfidence effect is stronger for soccer compared to Lotto ($b = -.076$, $t = -2.14$, $p = 0.033$) and stocks ($b = -.064$, $t = -1.68$, $p = 0.094$).

Skill and Illusion of Control

We also regressed perceived control on subjective skill for all soccer bets, controlling for accuracy, effort, and task differences. The analysis replicates the strong effect of subjective skill on perceived control ($b = .69$, $t = 8.70$, $p < .001$), indicating illusion of control. Again, the effect prevailed if the objective skill measure was used in lieu of the subjective one ($b = 6.63$, $t = 4.54$, $p <.001$). The effect was somewhat stronger for soccer bets compared to Lotto bets. The interaction, however, did not reach conventional significance levels ($b = -.13$, $t = -0.91$, $p = 0.365$). The effect of skill on perceived control was stronger for soccer bets compared to stock bets (IE: $b = -.43$, $t = -3.30$, $p = 0.001$).

General Discussion

Sport bets are very common in different countries and enjoy increasing interest in Germany also. There is a current debate in German legislation concerning the regulation of sport bets. This has been partially caused by a recent decision of the European Court of Justice, which criticizes the current regulation and practice as inconsistent. The two core questions are whether persons can influence the outcome of the bets largely by their skill, and whether bets involve factors that make them dangerous for the person betting. Problematic and pathologic gambling and all negative consequences following from them should be avoided. However, much more so than U.S. law, German legislation also tries to take care of consumer protection issues, such as preventing bettors' irrationality in judgments and biases from being exploited. Relevant empirical data are still scarce, perhaps in part due to the fact that data tends to concern other kinds of sports than the ones of particular interest in Germany, namely soccer.

To overcome this problem, we investigated persons' betting behavior in soccer bets in three comprehensive online studies. We were particularly interested in the influence of skill on accuracy, confidence, and perceived control and the prevalence of the related cognitive biases overconfidence and illusion of control. To add arguments to the legal debate, we went further by comparing soccer bets with pure games of chance (i.e., Lotto bets) and bets that do not fall under gambling law, namely bets on developments on the stock market.

Soccer bets should not be considered games of skill

We show that prediction performance in *1. Bundesliga* soccer games is better than chance in indicating that some skill component beyond mere guessing is involved. Nevertheless, our results also show that the differential influence of high vs. low skill is relatively small. Overall, we find a significant influence in short-term bets, but none in long-term bets. Taking into account real odds from online betting agencies, higher skill did not lead to significantly higher payoffs. Extending previous findings on hockey (Cantinotti, et al., 2004) and horse betting (Ladouceur, et al., 1998), we find that for soccer bets, no overall differential influence of skill on monetary wins can be found. We conclude that such an influence must either be very small, and maybe highly volatile (see Experiment 2), if it exists at all.

Under the predominant legal test, a game of skill is characterized by the outcome of a game being predominantly influenced by skill elements rather than by chance (Fiedler & Rock, 2009). The outcome is thereby defined as the difference between the payoff and the initial payment. In statistical terms, this would mean that more than half of the variance in wins between participants should be explained by skill. According to our results, this is not the case for soccer bets. Self-assessed skill and sport quiz together accounted for 2.5% of the variance when simultaneously entered in a regression that predicted participants' monetary wins (in Experiments 2 and 3), leaving 97.5% of the variance unexplained.[12] Similar but slightly higher proportions were found when inspecting short (3%) and long (5%) prediction horizons separately. Hence, according to the predominant test in German law, soccer bets should not be considered games of skill (however, see also below for limitations to our studies).

12 Of course, part of this low explanatory power might be attributed to the imprecise measurement of skills. However, the result also holds with a conservative estimation of true skill variance captured by the skill scale and the soccer quiz score. In other words, based on the intercorrelation of the scales (r = .70), one might assume that the scales at least capture 49% of the variance of soccer skills (i.e., .702 = .49).

Soccer bets induce systematic biases that might be harmful for bettors

It has been repeatedly argued that specific cognitive biases increase persons' willingness to bet, and that they are core determinants involved in the development of problematic gambling (e.g., Blaszczynski & Nower, 2002; Corney & Cummings, 1985; P. Rogers, 1998; Toneatto, et al., 1997). Particularly, illusion of control and overconfidence effects have been shown in betting tasks (e.g., Goodie, 2003; Goodie, 2005; Langer, 1975; Toneatto, et al., 1997). In line with these previous studies, we demonstrate for real soccer bets that confidence and perceived control increase with increasing skill, even when controlling for accuracy, indicating overconfidence and illusion of control. We furthermore show that persons with low skills seem to be relatively well-calibrated, whereas people with high skill show strong overconfidence, which is in line with recent, more differentiated views on overconfidence (Moore & Small, 2007). Obviously, such a differential effect is particularly problematic for sport bets in practice, because bettors will typically believe that they have high skills.

Overall, findings concerning perceived control also indicate an illusion of control. Particularly high-skilled participants think they have a strong influence on the outcome of the bets, even if that is not the case.

The data clearly show that soccer betting leads to cognitive biases, and particularly to overconfidence and illusion of control, which have the potential to harm bettors and induce problematic betting. The results concerning acceptance of additional bets also directly show that these biases lead to increased betting.

Games with assumed skill influence are more dangerous than pure games of chance

The German legal system implies that games of chance might be more dangerous than games that rest partially on skill, supposedly because people have control over the outcome. Previous findings concerning increased overconfidence in games with skill components speak against this assertion and indicate that biases might even be particularly strong in games with assumed skill influence (Goodie, 2003). Findings concerning higher prevalence rates of problem gamblers in soccer betting compared to Lotto point into the same direction (Meyer & Hayer, 2010). Considering all our data, we could show such an effect in that the influence of skill on confidence was stronger for soccer bets compared to Lotto bets even after controlling for accuracy. For illusion of control, this differential effect was not significant overall.

Soccer bets vs. betting on the stock market

For legal justice, it is important to treat equal things equally and different things differently. One domain in which bets are treated differently from usual games is "betting" on the stock market. Stock trades are obviously not regulated by gambling law. Persons have the possibility to buy and sell complex financial products, which include bets on stock developments that are comparable to the stock bets we offered in our study. Stock bets thereby share some similarities with soccer bets, in that people will often assume that they can influence their wins by skill. There might be many good reasons for being less restrictive in the regulation of stock trades than in the regulation of gambles. Nevertheless, we wanted to investigate whether stock bets are less dangerous than soccer bets concerning cognitive biases. Our results in the overall analysis indicate that overconfidence and illusion of control seemed to be somewhat smaller for stocks as compared to soccer bets. Hence, our data are generally in line with the hypothesis that unregulated bets on stocks might be less dangerous than soccer bets concerning cognitive biases. However, this might also be due to the fact that participants can be assumed to have low skill, if any, in stock predictions (see Moore & Healy, 2008). Hence, our results concerning stock bets need to be investigated in further analyses.

Limitations

This study has some methodological limitations that should be kept in mind when interpreting the results. Some can be ruled out by additional analyses; others might be addressed in further research. First, it might be criticized that we did not use true betting experts in our studies and that the effect might look quite different for persons really involved in betting. To test this hypothesis, we reran the core analyses with participants of the study who had been previously involved in real soccer bets (11%). We found that bettors did not score higher on accuracy compared to non-bettors ($F(1, 213) = 0.51$, $p = .48$) and they also showed a significant effect of skill on accuracy only for three-day predictions ($b = .0113$, $z = 2.01$, $p = 0.045$), but not for three-week predictions ($b = -.0024$, $z = -0.27$, $p = 0.788$). Bettors also showed comparable effects of skill on confidence ($b = .108$, $t = 2.98$, $p = 0.006$) and perceived control ($b = .511$, $t = 2.69$, $p = 0.012$); and they earned the same amount of money as non-bettors ($F(1, 44) = 0.00$, $p = .99$). Hence, our experimental results also hold for persons who are involved in real soccer betting. Furthermore, it should be kept in mind that—from a public-policy perspective—not only real bettors, but all potential participants in betting are relevant. The results are in line with previous findings from hockey and horse-betting, which provides converging evidence for our results. A second issue concerns the fact that in our study persons were not informed about the winning odds and their choices were incentivized independently of the odds. This prevents strategic betting, such as betting on the long-shots which might be part of professional betting strategies (see Ladouceur, et al., 1998, for further examples of betting strategies). However, even with the possibility to use such strategies, for example, the average horse-race bettor will lose about 16 to 17% of his or her money in the long run (Ladouceur, et al., 1998). So, one might assume that these strategies are not particularly efficient, and that allowing them should not change the pattern of results. Third, it might be objected that we instructed participants to make bets on all games, whereas in the real world they can bet only on games they are most confident to win. For this to be a successful strategy, it would necessitate that people show higher confidence in bets in which they make correct predictions. In five of six regression models for predicting confidence, we found no difference in confidence between correct and wrong (soccer) bets; only in one the effect turned out significant. To test this issue more directly, we regressed monetary wins (taking into account odds) on confidence and found no effect (b = -.0028, t = -1.06, p = 0.291). Hence, there is no correlation between confidence and monetary win; therefore, this limitation might also be considered to be of minor importance.

Summary and Conclusions

Our results show that the skill influence on accuracy in soccer bets, and also in resulting monetary payoffs, when taking into account real betting odds, is low, if existing. Therefore, according to the prevailing test in German Law, soccer bets should not be considered games of skill, but should fall under the strict regulation for games of chance. Soccer bets involve cognitive biases that might harm bettors. They induce overconfidence and illusion of control, both of which lead to increased betting and might even result in gambling addiction. Both biases increase with self-assessed and objectively measured skill. In contrast to the implicit assumption underlying regulation of gambling, but in line with previous findings, our results indicate that soccer bets are in some respects even more dangerous than pure games of chance such as lotto. We found that bets on the stock market—that obviously do not fall under the regime of gambling law—lead to somewhat less bias than soccer bets, although the reasons for this require further investigation. Elaborating on previous arguments and findings (Meyer & Hayer, 2010), our studies provide empirical evidence for the regulation of soccer bets.

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