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An Empirical Study on Risk Taking in Tournaments

by

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An Empirical Study on Risk Taking in Tournaments*

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Abstract

Individuals faced by a tournament can oftentimes not only choose their effort level, but also the risk level of their strategy. There are some theoretical contributions on risk taking in tournaments, which mainly point out disadvantages with respect to exerted effort. Empirical evidence is rare. In this paper we analyze risk taking behavior of professional soccer coaches. We find that risk taking concerning the kind of observed substitutions is, indeed, relevant. However, risk taking does not pay off.

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1. Introduction

Arranging a rank-order tournament between several agents, a principal usually wants to achieve two aims: First, she wants to induce incentives for the agents to work hard, second, she wants to identify the most able agent. The theoretical literature on risk taking in tournaments (Hvide 2002, Hvide & Kristiansen 2003, Yumoto 2003, Kräkel & Sliwka 2004) indicates that the achievement of these aims is extremely jeopardized when the agents are able to choose strategies of different risk. The agents may prefer to play high risk strategies and, as a direct consequence, to choose inefficiently low efforts. Moreover, the tournament's outcome would then be mainly influenced by luck or random components and, hence, would not entail much new information about the agents' abilities.

Summarizing, risk taking behavior in tournaments might have extremely negative consequences for the principal. It is therefore of great interest to explore how important risk taking is in practice. In this paper, we empirically address two questions. Do agents participating in rank-order tournaments make use of very risky strategies? If so, does risk taking pay off for the agents, that is, are risk taking agents more successful than non risk taking ones?

We examine data of German Major League Soccer.[1] The advantage of using soccer data is that soccer exactly represents the structure of a tournament, where agents may choose strategies of different risk. In our setting, the agents are the teams' coaches. They are in competition against each other, since coaches of rather unsuccessful teams are likely to get fired and to realize significant reductions in income. Further, risk taking can be measured very easily by considering the team formations. A very offensive formation is definitely riskier than a very defensive one. However, it should be stressed that in soccer, at least during the matches, the coaches' efforts are of little importance, since the players are the ones exerting effort. Hence, in soccer, the effort reducing effect of risk taking – stressed by the theoretical literature – should not be relevant. Negative

[1] Other papers, which examine soccer data, include e.g. Reilly & Witt (1995), Haugen & Hervik (2002) and Koning (2003). Incentive effects of sports tournaments have been analyzed by Ehrenberg & Bognanno (1990, Golf), Becker & Huselid (1992, stock car races) as well as Garicano & Palacios-Huerta (2001, soccer).

effects of risk taking in soccer are therefore not obvious. The soccer data allows us to evaluate the impact of risk taking on the tournament's outcome. Particularly, we can explore, whether risk taking or non risk taking agents are more successful.

There exist only a few related papers that empirically analyze risk taking in tournaments. Chevalier & Ellison (1997) show that fund managers raise their portfolio riskiness, when their funds performance is below the average. By catching up with the average, fund managers would realize a big increase in the inflow of investment. On the other hand, further falling behind the average would only entail small reductions in investments in the fund. Lee (2004) finds similar results investigating the World Poker Tour. Professional Poker players show a riskier behavior, when the chance of winning a lot of money comes along with little risks of losing money.

First, this paper supports the findings of Chevalier & Ellison and Lee. The coach of a team leading in a match is likely to switch to a less risky strategy, whereas the coach of the opponent team reacts in an opposite way, that is, he chooses a riskier team formation. Most interestingly, we show that switching to a strategy of higher risk is less successful than maintaining the initial one. We, therefore, find evidence that risk taking does not only affect the dispersion of an outcome, but also its expectancy. This aspect is neglected in the previous empirical and theoretical literature.

The paper is organized as follows: We present two hypotheses in section 2. A description of our data is placed in section 3. In section 4, we present our main results. Concluding remarks are offered in section 5.

2. Hypotheses

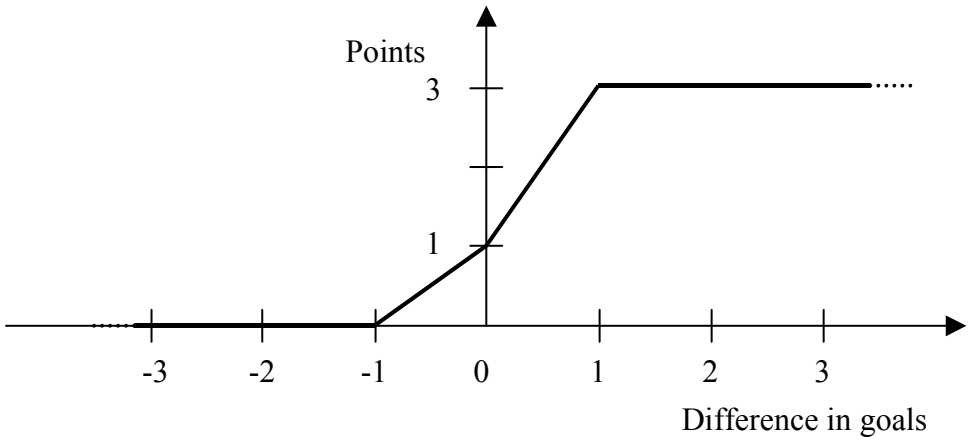
In German Major League Soccer (as in most other soccer leagues), a team winning a match receives three points, while a losing team receives no point. In case of a tie, both teams receive one point. The teams are ranked according to the overall points they have received. If some teams have same overall points, these teams are ranked according to the difference in goals scored and goals suffered. Hence, a coach mainly cares for points

received by his team. Figure 1 therefore describes the incentive structure during a single match for a certain team.

On the x-axis, we measure the difference in goals scored by the considered team and its opponent. If the team is one goal down, it will not lose any points by suffering further goals. On the other hand, the team will receive additional points by scoring goals itself. For instance, a team will get two more points (3 instead of 1), if it breaks a tie. The coach should then be likely to switch to a riskier strategy. If the considered team leads by one goal, the argumentation is contrary and the coach should be likely to switch to a less risky strategy. This argumentation is summarized in hypothesis 1.

> *Hypothesis 1. The coach of a team leading (being behind) during a match should switch to a less risky (riskier) strategy.*

Figure 1: Incentive structure of a soccer match

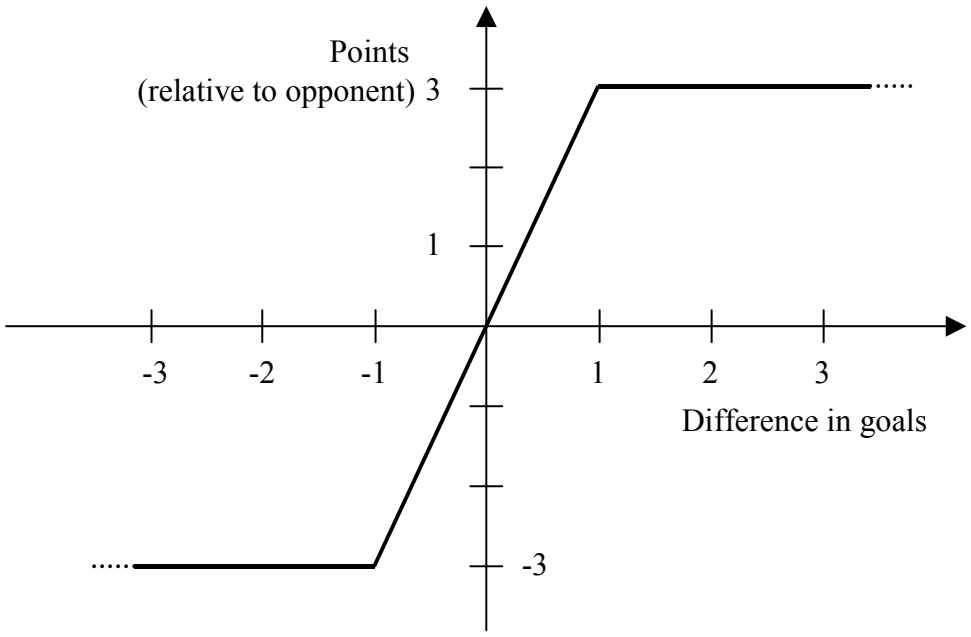


In sports like soccer, people often talk about so-called “six-point-matches”. These are matches between “direct rivals”, that is, matches, where teams having almost the same ranking compete. If a team wins such a match, it will not only receive 3 points, but also guarantee that its direct rival gets no point. The incentive structure in a six-point-match is described by figure 2. Starting from a tie, a team competing in a six-point-match has more to lose than a team competing in an ordinary three-point-match. The incentive

structure in the decisive area is linear instead of convex as in an ordinary match. One could therefore guess that coaches choose less risky starting formations in six-point-matches. This is hypothesis 2.

Hypothesis 2. In a match with teams being similar ranked, the coaches should choose less risky starting formations than in ordinary matches.

Figure 2: Incentive structure of a soccer match against direct rival



3. Data and Variables

Our data contains all 306 matches of season 2003/2004 of German Major League Soccer. The league consists of 18 teams, which are faced in a double round robin tournament. A soccer team consists of 11 players. In general, we distinguish between four tactical positions: goalkeeper, defender, midfielder and forward. The players are specialized in one of these positions. Inevitably, one and only one goalkeeper is one of the 11 players. The coaches can decide on the number of players of the other tactical positions. Up to three substitutions per team are allowed during a match. The coaches can undertake *risk neutral substitutions* (same tactical position), risk taking substitutions

(defender or midfielder replaced by forward, defender replaced by midfielder) and risk reducing substitutions (midfielder or forward replaced by defender, forward replaced by midfielder). A risk taking substitution usually increases the possibility to score a goal in a certain period, but also increases the probability to suffer one. We examine both the starting formations of the teams and the kind of substitutions. Besides, we know the scores at the moment of each substitution, the final score and the ranking of the team before the match. The data is available in the internet at www.kicker.de. Players are matched to tactical positions by Kicker – the main German soccer magazine – as well.

Examining 306 matches with two teams, we have got 612 observations. On average the teams consists of 3.5 defenders and 2.4 forwards at the beginning of a match. We observe 1682 substitutions during the whole season, whereby 24 percent can be defined as risk taking substitutions and 21 percent as risk reducing ones.

4. Results

First, we want to examine the effect of the current score on risk taking and risk reduction (hypothesis 1). We, therefore regress the goal difference – defined as the number of goals scored by the team minus goals scored by the opponent – on risk taking and risk reducing substitutions. Binary probit regressions provide evidence in support of hypothesis 1 (see Table 1). Indeed, the probability of risk taking (risk reducing) substitutions is decreasing (increasing) in the differences of goals. Coaches replace a more defensive player by a more offensive one, when their teams are behind. On the contrary, coaches want to reduce the probability of suffering a goal, when their teams are staying ahead.

The kind of substitution may also be affected by the ex ante probability to win the match. Usually it is a considerable advantage to play at home.[2] Additionally, teams at the top of the ranking are favorites against teams with weaker performance in the previous matches. Probably, favorites rather than underdogs will be up to risk taking substitutions. Hence, we expect a positive (negative) effect of a home match and a negative (positive) effect of the difference in the ranking – defined as the ranking of the

[2] During the observation period there have been 160 home, but only 74 away victories.

club minus the ranking of the opponent – on risk taking (risk reducing) behavior of the coaches. In tendency, the results confirm these considerations.

Table 1: Binary probit regressions on risk taking behavior

	Risk taking substitutions	**Risk reducing substitutions**
Goal difference	-0.230***	0.110***
	(8.84)	(4.39)
Home match	0.109	-0.053
	(1.47)	(0.70)
Difference in ranking	-0.012*	0.008
	(1.83)	(1.17)
Team dummies (18)	Yes	Yes
Pseudo R^2	0.080	0.050
Number of observations	1682	1682

Note: Absolute t-values in parentheses-. * and *** indicate significance at the 0.10 and 0.01 level.

Second, we hypothesized a more defensive starting formation in matches against direct rivals in the overall ranking (hypothesis 2) because of the different incentive structure. In order to examine this issue, we use the number of defenders and forwards in the starting formations as dependent variables in ordered probit regressions. The character of a match against a direct rival is measured with the absolute difference in the ranking, so that this variable has low values for matches against rivals. Hence, we expect a negative (positive) effect on the number of defenders (forwards). Tactical formations may also depend on the place of the match (home versus away match). Hypothesis 2 cannot be confirmed. The effects of the absolute difference in the ranking are not significant and the sign with respect to the number of forwards is even negative instead of positive (see Table 2). Obviously, the coaches do only concentrate on their own team and do not take into account the relative ranking to their opponent. Coaches choose to begin home matches with significant more forwards, though.

Table 2: Ordered probit regressions on number of defenders and forwards in starting formation

	# Defenders	# Forwards
Absolute difference in ranking	-0.012 (1.03)	-0.0002 (0.01)
Home match	-0.138 (1.55)	0.289*** (2.93)
Team dummies (18)	Yes	Yes
Pseudo R^2	0.191	0.260
Number of observations	612	612

Note: Absolute t-values in parentheses-. *** indicate significance at the 0.01 level.

At last, we want to evaluate the success of risk taking behavior in soccer matches. If a coach chooses a risk taking substitution – probably if his team is behind – he aims an advancement of the score and therefore, an advancement of received points. We measure success of a team in a particular match as the score advancement from the moment of the first substitution to the final whistle. It is possible that this measure is positive, but nevertheless a team looses a match. Therefore, we make use of an additional second measure: the advancement of received points, which is defined as the difference of actual points after a match minus hypothetical points due to the score at the moment of the first substitution. As mentioned above, a coach can undertake up to three substitutions during a match. We generate an overall measure of the coaches risk taking based on all observable substitutions. Forwards get the value 2, midfielder the value 1 and defender the value 0. We calculate the difference of the values of the new and the replaced player for each substitution. Then, the degree of risk taking is defined as the sum of these differences of all substitutions for a certain team and match. Hence, a high value determines a high level of risk taking and negative values coincide with risk reducing behavior. The distribution of the variables *score advancement*, *point advancement* and *degree of risk taking* are given in Table 3.

Table 3: Frequencies of score advancement, point advancement, and risk taking behavior

	Score advancement		Point advancement		Degree of risk taking	
-4	1	0.002			5	0.008
-3	9	0.015	2	0.003	18	0.029
-2	36	0.059	22	0.036	48	0.078
-1	133	0.217	61	0.100	142	0.232
0	249	0.407	418	0.683	182	0.297
+1	131	0.214	29	0.047	126	0.206
+2	40	0.065	70	0.114	59	0.096
+3	8	0.013	10	0.016	28	0.046
+4	4	0.007			4	0.007
+5	1	0.002				
Σ	612	1	612	1	612	1

The variables score advancement and point advancement have an ordinal scale. Evaluating the effect of risk taking behavior on success, we, therefore, use ordered probit regressions again. Home match and difference in ranking before the match again act as control variables. Table 4 reveals that risk taking behavior lead to a worsening of the score. Hence, the increase in the probability to suffer a goal outweighs the increased possibility to score an additional goal. As described in section 2, a team being behind has little to loose except for a worse goal difference, but can achieve a point advancement next to the score advancement. However, the degree of risk taking behavior does not lead to a point advancement, either. On the contrary, point advancement is also negatively associated with the degree of risk taking. Hence, avoiding offensive substitutions result in higher probabilities to catch up a handicap or break a tie. Probably, the coaches overestimate the advantages of risk taking on average. In other words, they underestimate the chances of score and point advancements with their chosen tactical starting formation. Obviously, the disadvantages of risk taking dominate. Therefore, not only the distribution of possible outcomes is dispersed by risk taking in professional soccer, but also the expectancy is affected negatively.

Table 4: Ordered probit regressions on score and point advancement

	Score advancement	Point advancement
Degree of risk taking	-0.118*** (3.78)	-0.058* (1.69)
Home match	0.442*** (5.16)	0.193** (2.07)
Difference in position	-0.010 (1.29)	-0.001 (0.12)
Team dummies (18)	Yes	Yes
Pseudo R^2	0.048	0.024
Number of observations	612	612

Note: Absolute t-values in parentheses-. *, ** and *** indicate significance at the 0.10, 0.05 and 0.01 level.

5. Conclusion

In this paper, we empirically analyzed the relevance of risk taking in tournaments. Using data from German Major League Soccer, we found that risk taking matters. Coaches of teams leading during a match switch to less risky strategies, while the opposite is true for coaches of teams being behind. Most interestingly, we demonstrated that switching to a riskier strategy for a coach is worse than maintaining the initial strategy in that it leads to a lower expected score and point advancement. This is quite surprising. One should expect that a team being one or more goals down should be more likely to achieve a point advancement, when it switches to riskier strategy. Obviously, an increase in risk not only enhances the variance of the outcome distribution, but also decreases its mean.

What do these results entail for the optimal organization of firms? Theoretical literature states that firms should not use tournaments in settings, where agents' efforts are a crucial issue and agents are able to play high-risk strategies. However, if agents´ efforts are less important, the decision of a firm, whether or not to arrange tournaments, should depend on the firm's objective function. We examined that the expectancy of the outcome is affected by risk taking as well. Firms that maximize aggregate performance

might therefore be better off with avoiding tournaments and implementing different incentive schemes. On the contrary, in environments where the best performance is to be maximized – such as perhaps in R&D departments, where only a new invention matters – tournaments may perform better as an incentive device.

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