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Favoritism of agents – The case of referees' home bias

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Abstract

We study the behavior of football (soccer) referees in the *German Bundesliga*. Referees are requested to act as impartial agents. However, they may allocate benefits and rewards in a biased way. Agency theory has long neglected this possible form of malfeasance of economic agents, but has rather concentrated on agents exerting suboptimal effort levels. Favoritism or biased behavior of referees can be investigated by examining their decisions on awarding penalties or extra time at the end of a football match. We can confirm a systematic home bias of referees.

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1. Introduction

Football (soccer) referees are employed to interpret the rules of football in an impartial way. However, they can exert considerable discretionary power, in particular when adding extra time, awarding penalties, allocating yellow or red cards and deciding on free-kicks or off-side. As a consequence, referees have a very important influence on the final result of a football match.

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Economically speaking, referees act as agents. Typically, agency theory is concerned with agents exerting (more or less) effort depending on incentives (see Prendergast, 1999; Laffont & Martimort, 2002). The problem of agents, like referees, making biased or impartial decisions in the sense that they show (statistically discernible) favoritism towards one of several principals has not been thoroughly explored so far in the economics literature. Prendergast and Topel (1996) are an exception by showing in a theoretical model that favoritism is not necessarily costly to organizations even though it may create arbitrary rewards.

The purpose of this paper is to provide an empirical test of favoritism in sports. Specifically, we look at two different types of referee decisions in the *German Bundesliga* in the season 2000/2001. First, we analyze the amount of extra time added by referees at the end of a match. [1] Second, we are going to examine referee decisions on penalties. [2] Both decisions may be influenced by a home bias of referees.

Using field data from the Spanish football league, Garicano, Palacios, and Prendergast (2001) have been the first to investigate the amount of extra time a referee adds after 90 min, depending upon the score of the game and the composition of the crowd watching the game. Garicano et al. (2001) provide clear evidence for a distinct home bias of referees, in the sense that referees add significantly more extra time in case the home team is behind by one goal than if it is ahead by one goal after 90 min. We apply the same methodology with respect to awarding extra time. Our results may confirm their evidence of referees' home bias for another major football league in Europe.

Referee decisions on penalties have been examined by Nevill, Newell, and Gale (1996) by counting the number of awarded penalties in English and Scottish football leagues, showing that home teams are awarded significantly more penalties than visiting teams. However, making an inference from the number of awarded penalties on home bias of referees would necessarily imply the assumption of an equal probability of the home team and the visiting team being awarded a penalty. This assumption seems unreasonable to us. Therefore, we will examine the relation of awarded to refused penalties for home and visiting team, respectively. This approach allows to control much more convincingly for a possible home bias of referees.

The rest of the paper is organized in the following way. Section 2 briefly dwells upon possible explanations for the home advantage in team sports, and Section 3 introduces our data set. Section 4 reports the results, and Section 5 discusses the implications of the results and concludes.

[1] Soccer matches consist of two halves with 45 min gross time each. The referee has the discretion to decide on adding extra time at the end of every half according to the rules of the game that are, however, not completely specified with respect to the amount of extra time to be added.

[2] A penalty is a direct shot on the goal from 11 m distance, unhindered by opposition players with the exception of the goal keeper.

2. Home advantage in team sports

Biased referee decisions, regardless whether they are a consequence of favoritism or not, are an important factor in explaining the home advantage in team sports, which means that home teams win significantly more often than visiting teams. In the large literature on the home advantage in team sports, social pressure exerted by the crowd has been shown to be of major importance (for surveys see Courneya & Carron, 1992, or Nevill & Holder, 1999). The two main channels through which the crowd factor becomes effective are the following: First, crowds can stimulate the home team to perform better. Even though the literature is not conclusive on that aspect, a recent study by Neave and Wolfson (2003) has been able to link crowd composition to physiological reaction of players. Specifically, they show that players have a significantly higher testosterone level in home matches than when playing away, which might be caused by a natural desire to defend one's 'own' territory.

Second, the noise created by the crowd can influence the referee to – subconsciously – favor the home team. Crowds vent their anger with large volume and rather quickly at referees for decisions that do not favor their preferred team. In order to control for the influence of the crowd noise on referee decisions, Nevill, Balmer, and Williams (2002) have shown a video-tape of 47 tackles from an English Premier League match to 40 qualified referees, who were asked to classify a tackle as regular or irregular. Referees were informed about the colors of the home team and visiting team, respectively. Then referees were split in two groups, with one group hearing the noise of the crowd's reaction, while the other watched the tackles silently. As a result, the group of referees who heard the sound was markedly more reluctant (by about 15%) to classify tackles of home teams as irregular and was more often uncertain in their decision. It is noteworthy that the decisions made by the group of referees who heard the noise were significantly more in line with those made by the original match referee than the decisions made by the group which watched the tackles silently. [3]

Evidence from psychology provides further guidance to explain a possible home bias of referees caused by crowd reactions. Referee decisions have to be made instantaneously, implying heavy time pressure on the side of referees. Wallsten and Barton (1982) have shown that under time pressure people have a tendency to focus on the most salient cues to make a decision. The crowd noise caused by a tackle may serve as a salient, yet potentially (and probably) biased cue for the referee's decision (see also Wickens & Hollands, 2000, or Nevill et al., 2002). As a consequence, when facing a contentious decision, the salient cue of crowd noise (remaining rather silent when a home team player makes a tackle, but booing when a visitor tackles) may cause a difference in assessing fouls of home players or visiting players. Another subtle form of how crowd noise influences referees may stem from the use of heuristics in

[3] Nevill et al. (2002) have chosen tackles from the match Liverpool vs. Leicester City. From a methodological point of view it would have been desirable to also consider tackles from the return match Leicester City vs. Liverpool in order to show that the bias of qualified referees was, in fact, a home bias rather than a Liverpool-bias.

decision making. Even though heuristics frequently result in systematic errors (Tversky & Kahneman, 1974), they are often used as rules of thumb to reduce complexity in judgment. If a referee is uncertain whether a tackle was regular or irregular, he might, therefore, place equal weight on the possibly biased auditory information from the crowd and on his visual information.

3. Data and basic statistics

Our data base has been constructed from the web-site of *Kicker Sportmagazin,* the most important magazine for German football (see http://www.kicker.de). The website indicates for each match by the minute the kick-off, goals, penalties, yellow or red cards, substitutions, and the final whistle of each half. In addition, there is a report on the referee's performance, which comments especially on whether awarded penalties have been legitimate according to the rules of the game and on whether a referee has refused to award a legitimate penalty. [4]

In the season 2000/2001, there were 2.93 goals per match on average, with home teams scoring 0.62 goals more than visiting teams. 161 out of 306 matches were won by the home teams, 76 by the visiting teams; 69 matches ended with a draw.

In total, 76 penalties were awarded; 55 for the home teams, respectively 21 for the visiting teams. Goals in the extra time of the second half were only scored in 11 out of 306 matches. Average extra time was 1.88 min in the second half, but significantly shorter in the first half (1.11 min; $p < 0.001$; t-test). Home teams were significantly less often penalized by yellow cards (1.98 vs. 2.40) and sending-offs through red cards (0.1 vs. 0.2), respectively ($p < 0.001$; t-test). On average, there were 2.65 substitutions per team (the maximum allowed being 3 players), with no significant difference between home and visiting teams.

4. Results

4.1. Home bias in awarding extra time

Fig. 1 presents average extra time in the second half, depending upon the score margin after 90 min. A positive score margin indicates that the home team is ahead when extra time starts. The most extra time is awarded in case the home team is one goal behind (score margin −1). A simple OLS-regression (reported in detail in Sutter & Kocher, 2002) confirms that extra time is about a quarter of a minute shorter for each additional unit in the absolute score margin. That means that referees award less extra time if it is already clear after 90 min which team is going to win.

[4] The reports on referees are written by the (trained) staff of *Kicker Sportmagazin*. Casual cross-checking of the staff's assessment of (il)legitimately awarded or refused penalties with the assessment of a referee official (from the German Football Association, *DFB*) – who commented on disputed referee decisions on TV ("*Aktuelles Sportstudio*" on "*ZDF*") – reveals that the staff's assessment seems to be impartial and sticking very closely to the rules of the game.

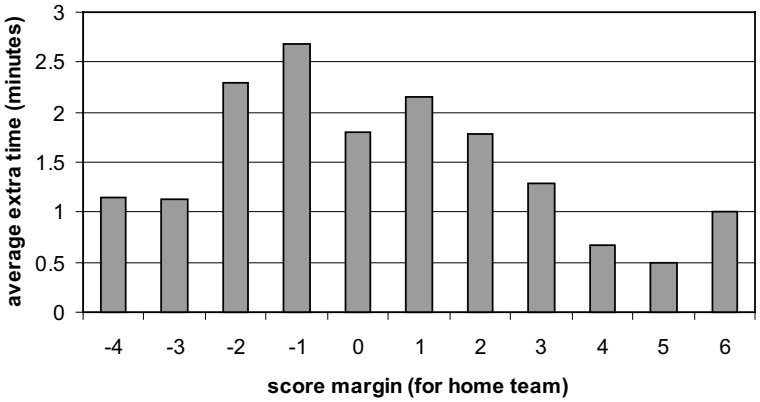

Fig. 1. Extra time by score margin (after 90 min).

In our further analysis, we will concentrate on matches with a close score margin, ranging from −1 to +1, since in these matches the discretionary power of the referee to decide on extra time can have the most weight. Note first that extra time is significantly longer when the home team is one goal behind ($N = 41$) than when it is one goal ahead ($N = 68$), respectively when the result is a draw ($N = 71$) after 90 min ($p < 0.05$; t-tests).

Taking into account the most important factors influencing extra time according to the rules of the game – player substitutions and the allocation of yellow and red cards – we present the OLS-results (with White correction for heteroscedasticity) on the influence of the score margin on extra time in columns 1 and 2 of Table 1. If the home team is ahead by one goal (score margin of +1) or the result is a draw (score margin of 0), the extra time is significantly shorter (about 30–50 s) than if the home team is behind by one goal (score margin of −1).

Concerning our control variables, [5] we find that the total number of yellow cards has a significantly positive influence on extra time in the second half. Red cards are only significant when the score margin is either 0 or −1. The number of player substitutions has no significant impact on extra time in the second half. [6]

[5] We have also considered additional models in which we controlled for (i) the influence of the relative strength of the home team vs. the visiting team (as measured by the rank in the previous round or at the end of the previous season, or alternatively measured by the budget of a team), (ii) the stage of the season (by including a dummy for each round), or (iii) for the number of spectators. Variables with respect to (i) and (ii) always turned out to be insignificant. The total number of spectators has a small, but significantly positive effect on extra time. Detailed results are reported in the discussion paper version of this paper (see Sutter & Kocher, 2002).

[6] The insignificance of the number of player substitutions may seem surprising at first sight. However, there is only very little variation in player substitutions in the second half. In all 306 matches, there are on average 5.03 substitutions in the second half with a standard deviation of 0.96. 77% of all matches have 5 or 6 (the maximum number) substitutions in the second half. Another 15% of matches have 4 substitutions.

Table 1
Minutes of extra time

Dependent variable	(1) Extra time in second half Score margin +1/−1[a]	(2) Extra time in second half Score margin 0/−1[b]	(3) Extra time in first half Score margin +1/−1[a]
Score margin	−0.53* (0.25)	−0.86** (0.28)	0.33~ (0.17)
Yellow cards	0.15* (0.06)	0.16* (0.07)	0.04 (0.07)
Red cards	0.01 (0.20)	0.45* (0.22)	0.43 (0.33)
Player substitution	0.14 (0.12)	0.01 (0.13)	0.41** (0.16)
Constant	1.29~ (0.66)	0.87 (0.69)	0.77** (0.20)
Adj. R^2	0.11	0.19	0.11
Durbin–Watson	2.17	1.64	1.85
N	109	112	134

OLS with White heteroscedasticity-consistent standard errors and covariance. Standard errors in parenthesis. ~, *, ** significant at 6%, 5%, 1% level.

[a] Score margin is coded 1 if home team is ahead by one goal, 0 if home team is behind by one goal.

[b] Score margin is coded 1 in case of a draw, 0 if home team is behind by one goal.

Column 3 in Table 1 reports the influence of the score difference on extra time added in the *first* half. The amount of extra time in the first half serves as a possible control for the existence of a home bias of referees. If referees decide on the amount of extra time in favor of home teams, there is no reason why referees should add more extra time when the home team is behind by one goal after the first 45 min, because there is still the second half to be played. Rather, referees might be tempted to add less extra time if the home team is behind by one goal in the first half in order to prevent more damage (by the visiting team scoring once more) and to give the home team the opportunity to regroup in the break as soon as possible. Therefore, if anything, we would expect a *positive* sign of the variable score margin on extra time in the *first* half of a match.

Results in column 3 of Table 1 support our expectation by showing that referees add about one third of a minute more extra time when the home team is ahead by one goal than when it is behind by one goal. In contrast to the second half, the number of yellow and red cards plays no role in explaining extra time in the first half, but the number of player substitutions significantly extends the amount of extra time. The latter result is most likely a consequence of the fact that the few substitutions in the first half – 0.28 substitutions on average in the first half and only 24% of matches with either one or two substitutions – are in most cases caused by injuries of players that need some immediate treatment on the field.

4.2. Home bias in awarding penalties

In 2000/2001 home teams were awarded 55 penalties, but visiting teams only 21. Of course, we have no reason to assume that it is equally likely that the home team and the visiting team is awarded a penalty. Given that home teams, typically, take the offensive more often than visiting teams, home teams are more likely to get into the penalty area which, in turn, might be responsible for the higher number of penalties for home teams.

Yet, it does not seem unreasonable to assume that, if referees were neutral arbitrators, the relation of legitimate and awarded penalties to legitimate but refused penalties should be the same for home and visiting teams. To test whether this is the case, we have gone through the reports on whether or not a penalty has been legitimate and whether a referee has refused to award a legitimate penalty. To qualify a referee's decision as 'refuse' we have considered only those cases where the report on the referee states that the 'referee would have been obliged by the rules to award a legitimate penalty, but refused to do so'.

Of the 55 penalties for home teams only 5 were classified as illegitimate, leaving us with 50 legitimately awarded penalties for home teams. In the reports it was indicated that in another 12 cases the referee would have been obliged to award a penalty to the home team, but failed to do so. For the visiting teams, only 1 out of 21 penalties was classified as illegitimate, [7] yielding 20 legitimately awarded penalties. Yet, in another 19 cases referees were reported to have refused to award a legitimate penalty to the visiting team, even though that would have been the only correct decision. Hence, whereas in 50 out of 62 cases (81%) the home team is awarded a penalty which is legitimate, visiting teams are awarded a legitimate penalty only in 20 out of 39 cases (51%). The difference in relative frequencies is highly significant ($\chi^2 = 9.7$; df $= 1$; $p < 0.01$), indicating a clear home bias of referees with regard to awarding penalties.

5. Conclusion

Our analysis of data from the season 2000/2001 of the *German Bundesliga* has confirmed the existence of a home bias of football referees by examining two types of decisions: first, football referees are much more likely to award (legitimate) penalties to the home team than to the visiting team, i.e. visiting teams are refused a legitimate penalty significantly more often. By concentrating on both awarded and refused penalties, our analysis seems to address home bias of referees more convincingly than the often-used simple counting of awarded penalties. Our result on awarding penalties, thus, adds a further piece to the puzzle of the home advantage of football teams. One explanation for referees' bias stems from the recent findings of Nevill et al. (2002), who have shown that referees tend to penalize home teams less often for the same type of tackles than they do visiting teams. Given this is true, one can readily infer that visiting teams will be awarded less often a (legitimate) penalty, because referees penalize tackles of the home teams (in the penalty area) less often.

Second, referees add significantly more extra time when the home team is behind by one goal than when it is ahead by one goal or when there is a draw after 90 min. This result confirms the earlier results of Garicano et al. (2001). However, compared to the results for the Spanish *Primera Division*, our results for the *German Bundesliga*

[7] With respect to illegitimate but awarded penalties out of the total number of penalties there is no significant difference between home teams and visiting teams.

indicate that the extent of home bias, even though significant, is much less pronounced in Germany. Whereas in Spain referees add almost 2 min more extra time in case the home team is behind than when it is ahead by one goal, the difference is only slightly more than half a minute in Germany.

We believe that our finding of a bias in penalty decisions is more important than the evidence on extra time. Because about 85% of penalties result in a goal, awarding a penalty is typically much more influential for the result of a match than adding half a minute more of extra time, where the (ex post) probability of scoring a goal in 1 min of extra time is 2%.

The degree of favoritism established in this paper most probably constitutes only a lower bound of favoritism exerted by referees. Other important decisions possibly affecting the result of a match – like assigning red cards to players or deciding on a free-kick near the penalty area and on off-sides – have been disregarded and await further analysis.

Another important issue which deserves a detailed investigation is concerned with the channels that induce referees to succumb to making biased decisions. Given the high level of competition among referees for being appointed to top league matches, there are good reasons to assume that referees try to appear fair and impartial in the eyes of their principal, the national football association. Therefore, it seems far more likely that the reported favoritism is a result of subconscious rather than deliberate effects on the part of the referees. The recent results of Nevill et al. (2002) and evidence from psychology point in this direction, but do not settle this issue definitely.

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