Is Home-Field Advantage Driven by the Fans? Evidence from Across the Ocean

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Abstract
Some have claimed that referee and home-field bias in football (American soccer) have been impacted by the fans at the match. When fans are hostile, the threat referees feel to their health and well-being influences their ability to call a fair match. We analyze two leagues with differing fan types: one 'hostile' league (Germany's Bundesliga) and one league perceived as 'peaceful' (America's Major League Soccer). Although there is a strong home-field bias inherent in football, we find evidence that part of the bias is due to the prospect of fan violence.

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Introduction

Judges and referees face many different forces that impact their ability to come to an unbiased conclusion, judgment, or call. These different forces can come as inherent behavioral biases or from external pressures. We focus on external pressures and extend the findings in Dohmen (2005). Analyzing football games, he found that stadiums without a running track, i.e. crowds closer to the field, have a larger impact on referee bias than those stadiums with a running track separating the fans from the pitch (field).

Thus, it is natural to expect that a league with historically aggressive fans, like those of the Bundesliga (Germany's top football league), will have a different impact on referee calls than a league with historically peaceful fans, like Major League Soccer (MLS) in the United States. The Budesliga has had many instances of hostile fans throughout the years, whereas violence at MLS games is new and still rare with the first instance occurring after our dataset.

Utilizing data from 2004 to 2009 on the Bundesliga and MLS matches we analyze if fan pressures are driving at least some of the biases found in football. The next section discusses bias. Section three presents the data in detail, followed by the methodology in section four, and the results in section five. We do find a difference between the two leagues and thus argue that there is at least some evidence that fan violence, or the potential threat thereof, increases referee bias. The last section concludes.

Biases

Social pressures on decision making can impact many aspects of life. When a decision maker is heavily influenced by the surrounding people, the social pressure can lead to bias judgment. Social pressures have been found in many sports (see Moskowitz and Wertheim, 2011). Dohmen (2005) found that social pressures lead to referee bias in football, finding that crowds closer to the field have a larger impact on referee bias. These social biases were also

examined by Garicano, Palacios-Huerta, and Prendergast (2005), who found the crowd to impact referee favoritism in football, and Buraimo, Forrest, and Simmons (2007), who found evidence of a home-team favorite driven by the fans.

Biases that occur from social pressures are different from other forms of bias, which are internal to the person making the judgment (see Price and Wolfers, 2010 or Morgan and Rotthoff, 2014). Although both internal and external influences on bias exist, we extend the literature that focuses on the impact of external factors, known as social pressures, on referee bias.

Data

For the purposes of this study, we gathered data for the Bundesliga, Germany's highest soccer league and arguably one of the best in the world, and MLS, North America's top soccer league.[2] Detailed match information was obtained from official league websites, Bundesliga.de and MLSsoccer.com, respectively. In addition, we used Weltfussball.de to cross-check the German data.

Every season, there are 18 teams in the Bundesliga with a total of 34 matches per team and a total of 306 matches for the season. From 2004/2005 – 2008/2009, we have a total of 1,530 matches and 25 different teams (due to the promotion and relegation system). MLS, due to expansion during the time period, consisted of 10 – 14 teams from 2004 – 2008 which results in 955 matches played during the five seasons.

The home field bias is consistent across leagues, with the Bundesliga showing the home team wins 46% of the time and the home team wins 48% of the time in MLS. The minimum and maximum number of yellow cards and red cards are similar across leagues. Attendance in the Bundesliga ranges from 10,914 to 83,000 (with the maximum at Borussia Dortmund's Signal

[2] The main focus, the impact of yellow and red cards, are found to have similar impacts in both the Bundesliga (Anders and Rotthoff, 2011) and the English Premier League (Jewell, 2009).

Iduna Park), with an average of 40,095. In MLS, attendance ranges from 3,805 to 92,650 fans (with the maximum at the Chivas' match at the Home Depot Center), with an average of 15,820. Summary statistics are contained in Table 1.

[Table 1]

Methodology

Koning (2000) used a probit model with match outcome being determined by differences between team-specific characteristics. We expand the literature by using a probit model to measure differences between the Bundesliga and MLS.

Teams get points in football for winning and tying, three and one respectively, but not for losing. Since there is no difference in winning by one goal or by multiple goals, we use a binary probit model following Anders and Rotthoff (2011). We analyze the effects of yellow and red cards on match outcome, as well as the impact of attendance.

Each individual match has a home (h) and away (a) team. Let $U_h = X_h\beta_h + \varepsilon_h$ be the match-winning potential of team h. X_h is a vector of match-specific, observable characteristics (such as *shots on goal, corner kicks, off-sides, yellow cards, yellow-to-red cards, red cards,* and *fouls* committed), while β_h is a vector of coefficients and ε_h is the error term, accounting for unobservable characteristics, such as luck and ability. The error terms are assumed to be distributed normally for both U_h and U_a.

Concentrating on the home team winning, we regress the match-specific variables on the outcome of the match:

$$\begin{aligned}\text{Game Outcome}_{\,h} = {} & \alpha + \beta_1 \text{HYellowC} + \beta_2 \text{HYellowRed} + \beta_3 \text{HRedC} + \beta_4 \text{HFouls} \\ & + \beta_5 \text{HCKicks} + \beta_6 \text{HOffs} + \beta_7 \text{HShots} + \beta_8 \text{HLWin} + \beta_9 \text{AYellowC} + \beta_{10} \text{AYellowRed} \\ & + \beta_{11} \text{ARedC} + \beta_{12} \text{AFouls} + \beta_{13} \text{ACKicks} + \beta_{14} \text{AOffs} + \beta_{15} \text{AShots} \\ & + \beta_{16} \text{ALWin} + \beta_{17} \text{Ln(Attendance)} + \varepsilon \qquad (1)\end{aligned}$$

To measure any impact the fans themselves have on the outcome of the match, we focus on the impact of attendance at a given match. We analyze attendance in two distinct ways: as *attendance* and *attendance squared* (to control for any curve-linear possibilities) and by using the *natural log of attendance* (to see if a percentage change in attendance impacts the probability of the home team winning the match).[3] We also control for year level fixed effects.

Results

The first two columns in Table 3 (marginal effects reported), show the results for the Bundesliga, where the probability of the home team winning decreases by 6% (significant at the one percentile) if the team receives a yellow card Meanwhile, the last two columns of Table 3 report the results for the MLS, which indicate that there is no statistical impact of receiving a yellow card. The effect of receiving a red card in a Bundesliga game, either getting a straight red card or an individual player receiving a second yellow card, is even greater, decreasing the probability of the home team winning by 42% and 21%, respectively, and is significant at the 1% level. Only the direct red card is statistically significant (at the fifth percentile) in the MLS and decreases the home team's winning probability by 14%.

Away team yellow cards are only significant for the Bundesliga. For away teams, the direct red card is the only statistically significant impact of the two and is similar across leagues. It is also important to note that home-team fouls increase the home team's probability of defeating its opponent by 6% in the Bundesliga and 10% in MLS (both are significant). This result supports a 'playing hard' strategy, but not to the point of receiving cards; consistent with Anders and Rotthoff (2011).

The home team's probability of winning increases by 9% when there is an increase in attendance by 1%, which is significant for the Bundesliga. However, there is no evidence that

[3] When using percentage attendance, attendance is not significant; which is why we do the robustness check.

attendance matters in MLS. In combination with the effect of receiving cards, which is an action taken by the referee to discipline the players, this suggests that social pressure on the referee by fans attending the game can lead to bias decision making.

[Table 2]

Robustness

We also run two additional robustness checks. First, we measure the impact of the absolute versus relative size of attendance. The average attendance in the Budesliga is 40,095, while MLS is 15,820, hence, it is possible that these larger attendance numbers are driving the results. Thus, we drop all Bundesliga matches with more than 40,095 (mean) fans. The impact of receiving cards in the Bundesliga is similar to the full sample. However, the attendance variables are now statistically insignificant, suggesting that it is possible that the social influences of fans are driven by the absolute size of the fan base, not how full the stadium is.

The second adds an away-team fixed effect to measure the impact of attendance on the probability of victory. Using a tobit estimation we continue to find that cards matter in the Bundesliga but not in MLS.

Conclusion

Dohmen (2005) argued that running tracks increase the safety of the referees, thus decreasing the bias displayed by referees. Our findings provide evidence supporting his results. We analyze two different leagues: one with hostile fans, the Bundesliga (the top German football league), and a league with peaceful fans, MLS in the United States.

Fan attendance influences the outcomes of matches in the Bundesliga, the 'hostile' league, but has no impact on MLS, our 'peaceful' league. These differences in home-field advantage are consistent with the research by Dohmen (2005) and Garicano, Palacios-Huerta,

and Prendergast (2005), in which they found that social pressures from the fans drive referee bias.

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Tables

Table1:	Summary Statistics Bundesliga				Summary Statistics MLS			
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**	**Mean**	**Std. Dev.**	**Min**	**Max**
HYellowCard	1.714	1.188	0	6	1.684	1.157	0	5
HYellowToRed	0.031	0.174	0	1	0.037	0.195	0	2
HRedCard	0.031	0.176	0	2	0.078	0.28	0	2
HFouls	18.112	4.923	3	40	14.126	4.295	3	30
HGoals	1.625	1.306	0	8	1.561	1.217	0	6
AYellowCard	2.07	1.276	0	6	1.965	1.216	0	7
AYellowToRed	0.062	0.247	0	2	0.045	0.207	0	1
ARedCard	0.063	0.249	0	2	0.081	0.277	0	2
AFouls	19.696	5.163	3	41	14.305	4.401	3	33
AFouls	1.215	1.124	0	6	1.158	1.156	0	9
Attendence	40095.922	17314.479	10914	83000	15820.18	7945.614	3805	92650

Table 2: Probit Model

Variables	Bundesliga		MLS	
Home Yellow Card	-0.0622***	-0.0619***	-0.0256	-0.0246
	(0.0122)	(0.0122)	(0.0158)	(0.0158)
Home Yellow-to-red		-0.216***	0.00601	0.00851
	(0.0682)	(0.0678)	(0.0883)	(0.0884)
Home Red Card	-0.420***	-0.418***	-0.137**	-0.135**
	(0.0967)	(0.0965)	(0.0635)	(0.0635)
Home Fouls	0.00561*	0.00561*	0.00959**	0.00933**
	(0.00303)	(0.00302)	(0.00422)	(0.00422)
Home Corner Kicks	-0.0381***	-0.0380***	-0.0398***	-0.0397***
	(0.00521)	(0.00520)	(0.00667)	(0.00667)
Home Off-Sides	0.0151***	0.0148***	0.0150*	0.0147*
	(0.00565)	(0.00563)	(0.00801)	(0.00799)
Home Total Shots	0.0180***	0.0179***	0.0123***	0.0120***
	(0.00323)	(0.00323)	(0.00428)	(0.00428)
Away Yellow Card	0.0189*	0.0189*	0.0193	0.0196
	(0.0111)	(0.0111)	(0.0155)	(0.0155)
Away Yellow-to-red	0.0799	0.0799	0.0496	0.0494
	(0.0556)	(0.0556)	(0.0829)	(0.0828)
Away Red Card	0.149***	0.148***	0.143**	0.146**
	(0.0543)	(0.0542)	(0.0642)	(0.0642)
Away Fouls	-0.00422	-0.00421	-0.00919**	-0.00893**
	(0.00281)	(0.00281)	(0.00425)	(0.00425)
Away Corner Kicks	0.0116*	0.0116*	0.0291***	0.0291***
	(0.00595)	(0.00595)	(0.00728)	(0.00728)
Away Off-Sides	-0.0149**	-0.0141**	-0.00673	-0.00692
	(0.00598)	(0.00586)	(0.00835)	(0.00834)
Away Total Shots	-0.00882***	-0.00882***	-0.0114**	-0.0117**
	(0.00337)	(0.00337)	(0.00461)	(0.00460)
Attendance	8.05e-06**		3.48e-06	
	(4.04e-06)		(5.32e-06)	
Attendance^2	-6.56e-11		-1.07e-10	
	(0)		(9.15e-11)	
Ln(Attendance)		0.0930***		-0.0274
		(0.0299)		(0.0405)
Observations	1,518	1,518	955	955

Standard errors reported

***p<0.01, **p<0.05, *p<0.1