Research Article

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How Much Does Home-Field Advantage Matter in Professional Soccer?

A Multilevel Bayesian Investigation

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Abstract: Home Field Advantage (HFA) was traditionally defined in terms of winning percentage of home games at the team level. In this article, we present a hierarchical model of HFA, spanning from the top sport level to the middle league level and all the way to lowest club level. Using scoring performance data from ESPN FC, we fit a Bayesian multilevel nested model to the parameters in the hierarchical model of HFA, allowing information obtained from the team level to inform the inferences at the upper league and sport levels.

Keywords: European Professional Soccer Leagues, Home Field Advantage, Poisson generative process, Stan

1 Introduction

In professional team sports, the term home field advantage (HFA) – also called home advantage, home ground or home court advantage, defender's advantage, home-ice advantage – describes the benefit that the home team is believed to gain over the visiting opponent. Its scientific definition is "the consistent finding that home teams in sport competition win over 50% of the games played under s balanced home and away schedule" (Courneya and Carron, 1992, p. 13). Due to the existence of HFA, many vital games, such as playoff or elimination matches, in major professional sports have special rules for determining which match is played at which place. As shown in Figure 1, the combined revenue of the Big Five European soccer leagues (English Premier League, Spanish La Liga, French Ligue 1, Bundesliga, Italian Serie A) more than doubled to 15 billion euros in 10 years from 2006/07 to 2016/17. The financial implications might partially explain UEFA's (the Union of European Football Associations) decision that

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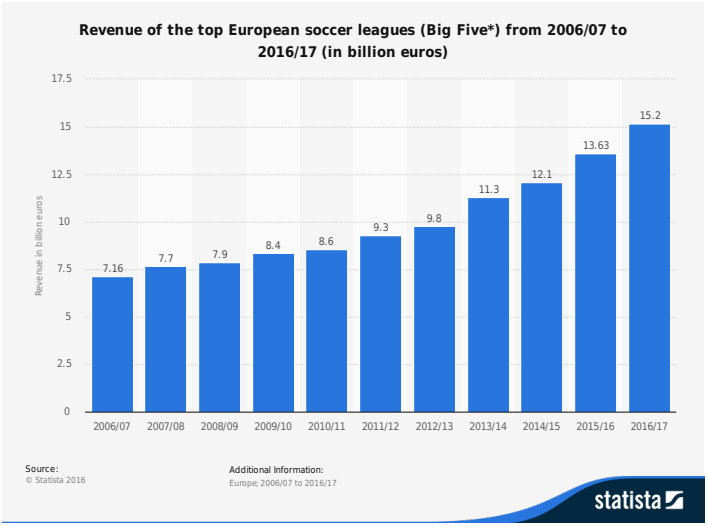
a second leg of any Champions League knock-off series is favorable to playing away with the the scores still in balance after the first leg competition (Atkins, 2013).

Fig. 1: *Revenue of the top European soccer leagues (Big Five*) from 2006/07 to 2016/17 (in billion euros)*

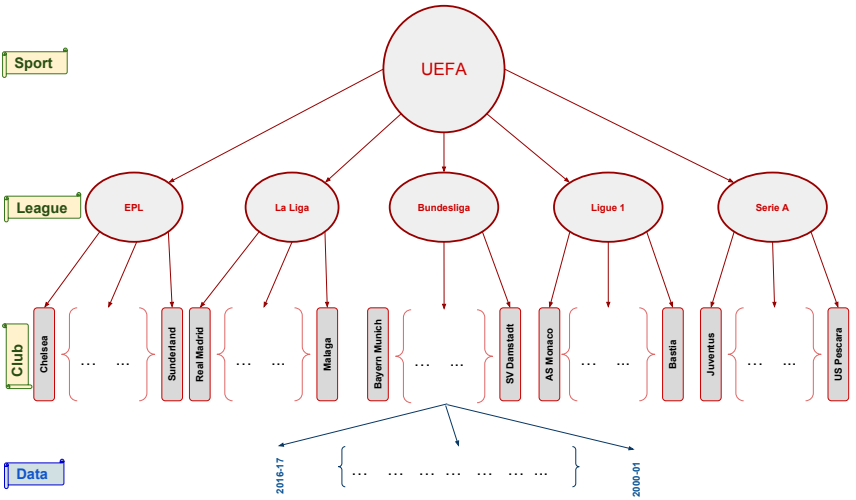


A second motivator for this study is related to the hotly debated topic of home field advantage (HFA) in soccer competition. The contributions we made in this paper are (1) highlighting the different generative process underlying most sports performance metrics and suggesting corresponding solutions. (2) investigating the long and firmly held belief of HFA simultaneously at sport, league, team levels. (3) using season performance data to rule out incidental game specifics.

2 Review of Literature

3 The Hierarchical Model of HFA

Fig. 2: The Hierarchical Model of Home Field Advantage



4 Data

Tab. 1: Descriptive Statistics

	Mean	Median	Std. Dev.	Min.	Max.	Skewness	Kurtosis
MHG	3.634	4	1.676	0	9	0.246	0.034
MAG	2.884	3	1.676	0	10	0.627	0.786

5 Computation and Results

We run 4 chains using the default sampler in Stan, the HMC variant of No-U-Turn Sampler (NUTS) (Hoffman and Gelman, 2014) and set

The model estimates are shown in figure 3 as shift from the 0. The outer contour lines show the 99.5% credible intervals, while the shaded area underneath covers the corresponding 95% credible interval. The light bar in the middle represents the mean.

Acknowledgment: We would like to thank ESPN FC for compiling the season-level club performance data and allow public access.

Fig. 3: Home Field Advantage Posterior Plot at Sport and League Levels

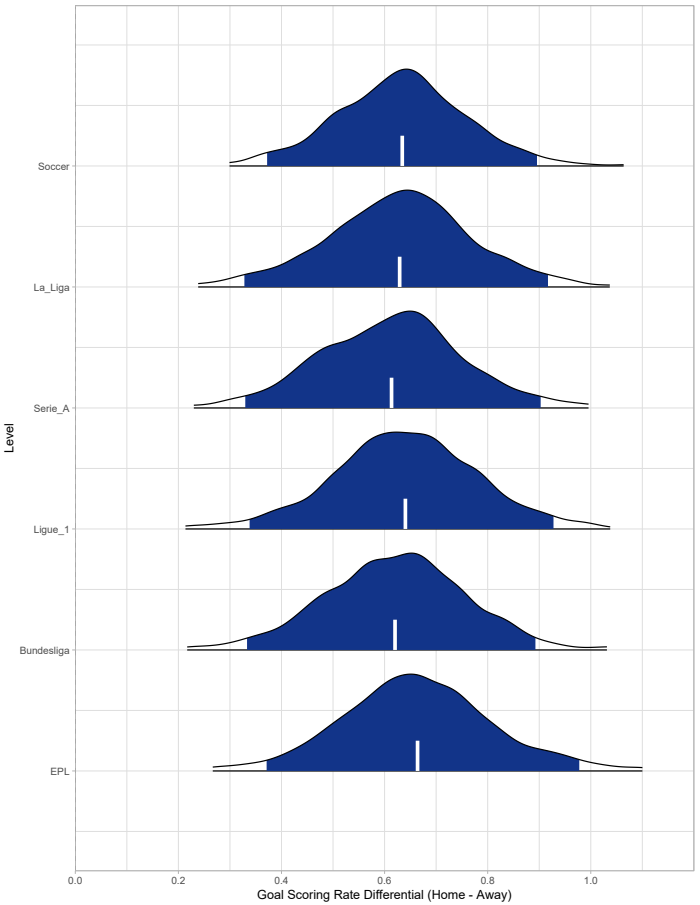


Fig. 4: Home Field Advantage Posterior Plot for La Liga Teams

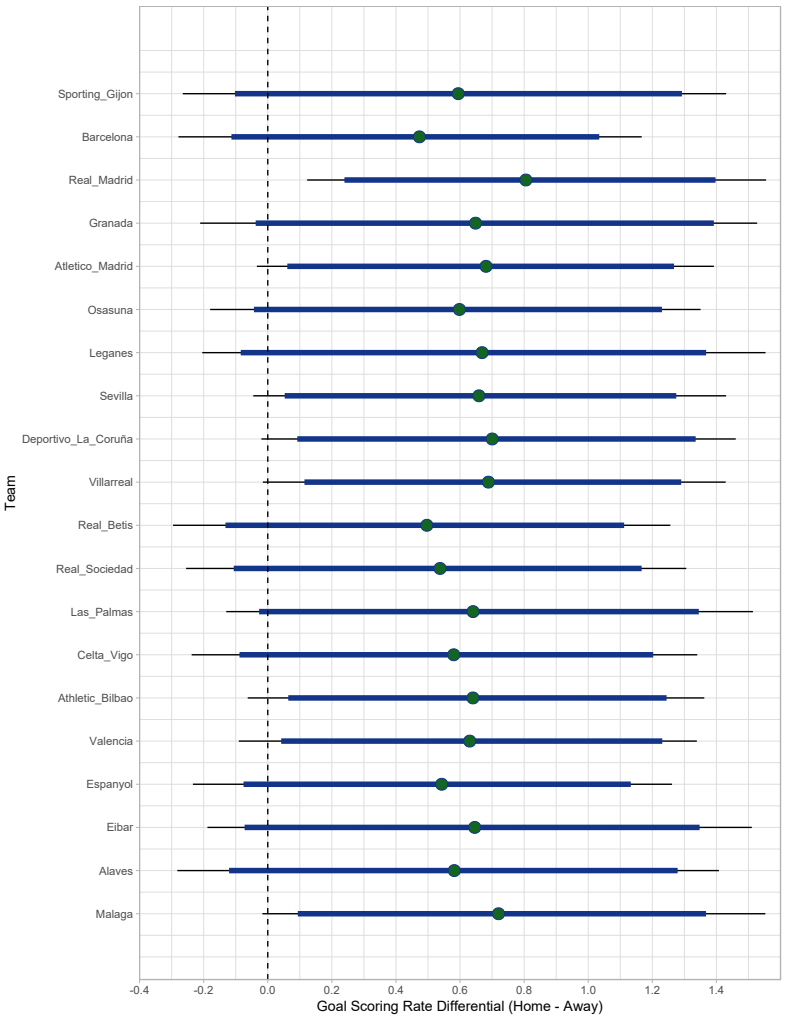


Fig. 5: Home Field Advantage Posterior Plot for Serie A Teams

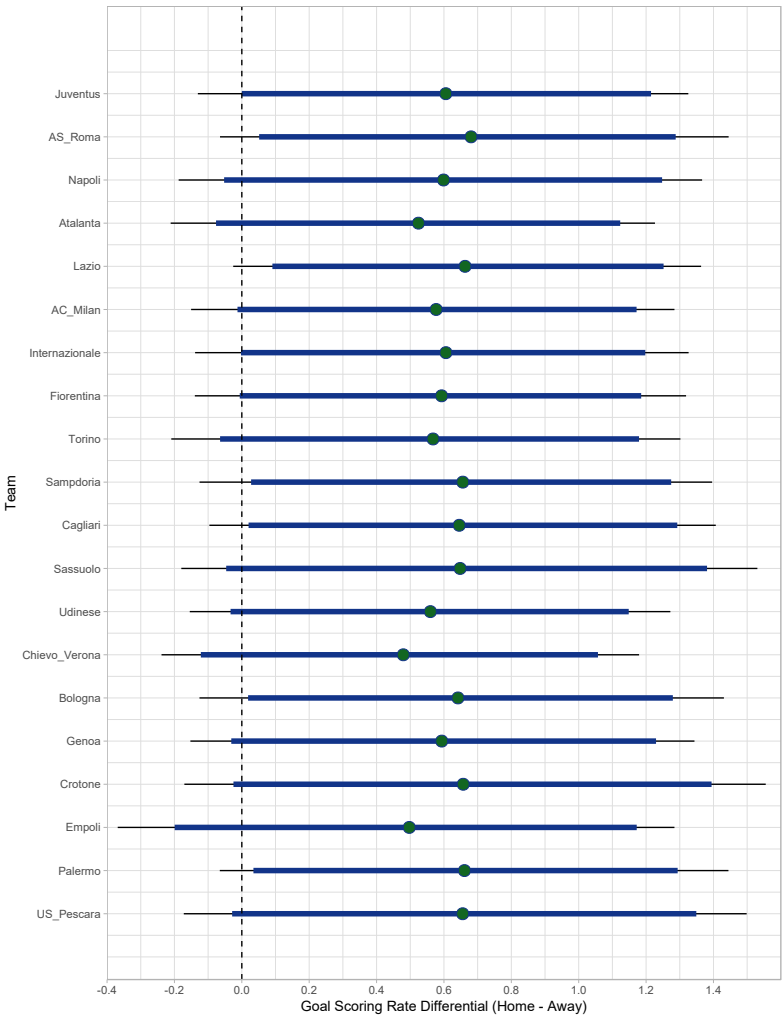


Fig. 6: Home Field Advantage Posterior Plot for Ligue 1 Teams

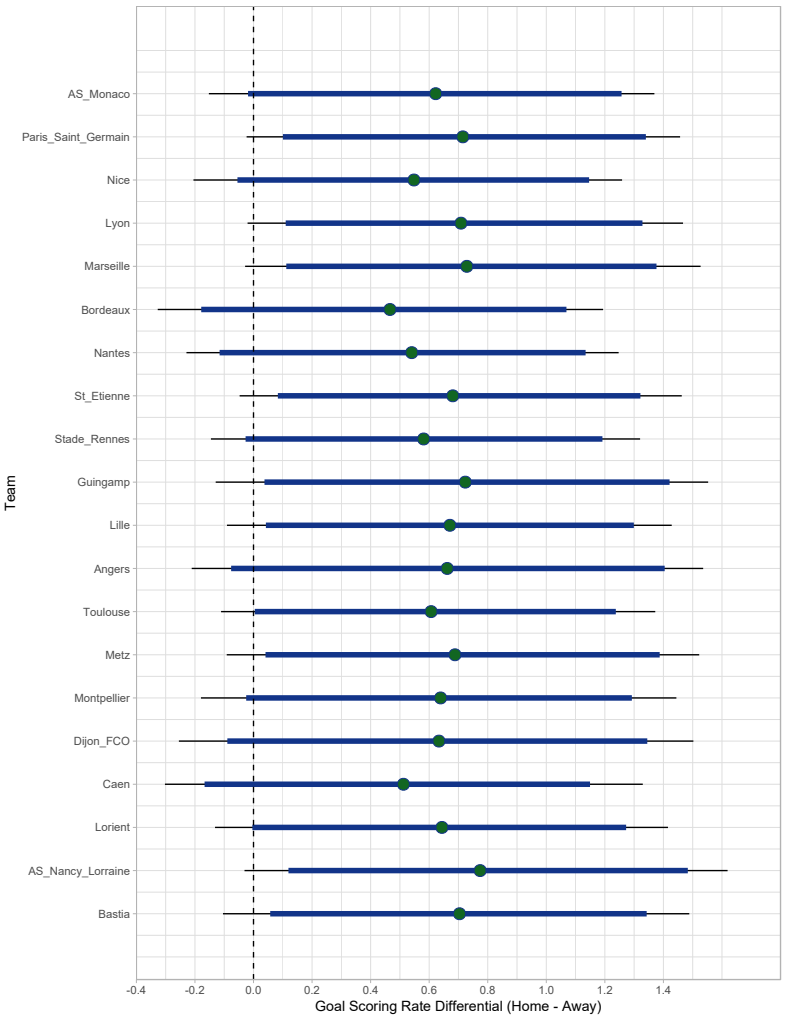


Fig. 7: Home Field Advantage Posterior Plot for Bundesliga Teams

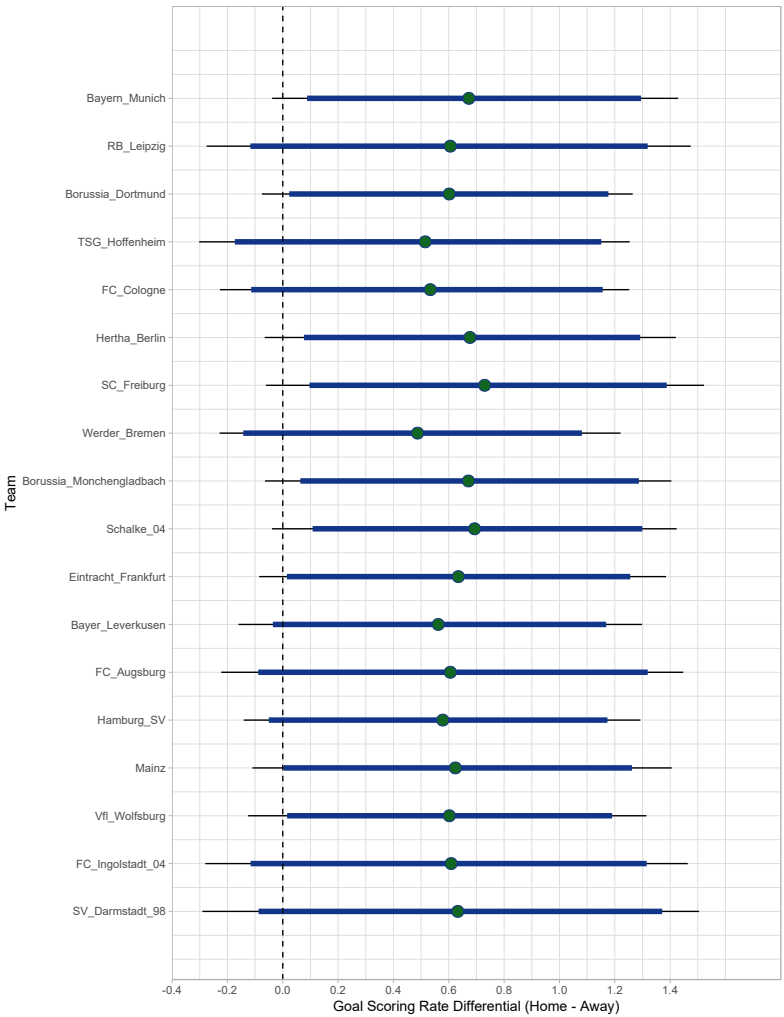
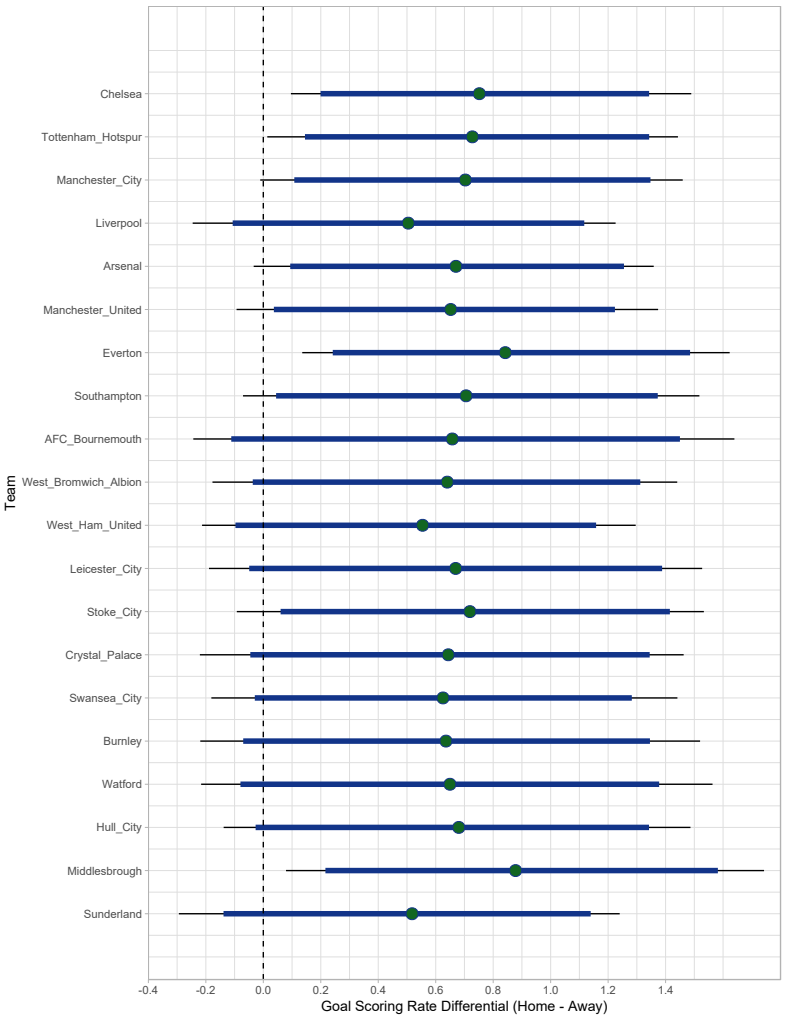


Fig. 8: Home Field Advantage Posterior Plot for English Premier League Teams



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