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Home Advantage in Different German Football League

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This study investigates the presence and variation of home advantage across different hierarchical levels in German men's football. Based on an extensive dataset comprising 357,530 matches from the 2023/2024 season—collected via a Python script—the analysis includes match outcomes, attendance figures, club locations, and prior season standings across 165 divisions in 28 football associations. These leagues span 13 hierarchical levels, from professional to amateur football. The results show that home advantage is significantly more pronounced in lower divisions. This effect manifests itself through a higher frequency of home wins, fewer draws, and greater sensitivity to travel distance in amateur divisions. In contrast, more professional leagues may benefit from standardised conditions, which mitigate home advantage. Overall, the findings highlight the strong influence of professionalisation on competitive balance. The study contributes to a deeper understanding of how contextual factors shape match outcomes and demonstrates the need for differentiated analysis across league levels when examining systematic advantages in sports.

Keywords: *Home advantage; Amateur football; Professional football; Competitive balance; Spectator effects; Travel distance*

Introduction

The phenomenon of home advantage is a central and widely examined topic in sports economics. It is among the best-documented empirical regularities in sport and has been analysed from different perspectives, such as spectator effects and referee decisions (Courneya & Carron 1992, Pollard & Pollard 2005). Research in this area frequently focuses on the influence of spectators on match outcomes (e.g., Dilger & Vischer 2022, Pollard 2006). Complementary or alternative approaches emphasise referee bias—that is, the impact of officiating decisions on the final result (Dilger & Vischer 2024, Cueva 2020, Sors et al. 2021).

The majority of existing research has concentrated on professional football, while amateur football is often only considered in comparison or as a secondary point of reference. However, investigating home advantage specifically in the amateur context is highly worthwhile. Even in the lower divisions, everyday factors play a big role: the presence of local fans, the distance the away team has to travel, or the strong identification of players with their home club. These influences can shape how a match unfolds, sometimes without players or referees even realising it. Comparing amateur and professional football can therefore yield valuable insights into the role of professionalisation, structural conditions, and organisational environments in the emergence of home advantage.

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This study aims to contribute to the still relatively limited body of research on home advantage in amateur football. The central research question of this paper is:

To what extent does home advantage *vary across different division levels?*

To address this question, a total of 357,530 matches from all German men's football leagues in the 2023/2024 season were automatically collected using a Python script. Where available, data include match results, spectator attendance, the addresses of home and away teams, as well as previous season standings. The German football system is hierarchically structured and consists of various competitive levels (hereinafter referred to as divisions). The designations of these divisions may vary depending on the region within Germany but can be classified in 13 comparable hierarchical division levels. Within each division, competition is further organised into specific competitive groups (hereinafter referred to as leagues). The dataset covers 165 nominally distinct divisions across 28 football associations. This results in 2,058 uniquely named leagues. The top three of these divisions are classified as professionally organised. The subsequent analysis employs suitable regression models to examine these relationships in detail.

Theoretical Background

Research on home advantage in football has shown that it fluctuates over time. Schwartz and Barsky (1977) documented a long-term home advantage across various team sports. Palacios-Huerta (2004) found that in English football the home advantage stood at 56.6 % between 1888 and 1915 but declined to 47.4 % between 1983 and 1996. Biermann (2011) attributes this decline to the increasing professionalisation of football and growing economic disparities between clubs. For the German Bundesliga, Strauß and Höfer (2001) calculated a home win rate of 53.3 %, with 26 % of matches ending in draws and 20.7 % in away wins during the period from 1963/64 to 1997/98. Research by Almeida and Volossovitch (2017) examining Portuguese football demonstrated that amateur leagues exhibited a significantly stronger home advantage, with a 60.36 % home win rate substantially exceeding the percentage observed in professional competitions.

A variety of factors have been discussed in the literature to explain home advantage. Schwartz and Barsky (1977) as well as Loughhead et al. (2003) highlight travel fatigue, environmental familiarity, and crowd support as key influences. However, Clarke and Norman (1995) relativise the importance of travel distance, arguing that modern transportation reduces this burden. Competition rules can also favour the home team, for example when it is automatically qualified for the group stage of a tournament (Strauß & MacMahon 2019). Additionally, referee decisions are considered a possible driver of home advantage (Wallace et al. 2005, Sutter & Kocher 2004), and tactical adjustments made by home teams may also contribute (Pollard 2006).

Spectators receive particular attention in the literature. Boyko et al. (2007) found that higher attendance levels are correlated with stronger home advantage —

reflected in goal differentials and referee-related decisions. The banning of away fans in Argentina's Primera División further amplified this effect, as home advantage increased when visiting supporters were no longer allowed (Colella et al. 2021). The COVID-19 pandemic provided new insights into the role of spectators by creating conditions in which matches were played behind closed doors. Reade et al. (2022) did not find significant effects on match outcomes but observed a decrease in yellow cards for away teams, indicating a reduction in referee bias. In the German Bundesliga, the absence of spectators led to an almost complete neutralisation of home advantage (Dilger & Vischer 2022). Scoppa (2021) observed a similar decline in home advantage in the top divisions of Germany, England, France, Italy, and Portugal. Fischer and Haucap (2021) did not identify a significant reduction in the 2nd and 3rd Bundesliga but confirmed the trend for the 1st division. These findings illustrate that home advantage in football is shaped by a variety of contextual factors and adjusts in response to changing external conditions. In the context of amateur football, Wunderlich et al. (2021) documented a non-spectator driven home advantage during the COVID-19 pandemic, while excluding travel fatigue as a contributing factor in lower leagues due to the comparatively small traveling distances in these competitions.

However, home advantage is not a phenomenon exclusive to football, it has also been documented in other sports. Schwartz and Barsky (1977) demonstrated its existence in major North American professional leagues such as the NFL, NBA, MLB, and NHL, although the effect was found to be weaker in the NFL. Vergin and Sosik (1999) observed that the betting market in the NFL had already accounted for the home advantage. Albert and Koning (2007) confirmed the presence of a cross-league home advantage in American football, which also appears in U.S. college football as well as in the Australian Football League (AFL). In tennis, Koning (2011) identified a statistically significant home advantage among male players, while results for the women's circuit were less conclusive. Research on so-called "ghost games" further supports the view that home advantage is a cross-sport phenomenon that is susceptible to external influences—most notably the presence or absence of spectators. For instance, studies have shown a measurable decline in home advantage in the NBA (Price & Yan 2022, Starke et al. 2024) and MLB (Currea 2021) during matches played without audiences. These findings underline the broader applicability of home advantage across disciplines and highlight how it can be moderated by situational and structural conditions.

Hypotheses

Most of the cited studies focus on professional sports, particularly on the top divisions in football and other team sports. This emphasis is primarily due to the availability of extensive and high-quality data in the professional sector, whereas the amateur domain has so far been examined less systematically. As Schwartz and Barsky (1977) and Loughhead et al. (2003) show, home advantage is strongly influenced by environmental familiarity and crowd support. However, both of these factors—as well as the overall level of performance and the degree of professionalisation—vary substantially across division levels. As professionalisation increases, one can typically observe a greater density of competitive balance and a reduction in environmental uncertainty, which suggests that home advantage should decrease in higher divisions.

H1: Home advantage *is more pronounced at lower division levels.*

Beyond winning probability, another common indicator for measuring home advantage is the average goal difference between home and away teams (Boyko et al. 2007). As the level of professionalisation increases and teams become more evenly matched in terms of performance, this goal difference is expected to decline. Furthermore, the number of draws is often seen as an additional measure of a league's competitive balance. Greater balance—reflected in smaller goal differences and a higher frequency of draws—is therefore more likely to be observed in the upper division levels, where team quality tends to be more homogeneous.

H2: Matches in higher division levels are more balanced.

Regarding travel distance as a factor influencing home advantage, much of the existing literature refers to older studies. Schwartz and Barsky (1977) and Clarke and Norman (1995) identified travel-related fatigue as a significant factor contributing to home advantage. However, this argument stems from a time when sports teams travelled under relatively basic conditions, faced longer travel times, and had limited access to recovery protocols. In modern professional football, teams benefit from sophisticated logistics, chartered flights, customised travel schedules, and scientifically grounded recovery programs. Accordingly, recent research assumes that travel distance plays only a minor role in professional leagues (e.g., Armatas & Pollard 2014, Pollard & Armatas 2017). Wunderlich et al. (2021) even assume no effect in regional amateur leagues due to minimal travel distances on match outcomes. In contrast, this factor may still impact amateur or semi-professional football, where teams often rely on bus or individual transportation face greater travel inconvenience. Against this backdrop, it is reasonable to assume that travel distance has a more pronounced effect on match outcomes in lower divisions.

H3: Travel distance has a stronger impact on match outcomes in amateur divisions than in professional divisions.

Data and Methodology

To test the hypotheses, a total of 357,530 matches from all German men's football leagues in the 2023/2024 season were automatically collected from kicker.de using a Python script. Where available, the data include match results, spectator numbers, the addresses of home and away teams, as well as league standings from previous seasons. The dataset covers 165 nominally distinct leagues across 28 football associations resulting in a dataset comprising 2,058 concrete leagues spread across 13 hierarchical levels.

Table 1 provides an overview of the different divisions, the corresponding associations, and their assignment to specific hierarchy levels. The top three of these levels are classified as professionally organised. The fourth division level is generally regarded—both in practice and due to promotion and relegation structures, as well as the presence of many reserve teams from Bundesliga clubs—as semi-professional, and therefore marks the dividing line between professional and amateur football.

Table 1. *Associations and Division Numbers*

Association	Division (German Designation)	Hierarchical Division Levels, 1-13
DFL	1. Bundesliga & 2. Bundesliga	1 - 2
DFB	3. Bundesliga	3
NFV, NOFV, WDFV, RLSW, BFV	Regionalliga Nord, Nordost, West, Südwest & Bayern	4
Badischer Fußball-Verband (FV)	Oberliga, Verbandsliga, Landesliga, Kreisliga, Kreisklasse-A, Kreisklasse-B, Kreisklasse C	5-11
Bayerischer FV	Bayernliga, Landesliga, Bezirksliga, Kreisliga, Kreisklasse A-Klasse, B-Klasse, C-Klasse	5-12
Berliner FV	Oberliga, Verbandsliga, Landesliga, Bezirksliga, Kreisliga-A, Kreisliga-B, Kreisliga-C	5-11
FV Brandenburg	Oberliga, Verbandsliga, Landesliga, Landesklasse, Kreisoberliga, Kreisliga, 1. Kreisklasse, 2. Kreisklasse	5-12
Bremer FV	Verbandsliga, Landesliga, Bezirksliga, 1. Kreisliga A, 2. Kreisliga B, 3. Kreisliga C, 1. Kreisklasse, 2. Kreisklasse	5-12
Hamburger FV	Verbandsliga, Landesliga, Bezirksliga, Kreisliga, Kreisklasse, Kreisklasse-B	5-10
Hessischer FV	Hessenliga, Verbandsliga, Gruppenliga, Kreisoberliga, Kreisliga-A, Kreisliga-B, Kreisliga-C, Kreisliga-D	5-12
FV Mecklenburg-Vorpommern	Oberliga, Verbandsliga, Landesliga, Landesklasse, Kreisoberliga, Kreisliga, 1. Kreisklasse	5-11
FV Mittelrhein	Verbandsliga, Landesliga, Bezirksliga, Kreisliga-A, Kreisliga-B, Kreisliga-C, Kreisliga-D	5-11
FV Niederrhein	Oberliga, Landesliga, Bezirksliga, Kreisliga-A, Kreisliga-B, Kreisliga-C, Kreisliga-D	5-11
Niedersächsischer FV	Oberliga, Landesliga, Bezirksliga, Kreisliga, 1. Kreisklasse, 2. Kreisklasse, 3. Kreisklasse, 4. Kreisklasse, 5. Kreisklasse	5-13
FV Rheinland	Oberliga, Rheinlandliga, Bezirksliga, Kreisliga-A, Kreisliga-B, Kreisliga-C, Kreisliga-D	5-11

Saarländischer FV	Oberliga, Saarland-Liga, Verbandsliga, Landesliga, Bezirksliga, Kreisliga A, Kreisliga B	5-11
Sächsischer FV	Oberliga, Landesliga, Landesklasse, Kreisoberliga, 1. Kreisliga, 2. Kreisliga, 3. Kreisliga, 1. Kreisklasse, 2. Kreisklasse	5-13
FV Sachsen-Anhalt	Oberliga, Verbandsliga, Landesliga, Landesklasse, Kreisoberliga, Kreisliga, 1. Kreisklasse, 2. Kreisklasse	5-12
Schleswig-Holsteinischer FV	Oberliga, Landesliga, Verbandsliga, Kreisliga, Kreisklasse-A, Kreisklasse-B, Kreisklasse-C	5-11
Südbadischer FV	Oberliga, Verbandsliga, Landesliga, Bezirksliga, 1. Kreisliga, 2. Kreisliga, 3. Kreisliga	5-11
Südwestdeutscher FV	Oberliga, Verbandsliga, Landesliga, Bezirksliga, A-Klasse, B-Klasse, C-Klasse, D-Klasse, Reserveklasse	5-13
Thüringer FV	Oberliga, Verbandsliga, Landesklasse, Kreisoberliga, Kreisliga, 1. Kreisklasse, 2. Kreisklasse	5-11
FV Westfalen	Oberliga, Verbandsliga, Landesliga, Bezirksliga, Kreisliga-A, Kreisliga-B, Kreisliga-C Kreisliga-D	5-12
Württembergischer FV	Oberliga, Verbandsliga, Landesliga, Bezirksliga, Kreisliga-A, Kreisliga-B, Kreisliga-C	5-11

The variable *ProfessionalDummy* in Table 2 distinguishes between the top three division levels, which are classified as part of the professional sector, and all remaining divisions, which belong to the amateur sector. The fourth division level is classified semi-professional and is therefore not part of the professional sector. The variable *Distance* (in km) serves as a proxy for travel distance and is calculated using the Haversine formula, which measures the straight-line distance between the postal codes of the home and away teams. The necessary latitude and longitude coordinates were retrieved from the GeoNames platform. In rare cases where multiple coordinates were listed for a single postal code due to differing reference points, the mean of these coordinates was used. The actual venue of the matches was not taken into account in the distance calculation—this limitation must be acknowledged in the context of the analysis.

To approximate the sporting strength of the teams, league standings and points earned in the previous season were used. Unlike in other studies, established betting odds could not be included here, as such data are not available for lower division levels. It should be noted that point totals from the previous season could be negative in some cases due to point deductions. Standings and points were only used as control variables if both teams had played in the same league during the previous season. Especially in amateur football, league compositions change frequently due to promotion, relegation, and team withdrawals or registrations. As a result, teams for which no previous season data were available were excluded from the models, which reduced the final sample size accordingly.

Table 2. *Descriptive Statistics*

Variables	N	Mean	Std. Dev.	Min	Max
Home_Win	357,530	0.489	0.5	0	1
Home_Pts	357,530	0.636	0.481	0	1
Draw	357,530	0.147	0.354	0	1
Away_Win	357,530	0.364	0.481	0	1
DivisionLevel	357,530	9.299	1.512	1	13
ProfessionalDummy	357,530	0.997	0.053	0	1
ScoreDiff	356,532	0.476	3.339	-34	40
Distance	285,069	18.255	28.565	0	756.758
Spectators	58,275	584.065	4100.245	1	81,365
H_PrevSeasonPos	334,148	7.413	4.314	1	21
H_PrevSeasonPts	334,148	38.164	17.189	-6	107
A_PrevSeasonPos	334,079	7.416	4.315	1	21
A_PrevSeasonPts	334,079	38.143	17.2	-6	107

Table 3 presents the key variables used to analyse differences in home advantage. The dependent variables are disaggregated by *DivisionLevel*. A clear pattern emerges: The average home win rate and the mean goal difference both increase as the division level decreases. At the same time, the proportion of draws declines. In practice, this means that matches in the lower leagues are less balanced: home teams not only win more often but also by larger margins, while draws, which usually signal evenly matched opponents, are much rarer. Compared to the professional divisions, several lower-tier divisions also show a descriptive increase in away wins. The observed level of home advantage in the professional divisions falls within an expected range, as reported in previous seasons or other studies, and does not represent an outlier in this context.

To test our hypotheses, we employ two different regression models. For our dependent variables *Home_Win*, *Draw*, and *Home_Points*, we apply binary logistic regression. The regression equation for a binary regression model is as follows:

$$P(Y = 1) = \frac{1}{1 + e^{-(\beta_0+\beta_1 x_1+\beta_2 x_2+\cdots+\beta_k x_k)}}.$$

Table 3. *Dependent Variables per Division Level*

DivisionLevel		Home_Win	Draw	Away_Win	ScoreDiff
1	Mean	0.437	0.264	0.297	0.395
	N	306	306	306	306
2	Mean	0.457	0.232	0.310	0.336
	N	306	306	306	306
3	Mean	0.454	0.265	0.280	0.346
	N	381	381	381	381
4	Mean	0.443	0.233	0.322	0.322
	N	1,530	1,530	1,530	1,530
5	Mean	0.466	0.194	0.338	0.346
	N	3,621	3,621	3,621	3,621
6	Mean	0.466	0.186	0.347	0.404
	N	9,354	9,354	9,354	9,350
7	Mean	0.475	0.174	0.350	0.420
	N	23,265	23,265	23,265	23,259
8	Mean	0.477	0.166	0.355	0.431
	N	54,002	54,002	54,002	53,969
9	Mean	0.485	0.154	0.360	0.456
	N	88,622	88,622	88,622	88,439
10	Mean	0.495	0.133	0.370	0.508
	N	103,268	103,268	103,268	102,907
11	Mean	0.499	0.123	0.376	0.518
	N	58,432	58,432	58,432	58,182
12	Mean	0.505	0.119	0.374	0.535
	N	13,521	13,521	13,521	13,360
13	Mean	0.508	0.127	0.363	0.651
	N	922	922	922	922
Total	Mean	0.488	0.146	0.364	0.475
	N	357,530	357,530	357,530	356,532

Y is the binary dependent variable (*Home_Win*, *Draw* or *Home_Points*), β_0 is the intercept, e is the base of the natural logarithm, $\beta_1, \beta_2, \dots, \beta_k$ are the coefficients estimated by the logit model and $x_1, x_2, \dots, x_k$ are the independent variables.

In the case of the linear regression with *ScoreDiff* as the dependent variable, the regression equation is as follows:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_k X_{ki} + \varepsilon_i$$

Y_i is the dependent variable (*ScoreDiff*), X_{ki} is the explanatory variable k for observation i, β represents the regression coefficients, and ε denotes the error term.

Empirical Results

Table 4 presents a series of regression models. In Model 1, the analysis tests whether the binary distinction between professional and amateur football influences the probability of a home win. This variable has a statistically significant effect, where 0 represents the amateur sector and 1 the professional divisions. Model 2 disaggregates this effect further by including dummy variables for individual division levels. Here, the coefficients show an increasing pattern from higher to lower divisions, showing that home advantage tends to increase as one moves further down the league pyramid. Most coefficients do not reach statistical significance in this basic specification.

Model 3 adds the control variables spectator attendance (*Spectators*) and travel distance (*Distance*), both of which are statistically significant. Their inclusion reinforces the division-specific effects already observed in the previous model. In Models 4 and 5, team strength is controlled for using two alternative indicators, league position (*PrevSeasonPos*) and points from the previous season (*PrevSeasonPts*). These models are only estimated for matches in which both teams competed in the same division during the prior season. Both control variables show highly significant effects, improve overall model fit, and confirm that the division-level effects on home advantage remain robust.

Table 5 presents results from subsample analyses, focusing on professional football in Models 1 and 2 and amateur football in Models 3 and 4. Models 1 and 3 include division level, travel distance, and spectator attendance as explanatory variables. In Models 2 and 4, additional control variables are added to account for team strength, thereby helping to identify the likely favourite. In Models 1 and 2, division level 4—commonly referred to as the Regionalliga—is assigned to the professional divisions. Due to the presence of promoted and relegated teams and the frequent inclusion of reserve teams from Bundesliga clubs, this division is often considered semi-professional. Division level continues to play a role here.

Table 4. *Binary Regression Home Win*

	(1)	(2)	(3)	(4)	(5)
	Home_Win	**Home_Win**	**Home_Win**	**Home_Win**	**Home_Win**
ProfessionalDummy	0.156*				
	(0.014)				
2.DivisionLevel		0.079	0.283	0.0463	0.0325
		(0.626)	(0.100)	(0.838)	(0.885)
3.DivisionLevel		0.065	0.664**	0.506	0.458
		(0.672)	(0.001)	(0.076)	(0.108)
4.DivisionLevel		0.023	0.956***	0.506	0.437
		(0.850)	(0.000)	(0.093)	(0.146)
5.DivisionLevel		0.116	1.056***	0.712*	0.632*
		(0.332)	(0.000)	(0.022)	(0.041)
6.DivisionLevel		0.115	1.058***	0.683*	0.596
		(0.325)	(0.000)	(0.028)	(0.054)
7.DivisionLevel		0.150	1.161***	0.794*	0.706*
		(0.197)	(0.000)	(0.011)	(0.023)
8.DivisionLevel		0.161	1.156***	0.798*	0.710*
		(0.163)	(0.000)	(0.011)	(0.023)
9.DivisionLevel		0.192	1.141***	0.668*	0.581
		(0.096)	(0.000)	(0.036)	(0.067)
10.DivisionLevel		0.233*	1.156***	0.766*	0.677*
		(0.043)	(0.000)	(0.016)	(0.033)
11.DivisionLevel		0.249*	0	0	0
		(0.031)	(.)	(.)	(.)
12.DivisionLevel		0.271*			
		(0.020)			
13.DivisionLevel		0.284*			
		(0.032)			
Distance_Level			0.000**	0.000	0.000
			(0.005)	(0.059)	(0.073)
Spectators			0.000***	0.000*	0.000
			(0.000)	(0.045)	(0.083)
H_PrevSeasonPos				-0.092***	
				(0.000)	
A_PrevSeasonPos				0.098***	
				(0.000)	
H_PrevSeasonPts					0.034***
					(0.000)
A_PrevSeasonPts					-0.034***
					(0.000)
Constant	-0.200**	-0.250*	-1.282***	-0.959**	-0.835**
	(0.002)	(0.030)	(0.000)	(0.003)	(0.009)
N	357530	357530	46075	23997	23997
R^2	0.000	0.000	0.000	0.037	0.041

*Note: p-values in parentheses; * p < 0.05, ** p < 0.01, *** p < 0.001; Home_Win = 1 for home win, 0 otherwise; (1) basic model only with professional dummy, (2) basic model with division levels, (3) includes controls, (4) includes PrevSeasonPos control, (5) includes PrevSeasonPts control.*

Table 5. *Binary Regression Home Win – Subsamples*

	(1)	(2)	(3)	(4)
	Home_Win	**Home_Win**	**Home_Win**	**Home_Win**
1.DivisionLevel	0	0		
	(.)	(.)		
2.DivisionLevel	0.279	0.106		
	(0.103)	(0.633)		
3.DivisionLevel	0.650**	0.642*		
	(0.002)	(0.021)		
4.DivisionLevel	0.833***	0.632*		
	(0.000)	(0.038)		
Distance	0.000	0.000	0.001***	0.001**
	(0.586)	(0.656)	(0.000)	(0.005)
Spectators	0.000***	0.000**	0.000***	0.000**
	(0.000)	(0.004)	(0.001)	(0.005)
H_ PrevSeasonPos		-0.014		-0.098***
		(0.287)		(0.000)
A_ PrevSeasonPos		0.046***		0.103***
		(0.001)		(0.000)
5.DivisionLevel			0	0
			(.)	(.)
6.DivisionLevel			0.059	0.043
			(0.322)	(0.602)
7.DivisionLevel			0.186**	0.184*
			(0.001)	(0.022)
8.DivisionLevel			0.197***	0.211*
			(0.001)	(0.011)
9.DivisionLevel			0.190**	0.088
			(0.007)	(0.376)
10.DivisionLevel			0.216**	0.202*
			(0.002)	(0.039)
11.DivisionLevel			0	0
			(.)	(.)
Constant	-1.084***	-1.226**	-0.369***	-0.424***
	(0.000)	(0.002)	(0.000)	(0.000)
N	1921	1171	44154	22826
R^2	0.007	0.015	0.000	0.040

*Note: p-values in parentheses; * p < 0.05, ** p < 0.01, *** p < 0.001; Home_Win = 1 for home win, 0 otherwise; (1) subsample professional divisions, (2) subsample professional divisions with further controls, (3) subsample amateur divisions, (4) subsample amateur divisions with further controls.*

Table 6 follows the same structure as Table 4, but instead of a binary logistic regression, it employs the goal difference as the dependent variable of a linear regression. Significant effects for division level are observed only in Model 3.

Likewise, the additional variables—travel distance, favourite identification (by previous season table position or points), and spectator attendance—also show significant effects exclusively in this model.

Table 6. *Linear Regression Score Difference*

	(1)	(2)	(3)	(4)	(5)
	ScoreDiff	**ScoreDiff**	**ScoreDiff**	**ScoreDiff**	**ScoreDiff**
ProfessionalDummy	0.117				
	(0.269)				
2.DivisionLevel		-0.058	0.188	-0.195	-0.225
		(0.828)	(0.401)	(0.474)	(0.406)
3.DivisionLevel		-0.049	0.678*	0.112	0.0338
		(0.849)	(0.011)	(0.743)	(0.921)
4.DivisionLevel		-0.072	1.064***	0.334	0.223
		(0.729)	(0.000)	(0.351)	(0.531)
5.DivisionLevel		-0.049	1.143***	0.464	0.349
		(0.805)	(0.000)	(0.207)	(0.339)
6.DivisionLevel		0.0088	1.259***	0.540	0.420
		(0.964)	(0.000)	(0.143)	(0.251)
7.DivisionLevel		0.025	1.315***	0.596	0.476
		(0.894)	(0.000)	(0.107)	(0.193)
8.DivisionLevel		0.036	1.338***	0.632	0.514
		(0.849)	(0.000)	(0.088)	(0.163)
9.DivisionLevel		0.061	1.269***	0.457	0.345
		(0.750)	(0.000)	(0.226)	(0.358)
10.DivisionLevel		0.113	1.240***	0.486	0.379
		(0.555)	(0.000)	(0.197)	(0.311)
11.DivisionLevel		0.123	-1.575	-2.198	-2.671
		(0.521)	(0.408)	(0.227)	(0.140)
12.DivisionLevel		0.140			
		(0.467)			
13.DivisionLevel		0.256			
		(0.244)			
Distance			0.001**	0.001*	0.001*
			(0.001)	(0.018)	(0.023)
Spectators			0.000***	0.000	0.000
			(0.000)	(0.262)	(0.434)
H_PrevSeasonPos				-0.147***	
				(0.000)	
A_PrevSeasonPos				0.151***	
				(0.000)	
H_PrevSeasonPts					0.053***
					(0.000)
A_PrevSeasonPts					-0.053***

					(0.000)
_cons	0.359***	0.395*	-0.941**	-0.255	-0.133
	(0.001)	(0.038)	(0.001)	(0.501)	(0.724)
N	356532	356532	46076	23999	23999
R^2	0.000	0.000	0.000	0.078	0.090

*Note: p-values in parentheses; * p < 0.05, ** p < 0.01, *** p < 0.001; ScoreDiff = H_Goals – A_Goals; (1) basic model only with professional dummy, (2) basic model with division levels, (3) includes controls, (4) includes PrevSeasonPos control, (5) includes PrevSeasonPts control.*

Table 7 provides a more detailed breakdown between professional and amateur football based on partial samples. Here, too, with a few exceptions, we observe stronger effects in the amateur leagues in Models 3 and 4, which underlines the greater relevance of the factors examined in the lower leagues. Models 1 and 2 cannot confirm this significantly. It is interesting to note that 11th Division Level appears to be an exception in terms of *ScoreDiff* in both Table 6 and 7.

Table 7. *Regression Score Difference – Subsamples*

	(1)	(2)	(3)	(4)
	ScoreDiff	**ScoreDiff**	**ScoreDiff**	**ScoreDiff**
1.DivisionLevel	0	0		
	(.)	(.)		
2.DivisionLevel	0.186	-0.077		
	(0.245)	(0.707)		
3.DivisionLevel	0.664***	0.414		
	(0.001)	(0.113)		
4.DivisionLevel	0.869***	0.596*		
	(0.000)	(0.035)		
Distance	0.000	0.000	0.002***	0.002***
	(0.554)	(0.668)	(0.000)	(0.000)
Spectators	0.000***	0.000**	0.000***	0.000**
	(0.000)	(0.001)	(0.000)	(0.003)
H_PrevSeasonPos		-0.020		-0.156***
		(0.123)		(0.000)
A_PrevSeasonPos		0.070***		0.158***
		(0.000)		(0.000)
5.DivisionLevel			0	0
			(.)	(.)
6.DivisionLevel			0.197*	0.170
			(0.015)	(0.096)
7.DivisionLevel			0.286***	0.266**
			(0.000)	(0.006)
8.DivisionLevel			0.333***	0.336***
			(0.000)	(0.001)
9.DivisionLevel			0.277**	0.173
			(0.003)	(0.149)

10.DivisionLevel			0.263**	0.221
			(0.004)	(0.061)
11.DivisionLevel			-2.555	-2.468
			(0.180)	(0.171)
Constant	-0.617**	-0.804*	0.000567	-0.020
	(0.006)	(0.026)	(0.995)	(0.865)
N	1921	1171	44155	22828
R^2	0.017	0.041	0.000	0.083

*Note: p-values in parentheses; * p < 0.05, ** p < 0.01, *** p < 0.001; ScoreDiff = H_Goals – A_Goals; (1) subsample professional divisions, (2) subsample professional divisions with further controls, (3) subsample amateur divisions, (4) subsample amateur divisions with further controls.*

Table 8. *Binary Regression Draw*

	(1)	(2)	(3)	(4)	(5)
	Draw	**Draw**	**Draw**	**Draw**	**Draw**
ProfessionalDummy	-0.689***				
	(0.000)				
2.DivisionLevel		-0.175	-0.258	-0.453	-0.452
		(0.350)	(0.185)	(0.083)	(0.084)
3.DivisionLevel		0.001	-0.251	-0.543	-0.543
		(0.991)	(0.272)	(0.092)	(0.092)
4.DivisionLevel		-0.168	-0.657**	-0.726*	-0.720*
		(0.240)	(0.008)	(0.032)	(0.033)
5.DivisionLevel		-0.396**	-0.809**	-0.864*	-0.857*
		(0.004)	(0.001)	(0.013)	(0.014)
6.DivisionLevel		-0.452***	-0.869***	-0.939**	-0.929**
		(0.001)	(0.001)	(0.007)	(0.008)
7.DivisionLevel		-0.529***	-1.021***	-1.088**	-1.076**
		(0.000)	(0.000)	(0.002)	(0.002)
8.DivisionLevel		-0.590***	-1.022***	-1.113**	-1.101**
		(0.000)	(0.000)	(0.002)	(0.002)
9.DivisionLevel		-0.681***	-1.026***	-1.098**	-1.086**
		(0.000)	(0.000)	(0.002)	(0.002)
10.DivisionLevel		-0.849***	-1.303***	-1.316***	-1.303***
		(0.000)	(0.000)	(0.000)	(0.000)
11.DivisionLevel		-0.942***	0	0	0
		(0.000)	(.)	(.)	(.)
12.DivisionLevel		-0.972***			
		(0.000)			
13.DivisionLevel		-0.897***			
		(0.000)			
Distance			-0.000	-0.000	-0.000
			(0.059)	(0.322)	(0.332)
Spectators			-0.000	-0.000	-0.000

			(0.083)	(0.075)	(0.078)
H_PrevSeasonPos				0.011*	
				(0.015)	
A_PrevSeasonPos				-0.013**	
				(0.003)	
H_PrevSeasonPts					-0.003**
					(0.007)
A_PrevSeasonPts					0.004**
					(0.004)
Constant	-1.073***	-1.022***	-0.497	-0.407	-0.446
	(0.000)	(0.000)	(0.051)	(0.260)	(0.218)
N	357530	357530	46075	23997	23997
R^2	0.000	0.003	0.002	0.002	0.002

*Note: p-values in parentheses; * p < 0.05, ** p < 0.01, *** p < 0.001; Draw = 1 for draw, 0 otherwise; (1) basic model only with professional dummy, (2) basic model with division levels, (3) includes controls, (4) includes PrevSeasonPos control, (5) includes PrevSeasonPts control.*

Table 8 follows the same structure as Tables 4 and 6 and uses the binary variable *Draw* as the dependent variable. This serves, alongside *ScoreDiff*, as a proxy for the competitive balance within the respective divisions. The analysis reveals significant effects for division level, suggesting systematic differences in match outcomes across the division hierarchy. However, no significant effects are observed for spectator attendance or travel distance, indicating that these factors do not appear to influence the likelihood of a draw in this context. The broader picture is nonetheless clear: draws are systematically less likely in lower divisions. This signals reduced competitive balance: rather than producing evenly matched contests, amateur football more often delivers decisive outcomes, typically in favour of the home team.

As additional robustness tests, we conducted subsample analyses based on Table 8, as well as estimations using the binary variable *Home_Points* (indicating whether the home team earned at least one point) and separate estimations for *Away_Win*. Using Home_Points and Away_Win as alternative dependent variables yields the same pattern: amateur clubs gain disproportionately at home. These tests confirmed the effects identified in the main models. This underlines that the main findings are not model-specific but reflect a systematic structural difference.

Discussion

In the following section, we discuss the implications of our hypotheses before addressing the limitations of our study and outlining directions for future research.

H1: Home advantage *is more pronounced at lower division levels.*

While Model 1 in Table 4 suggests that home advantage is generally higher in professional leagues than in amateur football, the more detailed analysis of individual divisions reveals that home advantage intensifies with decreasing division level within the amateur hierarchy. This finding may result from both the oversimplified binary classification in Model 1 and fundamental differences between professional and amateur football, such as distinct fan behavior patterns across these levels. Despite this initial result, Models 2-5 of Table 4 and all specifications in Table 5 support our hypothesis, showing statistically significant effects where division-specific effects and appropriate controls reveal the expected hierarchical pattern with *Home_Win* as the dependent variable. When using goal difference as an alternative indicator for home wins (Table 6), we observe corresponding effects, but these are only significant in Model 3. In contrast, the alternative proxy *Home_Points* confirms the expected pattern across robustness tests. Additionally, goal difference regains significance in the subsample models presented in Table 7. Overall, the increase in home advantage appears to be driven primarily by a decline in draws. While the number of away wins, and therefore overall wins, increases slightly as well, the rise in home wins is more substantial. Across almost all models, we find robust evidence that home advantage intensifies in lower divisions.

H2: Matches in higher division levels are more balanced.

This hypothesis is primarily supported by the results in Table 8, which displays the number of draws per division level. With minor exceptions, the number of draws decreases as division level decreases, lending support to the hypothesis. However, the second indicator for competitive balance, namely goal difference, does not show statistically significant effects in all models. While trends in the data point in the expected direction, the results are not consistently significant across all specifications.

H3: Travel distance has a stronger impact on match outcomes in amateur divisions than in professional divisions.

To evaluate this hypothesis, we examine the variable *Distance* (in km) across all models. In most cases, it shows a statistically significant effect, particularly in the subsample analyses of amateur football shown in Tables 5 and 7. This supports the assumption that travel distance plays a more important role in amateur football, likely due to limited infrastructure and fewer resources. Furthermore, longer distances may amplify home advantage in lower divisions as fewer away fans are willing to undertake extensive travel, thereby reducing the support for the visiting team and strengthening the home atmosphere.

Taken together, the results provide compelling evidence that the degree of professionalisation in football is a central explanatory factor for the extent of home advantage. Within amateur football, home advantage intensifies progressively as the level of professionalisation decreases. While in the top divisions improved travel logistics, standardised match conditions, balanced squad quality, professional support structures, and technological tools help mitigate home advantage, a markedly different picture emerges in amateur football: Here, conditions are more heterogeneous, infrastructural resources are more limited, and teams often operate with significant constraints.

These differences are reflected in the empirical findings: Home advantage is not only more pronounced at lower division levels, but can also be attributed to lower competitive balance and a greater influence of external factors such as travel distance. Particularly noteworthy is the significant decline in the number of draws in the lower divisions—an indicator of reduced competitive parity as evenly matched teams would theoretically produce more draws and closer margins of victory—accompanied by a noticeable increase in home wins and, to a lesser extent, away wins. Moreover, amateur divisions show stronger effects of travel distance on match outcomes, suggesting that logistical constraints, longer travel times, and a lack of recovery infrastructure play a meaningful role in shaping performance.

Overall, the findings clearly show that home advantage varies systematically across division levels. Most notably, the amateur sector exhibits a clear pattern of progressively intensifying home advantage as division level decreases, driven by structural disparities between home and away teams that compound at lower levels. This study thus provides a valuable contribution to understanding the conditions under which home advantage in football intensifies or diminishes, and highlights the importance of a differentiated perspective based on competition level and organisational context.

Beyond our core hypotheses, the study also highlights the relevant influence of spectators on home advantage. For players and coaches, the findings suggest that a higher degree of professionalisation can help mitigate existing biases or systematic advantages. However, several limitations must be acknowledged. First, travel distances are measured as straight-line kilometres between postal codes, which may under- or overestimate actual burdens. Second, the inclusion of control variables is constrained by data availability. Not all control variables are available across all division levels, and established variables such as betting odds—commonly used in professional settings—are not accessible for the amateur sector. As a result, certain relevant information is missing from the dataset, which limits the precision of the analysis. Third, the scope of the study is limited to German football leagues and a single season. Future research should expand the temporal dimension and aim to build a broader dataset that includes leagues from other countries and even across different sports. In addition, future studies should systematically incorporate the degree of professionalisation of each division as a structural variable in empirical models.

Conclusion

This study provides comprehensive evidence that the extent of home advantage in football is closely linked to the degree of professionalisation within a league. By analysing over 350,000 matches across 13 hierarchical levels in German men's football, the findings confirm that home advantage is not a uniform phenomenon, but one that varies systematically along the structural gradient of the sport.

In lower, amateur-level leagues, where clubs often operate under less standardised conditions and with limited resources, home teams benefit disproportionately from environmental familiarity, crowd support, and logistical asymmetries. The data show a clear decrease in the number of draws and a relative increase in home wins, suggesting a lower level of competitive balance. Additionally, travel distance plays a statistically significant role in determining match outcomes in these leagues – a factor that appears largely irrelevant at the professional level due to better infrastructure, transportation, and preparation. By contrast, top-tier leagues with higher degrees of professionalisation exhibit more balanced competition.

These findings have important implications for sports governance and future research. They suggest that behavioural phenomena like home advantage cannot be fully understood without accounting for the structural and organisational context in which matches are played. Moreover, they call for greater attention to the unique challenges of amateur football when designing policies aimed at improving fairness and integrity in competition.

The study highlights the value of large-scale, data-driven approaches for uncovering nuanced dynamics in sport and contributes to a more differentiated understanding of performance determinants across football's diverse competitive landscape.

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