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Working Paper

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Tinbergen Institute Discussion Paper, No. TI 2020-025/V

Provided in Cooperation with:

Tinbergen Institute, Amsterdam and Rotterdam

Suggested Citation: Peeters, Thomas; van Ours, Jan C. (2020) : Seasonal Home Advantage in English Professional Football; 1973-2018, Tinbergen Institute Discussion Paper, No. TI 2020-025/V, Tinbergen Institute, Amsterdam and Rotterdam

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Tinbergen Institute Discussion Paper

Seasonal Home Advantage in English Professional Football; 1973-2018

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Seasonal Home Advantage in English Professional Football; 1973–2018

Thomas Peeters* and Jan C. van Ours†

May 12, 2020

Abstract

We analyze 45 years of data from English professional football focusing on the determinants of home advantage. We conclude that seasonal home advantage is substantial and positively related to within-team variation in attendance. Furthermore, despite big cross-league differences in attendance, the average home advantage is about the same across the English leagues. The average home advantage over the period of analysis was 0.63 points and 0.45 goals difference. Finally, we find that over time there is a substantial decline in the home advantage that materializes equally across the leagues.

Keywords: Professional football; home advantage; managers

JEL-codes: Z21, L83

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1 Introduction

The existence of home advantage in professional football is well-established. Pollard (1986) studies how home advantage has developed in the top English division since its inception in 1888. He concludes that up to 1984 home advantage has been remarkably stable and that it is less marked in local derbies and the FA cup. Furthermore, Pollard (1986) concludes that crowd size and travel fatigue are not important while the effects of familiarity with local conditions, referee bias, and team tactics are unclear. Following Pollard (1986), quite a few studies have investigated home advantage in English professional football. Barnett and Hilditch (1993) investigated the effects of playing on an artificial pitch rather than on natural grass. They find an additional home advantage of playing on an artificial pitch of 0.28 points and 0.31 goals per match.¹ Clarke and Norman (1995) study seasonal home advantage for all English football teams over the period 1981 to 1990. Their study shows a lot of variation between teams and over time. Bray et al. (2003) study teams from all four divisions of the English football league over 19 seasons (1981 to 2000) finding that teams on average won 22% more games at home than away. Carmichael and Thomas (2005) suggest that home advantage is related to difference in playing style in the sense that home teams play more aggressive while away teams play more defensive. Dawson et al. (2007) conclude that in the English Premier League underdogs are more likely to receive disciplinary sanctions than favorites. They also state that due to a home team bias, home teams play more aggressive in front of large crowds but do not receive more disciplinary sanctions. Johnston (2008) did not find evidence for a referee bias affecting the home advantage. Boyko et al. (2010) claim that home advantage in English Premiership football is influenced by crowd size and referee decisions about penalties and yellow cards. Buraimo et al. (2010) conclude that there is a referee bias favoring home teams. Allen and Jones (2014) studying Premier League matches conclude that from season 1992/93 to season 2011/12 average home advantage did not show an upward or downward trend. Furthermore, they find teams at the lower end of the league table have a greater home advantage while contrary to what Attrill

¹There were four clubs in English professional football that had an artificial pitch for a while mainly during the 1980s. In 1995 such pitches were banned but since 2016 they are permitted in lowest two divisions in English professional football.

et al. (2008) find it does not matter whether teams play in a red colored or different colored shirt.

Home advantage in professional football is also studied in other countries. For example, Buraimo et al. (2010) looks at the highest German league, Armatas and Pollard (2014) at the Superleague in Greece. Garicano et al. (2005) show that Spanish referees grant more extra playing time when the home team is narrowly behind in the score. Pollard and Armatas (2017) study the home advantage in the group stages of the qualification for World Cup finals finding that this was greatest in Africa and South America and lowest in Europe. Ponzio and Scoppa (2018) analyze same-stadium derbies across Europe, i.e. matches between teams that share the same stadium. This set-up rules out travel distance and familiarity with the stadium as determinants of the home advantage. The main conclusion is that home advantage depends on the support of the crowd also because referee's decisions tend to be biased in favor of the home team. For Dutch professional football, Van Ours (2019) finds a home advantage of 0.33 points and 0.42 goals per match while teams who play on an artificial pitch have an additional home advantage. Finally, in a recent study Van Damme and Baert (2019) investigate the effects of various distance measures in European international football concluding that altitude is important as well as crowd sizes.

Despite many studies on home advantage in professional football it is not clear what the relevant determinants are. Interesting as it may be one may wonder why in a double round-robin competition home advantage is an issue at all. If every team plays the same number of matches home and away against the same opponents home advantages cancel. In this format, home advantage is only a relevant concern from a competition point of view, if some teams have a persistently larger average home advantage than others.

In our paper we ask whether seasonal home advantage is a relevant concern from a competitive point of view. To this end, we calculate team-specific seasonal home advantage for all clubs in the 4 English professional football divisions over a time period of 45 years from 1974 to 2018.² Focusing on seasonal home advantage rather than home advantage in individual matches allows us to separate home advantage from season-specific

²The names of the four leagues have changed over the period of analysis. We use the current names. We refer to years instead of seasons. Our data are from season 1973/74 to 2017/18.

differences in team quality. In turn, we can then investigate systematic differences in home advantage among teams in the league. In our baseline analysis, we focus on seasonal home advantage of a team in a particular season relative to the league average home advantage in that season. After all, it is the relative home advantage that determines whether or not a team has a competitive advantage.

As in previous studies we investigate the effects of stadium attendance, but we also look at the nature of the pitch (natural grass or artificial) and whether a team was just promoted or relegated. In addition to differences in relative home advantage between clubs, we also investigate the development of the absolute home advantage over time. We find that home advantage at all levels has declined significantly over the period of analysis. We made an attempt to find an explanation for this secular decline in home advantage in English professional football but did succeed. We can only speculate about potential determinants of the secular decline that manifested itself in all four leagues.

2 Calculating Seasonal Home Advantage

Clarke and Norman (1995) present a simple method to disentangle the performance of a team in a particular season into the quality of a team and its home advantage. In terms of points difference, this works as follows. Ignoring random influences and ignoring for the moment an index for season, the home point difference (*HPD*) of team i depends on the quality q_i of the team, the quality of its opponents q_j and the home advantage of the team h_i :³

$$HPD_i = (N - 1)q_i - \sum_{j(j \neq i)}^N q_j + (N - 1)h_i \quad (1)$$

where N is the number of teams in the league. Therefore, team i has $N - 1$ home matches.

³We also ignore the discrete character of the point difference. For individual matches the HPD can only have three values: +3, 0, -3. However, since a season varies from 38 to 46 matches this discrete character is not so relevant. Note that Home Win Difference can have values of +1, 0, -1. Therefore, since Home Win Difference and Home Point Difference are perfectly correlated we ignore Home Win Difference focusing on Home Point Difference and Home Goal Difference.

Similarly the away point difference (*APD*) of team i is equal to:

$$APD_i = (N - 1)q_i - \sum_{j(j \neq i)}^N q_j - \sum_{j(j \neq i)}^N h_j \quad (2)$$

Quality is normalized such that average quality over the teams in a league is zero: $\sum_{i=1}^N q_i = 0$, so:

$$\sum_{j(j \neq i)}^N q_j = -q_i \quad (3)$$

Furthermore, H is defined as the total home advantage aggregated over all teams:

$$H = \sum_{i=1}^N h_i = N\bar{h} \quad (4)$$

where \bar{h} is the average home advantage over all teams in the league. Therefore:

$$\sum_{j(j \neq i)}^N h_j = N\bar{h} - h_i \quad (5)$$

Using equations (3) and (5) we can rewrite equations (1) and (2) as:

$$HPD_i = Nq_i + (N - 1)h_i \quad (6)$$

and

$$APD_i = Nq_i + h_i - N\bar{h} \quad (7)$$

By combining equations (6) and (7) it is easy to find for the home advantage of team i :

$$h_i = \frac{HPD_i - APD_i - H}{N - 2} \quad (8)$$

Using equation (6) the quality of team i can be calculated as

$$q_i = \frac{HPD_i - (N - 1)h_i}{N} \quad (9)$$

Using end of season league table we can calculate for every team in the league its quality

and home advantage. Average seasonal performance of team i , P_i , is equal to:

$$P_i = \frac{HPD_i + APD_i}{N} = 2q_i + (h_i - \bar{h}) \quad (10)$$

From this we conclude that it is possible to split-up performance into two components, quality and relative home advantage. If $h_i > \bar{h}$, performance is enhanced by superior home advantage but if home advantage of team i is equal to the average home advantage, performance only depends on quality. In the empirical analysis, we will use relative home advantage as our main dependent variable.

As an alternative to home point difference and away point difference we also use home goal difference (HGD) and away goal difference (AGD). This leads to home advantage in terms of goal difference which is strongly but not perfectly correlated with home advantage in point difference.

3 Descriptive Data Analysis

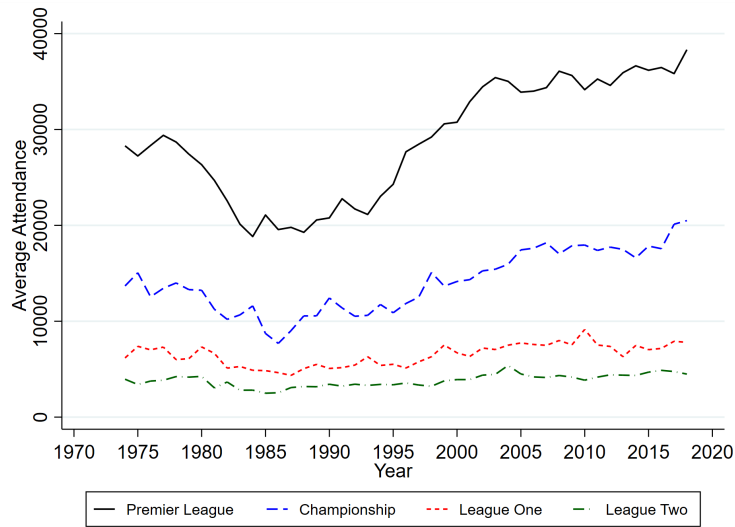
3.1 Developments over time

Figure 1 shows the evolution of match attendance in the English professional football leagues. As shown in the table at the bottom of the graph there are substantial differences between the leagues. Whereas the average Premier League match had a crowd of almost 30,000, the Championship had almost 15,000, League One a little over 5,000 and in League Two less than 4,000 attendants visited a match.

The developments over the period of analysis are spectacular. We see a big drop in average attendance from 1974 through the mid-1980s. After that, we observe a steady increase, which runs all the way to 2018. In absolute terms, this evolution is most dramatic for Premier League clubs, but there was a big relative increase at all levels. In the Premier League the average crowd size increased from about 20,000 in the mid 1980s to almost 40,000 recently; in the Championship the increase was from less than 8,000 to over 20,000; in League One from less than 5,000 to almost 8,000 and in League Two from 2,500 to about 4,500.

Based on the calculations presented in the previous section, Figure 2 shows the evolu-

Figure 1: Attendance by division; 1974-2018



	Premier League	Championship	League One	League Two
Averages	28.8	14.1	6.5	3.8
Attendance (1000)	28.8	14.1	6.5	3.8

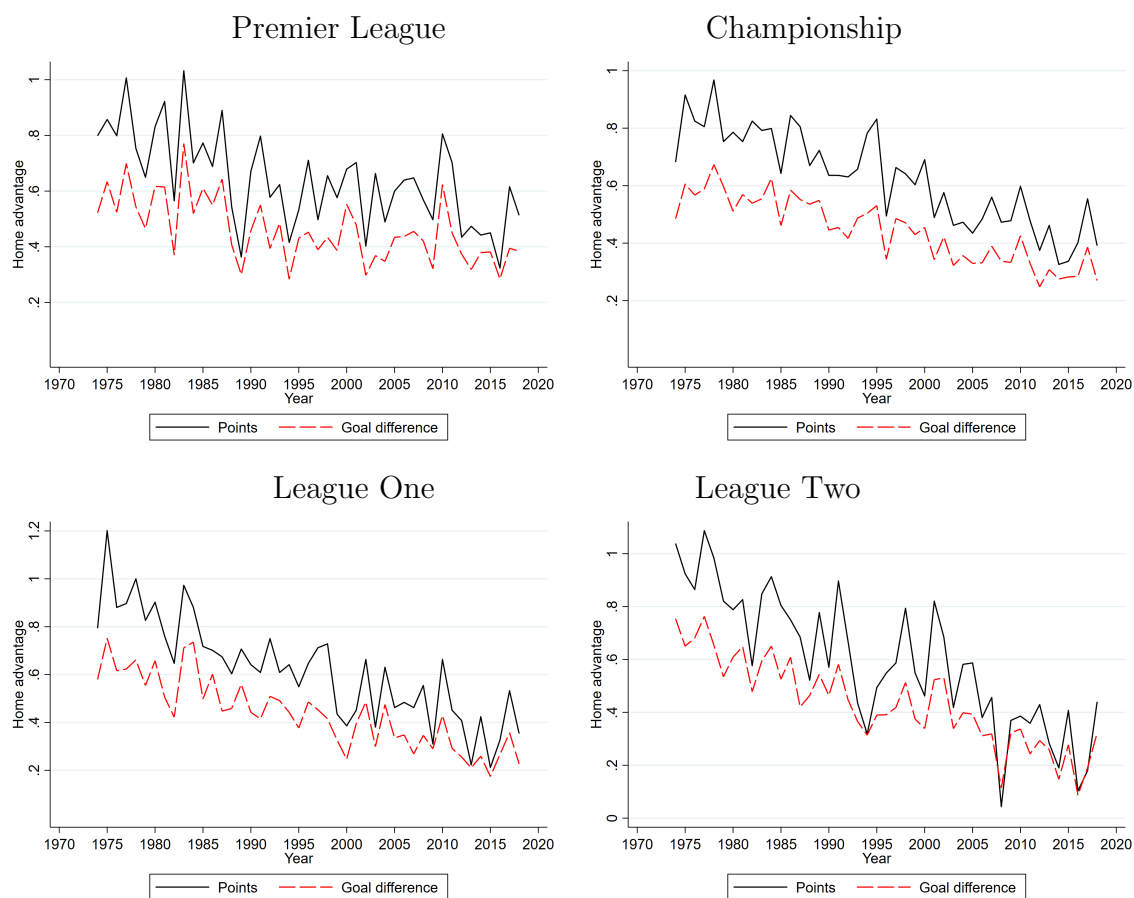
tion of the absolute home advantage by league. As presented in the table at the bottom of the figure, average home advantage is highest in the Premier League and lowest in League Two although the differences are small. Whereas home advantage in the Premier League is 0.64 points and 0.46 goals, for League Two this is 0.59 points and 0.44 goals. The graphs in Figure 2 show that on average there is a clear positive home advantage but there are substantial fluctuations from year to year. In the Premier League for example, home advantage fluctuates between 0.4 and 0.9 points and between 0.3 and 0.6 goals. Still, it is clear that home advantages declines over time in all leagues.

3.2 Individual clubs and home advantage

In terms of the on-field competition absolute home advantage is not very important, because the round robin format cancels out the aggregate effect of home advantage across clubs. What matters is relative home advantage, i.e. whether a club has a higher than its direct competitors.

Table 1 gives an overview of the 65 clubs, which appeared in one of the top four divisions of English football in every season over the period 1974-2018. The table shows how many years the club played in each division. There are only 3 clubs that have played

Figure 2: Absolute Home Advantages English professional football by league; 1974-2018



Average Home Advantage	Premier League	Championship	League One	League Two
Points	0.64	0.63	0.62	0.59
Goal Difference	0.46	0.44	0.44	0.44

in the Premier League all the time: Arsenal, Everton and Liverpool. All other clubs have played in at least two divisions, some clubs even in all four. For example, Bolton Wanderers played 15 seasons in the top division, but at one point went all the way down to the fourth division. Again other clubs, e.g. Chesterfield, Northampton Town and Rochdale, never played at the top level or even at the second level, but did maintain its position in the top four divisions throughout our data sample.

Table 1 also gives information about the average home advantage both in number of points as well as in goal difference. Over the 45 years of our period of analysis every club in the balanced panel had a positive home advantage with at the extremes Newcastle United with a home advantage of 0.99 points and 0.71 goals difference per home match, Crystal Palace with a home advantage of 0.36 points per match and Wolverhampton

Wanderers with a 0.27 goals difference per home match. Naturally, these unconditional averages may be driven by a host of underlying differences between clubs, which we explore in the next section.

Table 1: Overview Balanced Panel by Club and Division; 1974-2018

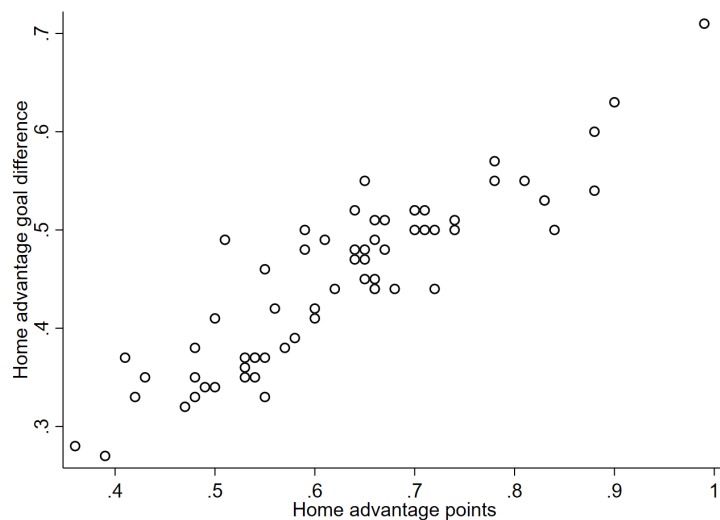
Club	Division				Home Adv		Club	Division				Home Adv	
	1	2	3	4	Point	GD		1	2	3	4	Point	GD
Arsenal	45	0	0	0	0.64	0.47	Middlesbrough	24	20	1	0	0.72	0.44
Aston Villa	40	5	0	0	0.57	0.38	Millwall	2	25	18	0	0.67	0.48
Barnsley	1	30	8	6	0.68	0.44	Newcastle United	33	12	0	0	0.99	0.71
Birmingham City	18	23	4	0	0.55	0.33	Northampton Town	0	0	14	31	0.62	0.44
Blackburn Rovers	18	23	4	0	0.59	0.48	Norwich City	24	20	1	0	0.81	0.55
Blackpool	1	12	24	8	0.65	0.45	Nottingham Forest	20	22	3	0	0.58	0.39
Bolton Wanderers	15	19	10	1	0.83	0.53	Notts County	4	13	18	10	0.42	0.33
Bournemouth	3	5	27	10	0.66	0.44	Oldham Athletic	3	20	22	0	0.74	0.50
Bradford City	2	11	18	14	0.54	0.37	Peterborough United	0	5	21	19	0.48	0.38
Brentford	0	5	32	8	0.53	0.37	Plymouth Argyle	0	14	20	11	0.88	0.54
Brighton & Hove Albion	5	19	16	5	0.65	0.47	Port Vale	0	9	23	13	0.66	0.45
Bristol City	4	19	20	2	0.72	0.50	Portsmouth	8	24	7	6	0.65	0.55
Burnley	7	20	11	7	0.78	0.57	Preston North End	0	18	22	5	0.83	0.53
Bury	0	2	22	21	0.50	0.34	Queens Park Rangers	22	20	3	0	0.84	0.50
Cardiff City	1	24	10	10	0.53	0.35	Reading	3	19	17	6	0.64	0.48
Charlton Athletic	12	25	8	0	0.53	0.36	Rochdale	0	0	7	38	0.55	0.46
Chelsea	37	8	0	0	0.41	0.37	Rotherham United	0	9	23	13	0.50	0.41
Chesterfield	0	0	29	16	0.66	0.44	Scunthorpe United	0	3	11	31	0.70	0.50
Coventry City	28	11	5	1	0.60	0.42	Sheffield United	8	25	11	1	0.70	0.52
Crewe Alexandra	0	8	13	24	0.54	0.35	Sheffield Wednesday	15	21	9	0	0.47	0.32
Crystal Palace	14	28	3	0	0.36	0.28	Southampton	34	9	2	0	0.88	0.60
Derby County	18	25	2	0	0.67	0.51	Southend United	0	7	19	19	0.66	0.49
Everton	45	0	0	0	0.74	0.51	Stoke City	20	18	7	0	0.71	0.52
Fulham	13	17	12	3	0.60	0.41	Sunderland	23	21	1	0	0.56	0.42
Gillingham	0	5	28	12	0.90	0.63	Swansea City	9	6	15	15	0.78	0.55
Huddersfield Town	1	16	22	6	0.64	0.52	Swindon Town	1	12	25	7	0.71	0.50
Hull City	5	19	11	10	0.59	0.50	Tottenham Hotspur	44	1	0	0	0.49	0.34
Ipswich Town	18	27	0	0	0.65	0.48	Walsall	0	5	33	7	0.48	0.33
Leeds United	23	19	3	0	0.55	0.37	Watford	11	26	5	3	0.48	0.35
Leicester City	22	22	1	0	0.54	0.37	West Bromwich Albion	22	21	2	0	0.43	0.35
Liverpool	45	0	0	0	0.70	0.52	West Ham United	36	9	0	0	0.61	0.49
Manchester City	36	8	1	0	0.66	0.51	Wolverhampton Wanderers	13	27	3	2	0.39	0.27
Manchester United	44	1	0	0	0.51	0.49							
Total								900	917	707	401	0.63	0.45

The balanced panel consists of 65 clubs.

Figure 3 presents an overview of the spread in the two types of home advantages per club over the period of analysis. Of course, there is a high correlation between the two measures but the correlation is not perfect. Clubs with the same home advantage in number of points have a different home advantage in terms of goal difference in vice versa. What matters for the competition is the home advantage in number of points. What matters in terms of excitement during home matches is the home advantage in

goal difference. Apparently some clubs have a more spectacular home play with large goal differences but the same home advantage of clubs that play less spectacular but secure their home matches with a small goal difference.

Figure 3: Home Advantage in points and goal difference balanced panel; 1974-2018



3.3 Managers and home advantage

In addition to looking at heterogeneity among clubs, we also investigate whether there is heterogeneity in home advantage at the level of individual managers. Unlike clubs, managers have relatively short careers in the data. Given the considerable differences in seasonal home advantage over time and division, this may distort a comparison of managerial averages in the vein of our analysis in Table 1. Therefore we first regress seasonal home advantage on a set of season and division dummies. We then average the residual of this regression for each manager with at least six full seasons of managerial experience, taking only full seasons with a club into account. We finally normalize this number by subtracting the average level of seasonal home advantage from the manager's average. This allows us to rank managers according to the average home advantage they enjoyed over their career in the data. Any positive number indicates a manager enjoyed more division- and seasonally-adjusted home advantage than his peers, whereas negative numbers indicate the opposite.

Panel a of Table 2 gives the top 10 of managers ranked according to their contribution

to the home advantage as measured in points.⁴ Clearly, many of the top 10 managers have been active in more than one league. The number one – Nigel Worthington – has been active in all leagues. David Hodgson and Jim Iley have been manager of only League Two teams while Harry Redknapp spent 12 seasons of his 22 as manager in the Premier League. It is also clear that home advantage in goal difference is not perfectly correlated with the home advantage in number of points. Glenn Hoddle for example ranks very high in terms of points but does not stick out in terms of goal difference.

Panel b of Table 2 gives the bottom 10 of managers ranked according to their contribution to the home advantage as measured in points. Again, there is not a clear pattern in terms of leagues in which the bottom 10 managers were active. Alan Durbin has been active in all four leagues while Jim Bentley managed clubs only in League Two and David O’Leary managed only clubs in the Premier League.

Finally, panel c of Table 2 provides information about home advantages of the most experienced managers. There is no clear pattern of possible relationship between manager experience and contribution to the home advantage. Dario Gradi and Alex Ferguson who were manager for 26 seasons have a small negative contribution to the home advantage as measured in points. In contrast to the popular notion of "Fergie time", the former Manchester United manager Alex Ferguson does not appear to have enjoyed a larger home advantage than the average English manager. Of the top 10 most experienced managers only Jim Smith and Harry Redknapp have a relatively large positive home advantage but all other managers are in the range from -0.2 to +0.2.

4 Quantitative Analysis

4.1 Relative Home Advantage

The appendix provides information about the data we collected for the 45 seasons of professional English football. To determine the drivers of home advantage at club level, we relate seasonal home advantage of club i in league j in season t to a set of club

⁴Note that the ranking is based on averages. Often, the difference between the home advantages across managers may be too small to be statistically significantly different from zero, because the observations per manager tends to be low.

Table 2: Contribution of Managers to the Home Advantage

	Manager	Home Advantage		Seasons active				Total
		Points	GD	PL	Ch	L1	L2	
a. Top 10								
1	Nigel Worthington	0.59	0.28	1	4	2	1	8
2	Terry Cooper	0.58	0.28	0	2	5	5	12
3	Chris Hughton	0.58	0.43	2	4	0	0	6
4	Glenn Hoddle	0.58	0.03	3	3	0	0	6
5	Ray Harford	0.52	0.26	4	2	0	0	6
6	Lawrie McMenemy	0.49	0.24	7	5	0	0	12
7	David Hodgson	0.47	0.30	0	0	0	6	6
8	Bob Stokoe	0.45	0.36	0	6	2	0	8
9	Harry Redknapp	0.43	0.28	12	5	5	0	22
10	Jim Iley	0.43	0.14	0	0	0	8	8
b. Bottom 10								
10	David O'Leary	-0.51	-0.30	6	0	0	0	6
9	Bobby Gould	-0.51	-0.16	5	0	3	1	9
8	Joe Kinnear	-0.55	-0.24	7	0	1	1	9
7	Jim Bentley	-0.58	-0.41	0	0	0	7	7
6	Martin O'Neill	-0.58	-0.43	8	0	1	1	10
5	George Petchey	-0.60	-0.45	0	5	1	0	6
4	Jimmy Sirrel	-0.60	-0.36	1	6	2	0	9
3	Alan Durban	-0.61	-0.34	4	1	3	1	9
2	Paul Jewell	-0.64	-0.29	3	4	2	0	9
1	Bobby Campbell	-0.81	-0.43	1	5	1	0	7
c. Most experienced								
1	Dario Gradi	-0.15	-0.17	0	7	8	11	26
2	Alex Ferguson	-0.16	0.06	26	0	0	0	26
3	Jim Smith	0.38	0.21	10	9	3	1	23
4	Harry Redknapp	0.43	0.28	12	5	5	0	22
5	Graham Taylor	-0.06	-0.03	9	6	3	4	22
6	Arsène Wenger	0.16	0.17	21	0	0	0	21
7	Graham Turner	0.05	0.02	2	10	2	7	21
8	Joe Royle	0.14	0.07	5	13	1	0	19
9	John Lyall	-0.17	-0.03	14	5	0	0	19
10	Lennie Lawrence	-0.20	-0.10	5	8	6	0	19

Note that the ranking of managers in panels a and b is according to their contribution to the home advantage in points; the ranking in panel c is according to the number of teams they managed.

characteristics x as follows (ignoring the error term):

$$h_{ijt} = \alpha_i + \beta x_{ijt} + \gamma_j + \delta_t \quad (11)$$

where x_{it} is a vector of time-varying club-specific variables, α_i are club fixed effects, β is a vector of parameters γ_j are divisional dummies, and δ_t are season fixed effects.

In our baseline estimates, we focus on the relative home advantage by subtracting the league average home advantage thus removing the calendar year fixed effects from the

analysis:

$$h_{ijt}^r = h_{ijt} - \bar{h}_{jt} = \alpha_i + \beta x_{ijt} + \gamma_j \quad (12)$$

In the estimation we focus on the following explanatory variables:

- Relative attendance defined as the log of the club's average home attendance divided by the division average for the season. The logic here is that higher attendance may exert pressure on the referee to favor the home team Garicano et al. (2005).
- Use of an artificial pitch which may help a club's home advantage, because visiting teams will typically not be as familiar with this type of turf as the home team is.
- Promotion of relegation to a new division since recently promoted or regulated may have an advantage if visiting teams are less familiar with their grounds compared to other grounds in the division.

We introduce club fixed effects to account for time-invariant differences between clubs such as the nature and size of the pitch, the distance between the crowd and the pitch, the shape of the stadium and so on. We also include dummy variables representing the league. For clubs that always played in the same league the club fixed effects and the league dummy coincide but this is only the case for a handful of clubs.

Table 3 shows parameter estimates based on our panel of 114 clubs. Relative attendance has a positive and significant parameter estimate. Also playing on an artificial pitch has a positive and significant effect on home advantage whereby the point estimates are somewhat larger than those of Barnett and Hilditch (1993). Furthermore, being promoted has a positive effect on home advantage while being relegated has a negative but (sometimes) insignificant effect on home advantage.

In further sensitivity analyses, we also investigated the effect of the club's relative wage bill, the absolute size of the crowd in home matches and away matches and the introduction of a new stadium. None of these variables have a significant effect on relative home advantage.

Clearly, our analysis shows that relative home advantage is correlated with attendance. We hesitate to interpret these correlations as causal effects, as it is conceivable that a strong "home reputation" draws more attendance to the stadium. However, since

Table 3: **Parameter Estimates Relative Home Advantage**

Variables	Relative home advantage goal difference				Relative home advantage points			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Attendance	0.09*** (0.03)			0.08** (0.03)	0.12** (0.05)			0.11** (0.05)
Artificial pitch		0.37*** (0.11)		0.36*** (0.11)		0.56*** (0.17)		0.55*** (0.17)
Promoted			0.06** (0.02)	0.05** (0.02)			0.07* (0.04)	0.06* (0.04)
Relegated			-0.04 (0.03)	-0.04* (0.03)			-0.07* (0.04)	-0.08* (0.04)
R-squared	0.06	0.06	0.06	0.06	0.05	0.06	0.06	0.06

Note: Attendance = relative attendance. All estimates are based on 4,140 observations of 114 teams.

All estimates include team fixed effects; parameters for the league dummies and constants are not reported; robust standard errors in parentheses; *** (**, *) indicates that a parameter estimate is significantly different from zero at a 1 (5,10) %-level.

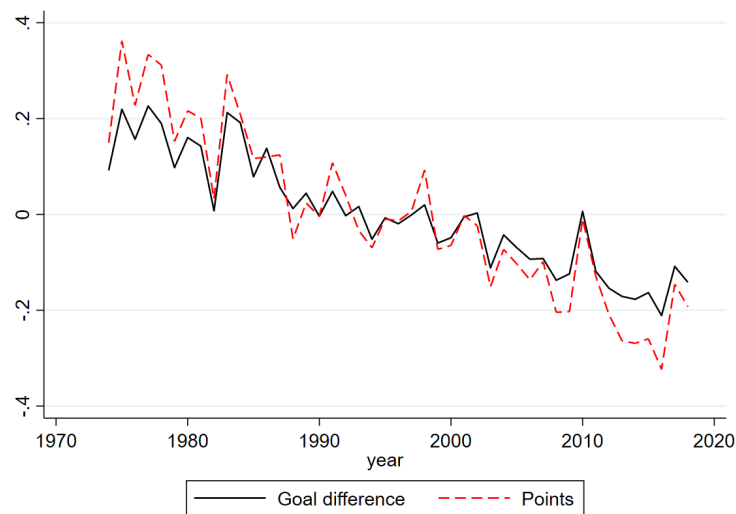
the parameter estimates are identified on within club variation between seasons reverse causality does not seem very likely. The effect of artificial pitches is economically and statistically significant. We have to point out here that no English club currently plays on artificial turf. Our observations on artificial pitches date back to a time when the quality of these pitches was far lower than today. This may imply we overestimate what the effect would be if a club were to introduce an artificial pitch today. While promotion seems to have a favorable effect, this would be an objective of most clubs in its own right, not for increasing the home advantage. From a competition point of view the main question is whether clubs are able to exploit their relative home advantage through the factors we examined. Given our reasoning above, the answer is, most likely not.

4.2 Developments over time

To investigate the development of the average home advantage over time we estimated equation 11, i.e. the determinants of the absolute home advantage. Thus, we can estimate calendar year fixed effects representing the average home advantage. Figure 4 plots the estimated calendar time fixed effects whereby the average over the period of analysis is normalized to zero.

Clearly, since the mid 1980s there is a strong downward trend in home advantage that is apart from yearly fluctuations not leveling of in recent year. It is hard to relate this downward trend to changes in the nature of the game. For example, one might expect that

Figure 4: Calendar Year Fixed Effects Home Advantage Estimates; 1974-2018



the increase in live game broadcasts in the early nineties caused by the EPL TV contract would lead to better monitoring of refereeing decisions and hence lower home advantage (see e.g., Garicano et al. (2005)). However, home advantage was already in decline long before TV broadcasting dramatically went up and continued to decline gradually ever since. Likewise, we do not see any jumps for the introduction of the 3-point-for-a-win rule in 1983. Sadly, our data sample ends shortly before the much debated introduction of the Video Assistant Referee (VAR) system.

5 Conclusions

Home advantage is a well-established phenomenon in professional sports. We analyze 45 years of data from English professional football focusing seasonal home advantage, i.e. the phenomenon that over a season football teams have better results in terms of points and goal difference at home than away. Since a club plays the same number of matches at home and away, home advantage is only relevant for the overall performance of a club if it is higher than average league home advantage, i.e. if there is a positive relative home advantage.

We conclude that relative home advantage over a season is substantial and positively related to attendance. Our analysis focuses on the question whether some teams benefit

more than average from home advantage, i.e. whether some teams have a higher than average home advantage over a period of several years. We find that home advantage increases with stadium attendance although the variation in home advantage from year to year is subject to big changes. We also find that over the past 45 years there has been a secular decline in home advantage, i.e. home advantage in the past was substantially larger than it currently is. Since the decline is secular it does not seem to be related to developments in technology which involve closer monitoring of referee decisions.

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Appendix: Data and Descriptives

Game-level data (91,469 observations)				
Variable	Mean	Std. dev.	Definition	Source
Win	0.47	0.50	Dummy = 1 if home team wins	rsssf.com and
Draw	0.27	0.45	Dummy = 1 if home team draws	football-data.co.uk
Loss	0.26	0.44	Dummy = 1 if home team loses	
Points	1.67	1.29	Points obtained by home team	
Score	1.52	1.26	Score of home team	
Opponent score	1.08	1.05	Score of away team	
Goal difference	0.44	1.64	Goal difference for home team	
Club-season-level data (4,140 observations)				
Variable	Mean	std. dev.	Definition	Source
Home adv goaldif	0.62	0.75	Seasonal home adv in goal dif per game	Author calculation
Home adv points	0.44	0.49	Seasonal home adv in points per game	as described
Ability goaldif	0.00	0.71	Seasonal ability in goal dif per game	in section 2
Ability points	0.00	0.50	Seasonal ability in point per game	
Raw attendance	12752	11813	Average attendance per home game	european-football-
Rel. attendance	-0.09	0.41	Attendance/seasonal division average	statistics.co.uk
Artificial pitch	0.01	0.07	Dummy = 1 if team plays on artificial turf	Wikipedia
Promoted	0.14	0.35	Dummy = 1 if team promoted last season	rsssf.com
Relegated	0.11	0.31	Dummy = 1 if team relegated last season	
Year	1996	13	Year season ends	
Division	2.55	1.10	Division team plays in	
Manager				Peeters et al. (2017)