The Global Home Advantage in Soccer: Status, developments and causes

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Keywords: sports performance, home advantage, league homogeneity

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Apart from a recent adjustment of some English wording, technical changes as well as APA-styling (we thank Edda van Meurs, Muenster), the work on this version of the manuscript has been finished in the first months of 2014 (after collecting and analysing the data in 2013). Therefore, recent data or articles published since 2014 until now were not considered in this manuscript. In particular, the seminal publication of

> Pollard, R., & Gómez, M. A. (2014). Components of home advantage in 157 national soccer leagues worldwide. *International Journal of Sport and Exercise Psychology, 12*(3), 218-233. doi:10.1080/1612197X.2014.888245

which has been published at the same time in 2014, could not be integrated, resp. the authors of this manuscript were not aware of this publication on the same topic at the time.

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Abstract

This study investigates the global home advantage in soccer, the sport where it is most striking. We analysed data from the highest (premier) league in 194 of 208 FIFA countries. Available data ranged from 1888 up to the season 2011/2012, resulting in a total of N = 684,162 games. The study includes several variables from previous literature that have been discussed as potential moderators for home advantage in soccer.

A multiple of the matches compared to a recent meta-analysis by Jamieson (2010) was used. We identified and controlled many up to now hidden confounding variables (such as leagues taking place in one stadium) and analysed home advantage on three major levels (confederation, league, and team). The explanatory power of the analyses is ensured by elaborate techniques, e.g., concerning the existence of team-specific home advantages.

Overall, the global home advantage in soccer has decreased since the 1980s but still accumulates to a home winning percentage of 61.9% (of all decided games) in the new millennium. Concerning the three levels, we find home-advantage variance to be mainly occurring on the league level. Here, the actual global home advantage follows a normal distribution – with an immense variation between the different leagues. General country-specific variables yield no contribution for the understanding of home advantage, whereas several league characteristics (e.g., league homogeneity) account for about 30% of the variance in home-advantage magnitude.

Keywords: sports performance, home advantage, league homogeneity

Introduction

Home advantage in sport is defined as the heightened probability to win at home rather than when playing away (Courneya & Carron, 1992), and can be seen as one of the most prominent effects in sport psychology (Allen & Jones, 2014a; MacMahon & Strauss, 2014). However, the causes are still unclear. Allen and Jones (2014a) summarized three hypotheses regarding the driving forces of the home advantage: a) psychological states, b) territorial hormone-related reasons, and c) spectator influences. Other researchers see the influence of the referee as the main factor (Nevill, Balmer, & Williams, 2002; Nevill, Webb, & Watts, 2013; Unkelbach & Memmert, 2010).

Home advantage has been ascertained in all team sports. In individual sports, the home advantage effect is generally smaller (Jones, 2013). In a current meta-analysis, different sport types were analysed and an overall relative home advantage of 60.4% (winning percentage in decided competitions) was found, but also a large variance between sport types, ranging from 55.6% in baseball to 67.4% in soccer (Jamieson, 2010).

Concerning soccer, Jamieson (2010) investigated 40,380 men's games taken from several studies. Among these was a study with data from the very beginning of professional soccer in England (1888 – 2003) by Pollard and Pollard (2005). Their main finding was that home advantage existed throughout its history with a declining trend since the 1980s, similar to other professional sports like basketball in the US (Palacios-Huerta, 2004; Pollard, 2006a; Pollard & Pollard, 2005). This decline is also evident in the southwest European soccer leagues of Portugal, Italy, France and Spain, reaching its lowest level in these countries so far (Pollard & Gómez, 2009). However, new data from Allen and Jones (2014b) show that this decline seems to plateau during the last 20 years of English professional soccer.

In terms of geographical differences, the variance in home-advantage magnitude in soccer has been analysed using data from six seasons (between 1997 and 2003) in the premier

leagues of 51 European, ten South American and 11 countries from other continents (Pollard, 2006b). Relative home advantage was highest in the Balkan countries (up to 83.0% in Bosnia) and generally lower in the northern part of Europe (around 60%). In South America, home advantage was high in Andean countries (over 70%) and less pronounced in other countries such as Uruguay (52.6%). General characteristics of the countries like the geographical location, the area or the history of the countries' resp. leagues have been proposed to account for the variability in home advantage (Pollard, 2006b). However, attempts to argue for the causal impact of these variables on home advantage are rare and the asserted impact, therefore, has to be discussed. In the following, we divide some potential moderators of home advantage into *country-general* variables and *league-specific* variables.

A key *country-general* moderator variable is the geographical location of a country, proposed by Pollard (2006b). Pollard (2006b) found home advantage in Europe to be lower in the northern compared to southern countries. In South America, home advantage was highest in the Andean countries like Bolivia. Thus, we included the capital's temperature and average altitude as well as the area in km^2 and population as variables discriminating leagues of different geographical locations. Moreover, the confederation (which is similar to the continents) is added, as well as socio-cultural variables, which may indirectly affect home advantage (e.g., political instability, cf. Pollard, 2006b). Higher home advantage was found e.g., in the Balkan countries, which have been extremely shaken by war in the last decades.

We define *league-specific* variables as variables that describe the characteristics of the respective premier leagues rather than characteristics of the countries. First, the heterogeneity of the team's abilities is a potential moderator, as home advantage should influence the match outcome above all when teams are competitive (Bray, 1999; Forrest, Beaumont, Goddard, & Simmons, 2005; Pollard & Gómez, 2012). Therefore, in leagues with many teams of equal strength, home advantage should increase. Second, the professionalism of players may have

an impact on home advantage (cf. Pollard, 2006b). Professional players may be better prepared for playing away and less emotional about their home environment. Further, professional players may have easier conditions for travelling, which potentially reduces home advantage. On the other hand, more spectators and tension can be expected in more professional leagues, increasing home advantage. Third, it has been suggested by Jamieson (2010) that the home advantage may decrease with the length of a season. This may, however, be due to an artefact, as different sports with different magnitudes of home advantage were compared, leading to distorted conclusions. It also seems plausible that the opposite effect is true (i.e., a small number of games per season leads to a reduced home advantage), as several studies argue for a reduced home advantage in important and decisive games, e.g., due to choking (Lidor, Bar-Eli, Arnon, & Bar-Eli, 2010; Pollard, 1986). Finally, the number of goals scored is included as soccer leagues might differ in this regard. In the following, league homogeneity, professionalism, match days and sum of goals are described as *league-specific* variables.

Previous literature to examine the phenomenon of home advantage has often been limited by the number of the investigated leagues, countries, and/or seasons, and did not provide a satisfactory combination of all three factors (leagues, countries, and seasons). This study aims to capture the full range of data on professional soccer around the world to create a least-biased overall picture of global home advantage in premier-league soccer and its history since its beginning in 1888.

Our aims are threefold: First, we investigate home advantage in men's soccer on a global scale by compiling all data available from the 208 FIFA Premier Leagues using an unprecedented data collection from web scraping. We use variance extrapolation techniques to analyse the variation of home advantage magnitude on the three main levels of global soccer (confederation, league, and team).

Second, we present the global development over time of home advantage in men's soccer starting in 1888 up until the season 2011/2012. We are thereby questioning whether there is worldwide assimilation in home-advantage magnitude within the globalizing world and whether the global home advantage is (still) decreasing.

Third, we test a variety of potential moderating variables to account for differences between the respective leagues. The impact of these moderators can be helpful for the understanding of the overall home-advantage magnitude and its change over time, and it might eventually indicate suggestions for the causes of home advantage.

Method

The data was collected from open-source online databases, with a focus on http://www.rsssf.com, http://www.scoresway.com, http://www.weltfussball.de, as well as from further searches on the web (see Supplementary Information 1). The aim was to compile data from the premier leagues of every FIFA country. Inclusion criteria (such as the existence of a uniform premier league in the country) were established to ensure the explanatory power of the analyses (summed up in Supplementary Information 2). Data from 14 of the 208 FIFA countries did not fulfil these requirements or there was no data available, resulting in a total N = 684,162 matches from 194 countries. In 30 of these countries, the league was mainly or entirely played in a single stadium. These countries were examined separately. Therefore, the main analyses include data from 164 FIFA countries (N = 670,954 matches). Results for the additional countries, where home advantage was considerably reduced, can be found in the Supplements. Ethical approval for the study was obtained from the ethics committee of the University of Muenster.

To quantify the current global home advantage, all seasons starting in the new millennium (January 1st, 2000) and ending before September 2012 – altogether N = 305,267

matches – were analysed. 1,602 out of the 1,779 seasons (estimated value, by information from the respective web pages) played in these countries were gathered (proportion: 90.1%). For the historical development, all data available since 1888/89 were analysed (N = 670,954 matches, 3,285 seasons).

Several measures exist to identify home advantage (Clarke & Norman, 1995; Courneya & Carron, 1992; Heuer & Rubner, 2009; Pollard & Gómez, 2009). Here, relative home advantage was used in all the analyses because it is most broadly applicable and most frequently used in the scientific literature and was shown to be at least as reliable as alternative measures (Table 1; absolute HA, point HA, goal HA). Additionally, the supplements contain information on the other measures. The existence of team-specific home advantages – i.e., differing from the mean value in the specific premier league and season – can be tested by autocorrelating the match home advantages of the teams (for details, see Supplementary Information 3).

For the moderator analyses, only the seasons since 2000 were included. Details on the origin of the country variables and computation of the league-specific variables can be found in the Supplementary Information 1 and 4.

Results

Aim 1: We start with the most common research question, the premier leagues of the countries. Overall, worldwide (relative) home advantage in 2000-2011 amounted to 61.9% (1,602 seasons), i.e., roughly 62 out of 100 matches are won by the home team. Descriptive statistics of all premier leagues are presented in the Supplementary Tables 1, 2 and 3. There is an immense variation in home advantage between the leagues, reaching from 48.6% (SE=1.0%) in San Marino to 92.3% (SE=0.7%) in Nigeria. After correcting for the linear shifts over time since 2000 and eliminating the premier leagues of Nigeria (an outlier with

more than 4 *SD* from the mean relative home advantage) as well as of Bosnia and Herzegovina (82.98%; due to ongoing discussions about match-fixing), relative home advantage throughout worldwide countries follows a normal distribution (Figure 1). By grouping the premier leagues into confederations, we found significant differences between them, reaching from 54.2% in Oceania to 65.8% in South America. This finding is further addressed in Aim 3. 29% of the countries showed significant team-specific effects (i.e., deviating by >2 *SE* from 0), with a mean *SD* between teams of 2.8% in relative home advantage (Figure 1). With the mean team number *T*=13.3 per season, the team differences can explain only roughly $\frac{2.8\%}{\sqrt{13.3}} = 0.8\%$, i.e., about $\frac{1}{10}$th of the *SD* between countries. This implies the existence of a league-specific home advantage.

Aim 2: Concerning the global development of home advantage since the inaugural English season in 1888 (*N* = 670,954 matches, 3,285 seasons), three time-regimes were identified (see Figure 2): i) period with no clear trend until the end of the Second World War; ii) period of consistent increase in home advantage, approximately until the beginning of the 1980s, iii) period of consistent decrease in home advantage up until this present analysis. In these last decades, there is also an assimilation of the home-advantage magnitude between different premier leagues around the globe. The home-advantage variance between countries decreased from 7.9% in 1976-1985 to 5.1% since 2006. Since the mean home advantage has fallen from 69.1% in 1976-1985 to 63.0% in 2006-2011, potential floor effects must be controlled. To do so, we studied the effects of declining home advantage with a constant *SD* = 7.9% (as in 1976-1985). Therefore, we truncated a simulated normal distribution *N*(0.630, 0.079) for 2006-2011 by setting all values ≤0.5 to 0.5 (*N*=100,000). This lowered *SD* to 7.5%, i.e., only 14% of the observed decline. This procedure gives a conservative assessment for the floor effect of normal distributions (as obviously, the real standard deviation in 2006-2011 is lower than 7.9%), so the assimilation can be attributed at the upmost to 14% to floor effects.

Since 2000, home advantage has declined (in absolute values) by 0.16% (*SE*=0.04%) per season or 1% per six years. However, this result is mainly driven by the European Confederation (UEFA) with a decline of -0.26 (*SE*=.06%) per season, whereas the other confederations yield no significant results (Supplementary Figure 1).

Aim 3: As shown in Figure 1, the astonishing variance in home-advantage magnitudes between the premier leagues cannot be explained by team-specific differences. Therefore, we tested various potential moderators of home advantage on the level of premier leagues. These were divided into country-general and league-specific variables. Country-general variables included the temperature, the area of the country as well as several economic or socio-cultural variables (see Supplementary Information 1). These have been hypothesized to influence home advantage (Pollard, 2006a), but a regression analysis with the principal components of the country variables (due to multicollinearity) yielded no significant predictors for the respective countries (for details, see Supplementary Tables 4 and 5).

The league-specific variables were investigated in a separate analysis. They resolved about one-third of the global home-advantage variance in the multiple linear regression (Supplementary Table 6). First, global home advantage is not related to the professionalism of a league. In contrast, the league homogeneity is a respectable negative predictor (β = -.47, *SE* = .07). Indeed, the significant differences between the home advantages in the confederations almost completely vanished when taking the league homogeneity of the respective premier leagues into account (Supplementary Figure 2). We also found the sum of goals (β = -.25, *SE* = .07) to be negatively related to home advantage. A more in-depth analysis revealed that the home advantage is particularly pronounced in close matches, especially in more homogeneous leagues like most of the world's top leagues. This is achieved by computing match result probabilities under the assumption of a constant (i.e., not score-dependent) advantage for the home team. To do so, the team strengths (per season) were estimated first. Subsequently, we

analysed how well the number of goals scored can be described by Poissonian processes for the teams, i.e. assuming independent team performances expressed by goals. Deviations from this directly highlight the non-Poissonian characteristics of a soccer match, e.g. a score-dependent amount of home advantage (Heuer, Müller, & Rubner, 2010). We displayed this tendency for three exemplary leagues in Figure 3. Lastly, the number of match days was a small predictor for home advantage (β = -.22, *SE* = .07), indicating that in longer seasons, teams perform relatively better at home.

Discussion

This study shows that home advantage in soccer is an almost omnipresent phenomenon, yet it is shaped by heavy fluctuations across different countries. The current benchmark analysis (Jamieson, 2010) overestimated the global home-advantage magnitude in soccer considerably, mainly due to the restrictions on countries and seasons (most of the included data was taken from former decades). This study investigated the origin of home-advantage differences on three different levels. Whereas the differences on the league- and confederation-level can be rather easily compared within our extensive dataset, the chance to compare the impact of team-specific effects is only achieved by controlling for the considerable random effects. Home-advantage differences then are shown to arise mainly on the country-level (or country regions within a confederation), since team-specific differences are small and differences between confederations also vanish when taking the homogeneity of a league (therefore a league variable) into account. It may be of future interest to explore the reasons why this level is of such particular importance.

For the last 30 years, there is a declining trend in home advantage. Other than suggested so far (Pollard & Pollard, 2005), the magnitude or even the existence of this still existent trend was found to depend on the confederation. Therefore, general conclusions to all

countries of the globe are questionable. This is confirmed by Allen and Jones (2014b) for the English Premier League. Considering its history, the global home advantage may not even be at its historical all-time low, as it is comparable e.g., to the beginning of the 20th century (Figure 2A). Coincidentally, there is a tendency for an assimilation of the home advantage in the last decades. This might be explained by the globalization of players, coaches, and knowledge (like training skills) in the world's top leagues.

Contrary to previous suggestions, we found no substantial relation of home advantage to any geographic, economic, or socio-cultural variables. Solely league-specific variables such as the league's homogeneity, the number of goals scored, and the season's length (match days) independently accounted for about 30% of the variance between premier leagues. Interestingly, with our dataset focusing on a single sport, we come to a different conclusion than Jamieson (2010) concerning the impact of match days: in longer seasons, teams perform better at home, though the impact was rather negligible. A look at the exemplary countries (Figure 3) suggests that home advantage comprises the art of scoring exactly one more goal than the opponent. Overall, we managed to explain part of the home advantage by league-specific effects. Future research should aim to identify the reason for the remaining variance. Our results clearly show that several reasons discussed so far in the literature, such as the level of performance or the temperature, can be safely excluded.

It has been shown to be highly difficult to identify the causes of home advantage (Carron, Loughhead, & Bray, 2005). Overall, in light of the coexistence of countries with no as well as with heavy home advantage, transnational studies seem favourable in searching for its causes, even more so because no comparable global analyses have been conducted so far. These analyses should focus more on the athletes or teams rather than the environments. It may also be appealing to investigate the considerable developments in home-advantage magnitude. However, if research does not accelerate its pace, the task might come to an end:

279 As the global home advantage in soccer is continuously declining over the last decades, a
280 continuation of this trend would end the era of home advantage within approximately half a
281 century.

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342

343 **Table 1.** The quality of home advantage measures.

344 Pearson correlation of home advantage measures between the first (HA1) and second half
345 (HA2) of the season to test the existence of a superior measure (consistency check). Included
346 are seasons from 2000-2011 with knowledge of the two halves of a season (*N*=291,787
347 matches, 1491 seasons).

348

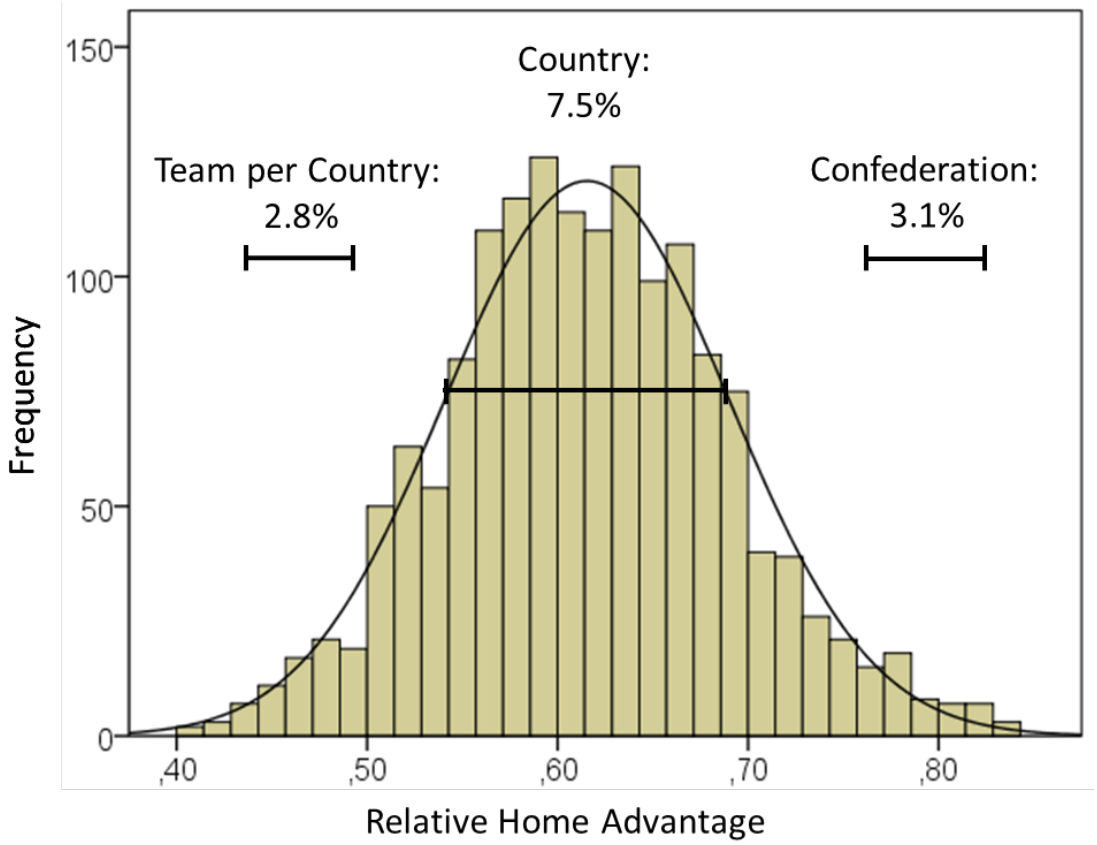
	Abs. HA2	Rel. HA2	Points HA2	Goals HA2
Abs. HA1	**.606 (*SE*=.016)**	.567	.612	.457
Rel. HA1		**.636 (*SE*=.015)**	.616	.470
Points HA1			**.640 (*SE*=.014)**	.481
Goals HA1				**.505 (*SE*=.018)**

349

350 Abs. HA: Absolute home advantage, i.e., the proportion of home wins by all games played.
351 Rel. HA: Relative home advantage, i.e., the proportion of home wins by all decided games.
352 Points HA: Home advantage in points, i.e., the number of points gained at home by the total
353 number of points allocated.
354 Goals HA: Home advantage in goals, i.e., the difference of the no. of goals conceded at home
355 and away.

Figure 1. Distribution of the global home advantage.

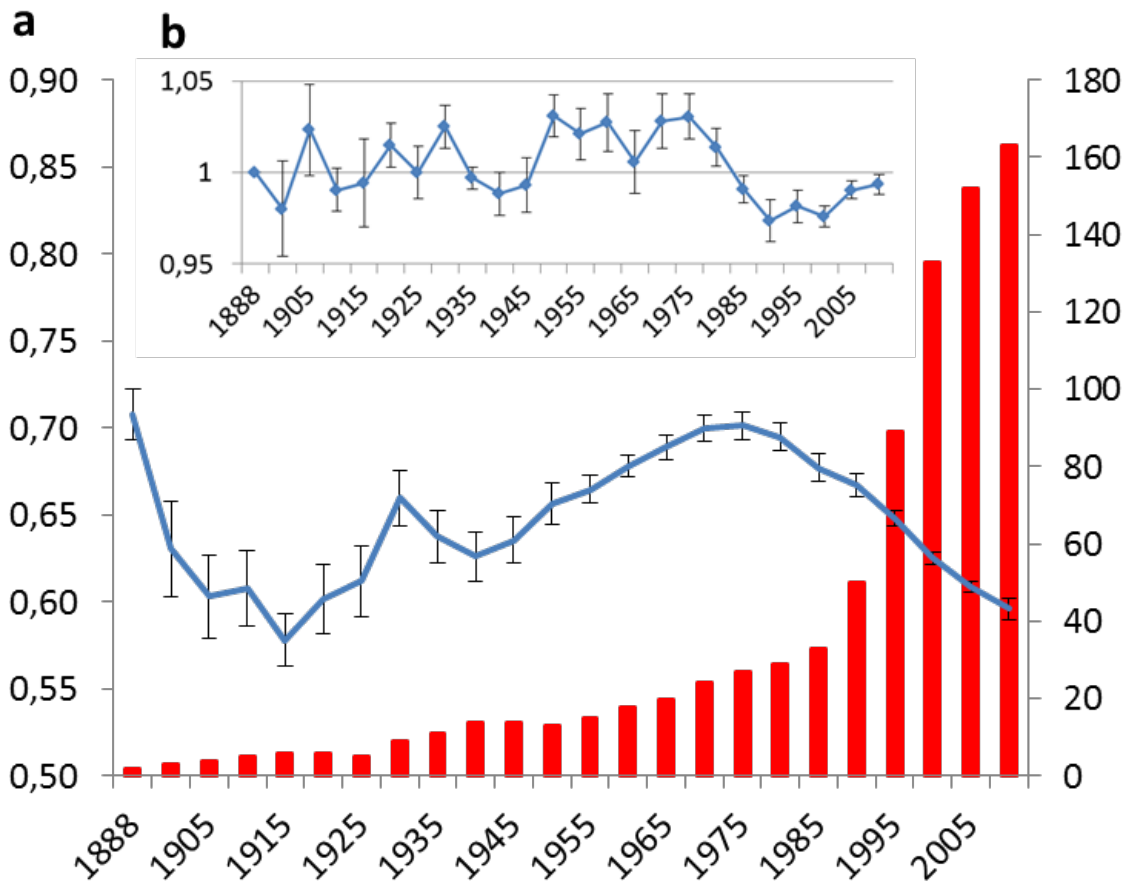
a) Global relative home advantage, fitted by a normal distribution (Kolmogorov-Smirnov Test, N = 1,578 seasons, M = 61.6, SD = 7.5%, p = .325). Additionally, the team-specific home-advantage variation (mean of the extrapolated standard deviations of the team home advantages) and the variation of the six confederations are shown.



364 **Figure 2.** The historical development of global relative home advantage.

365 Seasons were put into categories of five years (e.g., 1995 – 1999 is named "1995"). The
366 seasons between 1888 and 1899 (named "1888") served as baseline. Five-year periods with
367 less than 50 matches were deleted for the specific country and countries with less than 300
368 matches were not included at all. The *SE* results from the variance of the countries. In case of
369 missing data or not held competitions, the development is linearly interpolated. a) Global
370 relative home advantage (line) and the number of countries (bars) from which data were
371 included. b) The arithmetic mean of the changes in comparison to the foregoing five-year
372 period in each country. This curve shows that the recent decline is not the result of the
373 differing no. of countries incorporated.

374



375

376 **Figure 3.** The impact of league-specific variables on relative home advantage.

377 a) Scatterplot of the relative home advantage and the ratio $\left(\frac{\text{empirical value}}{\text{poisson estimation}}\right)$ for $\Delta G = 1$

378 minus the ratio for $\Delta G = -1$, $r = .53$ ($N = 136$ countries) or $r = .40$ (without NGA and BIH,

379 labelled by red dots).

380 b) Match result distributions in relative shares (red line, with *SE*) and probability estimations

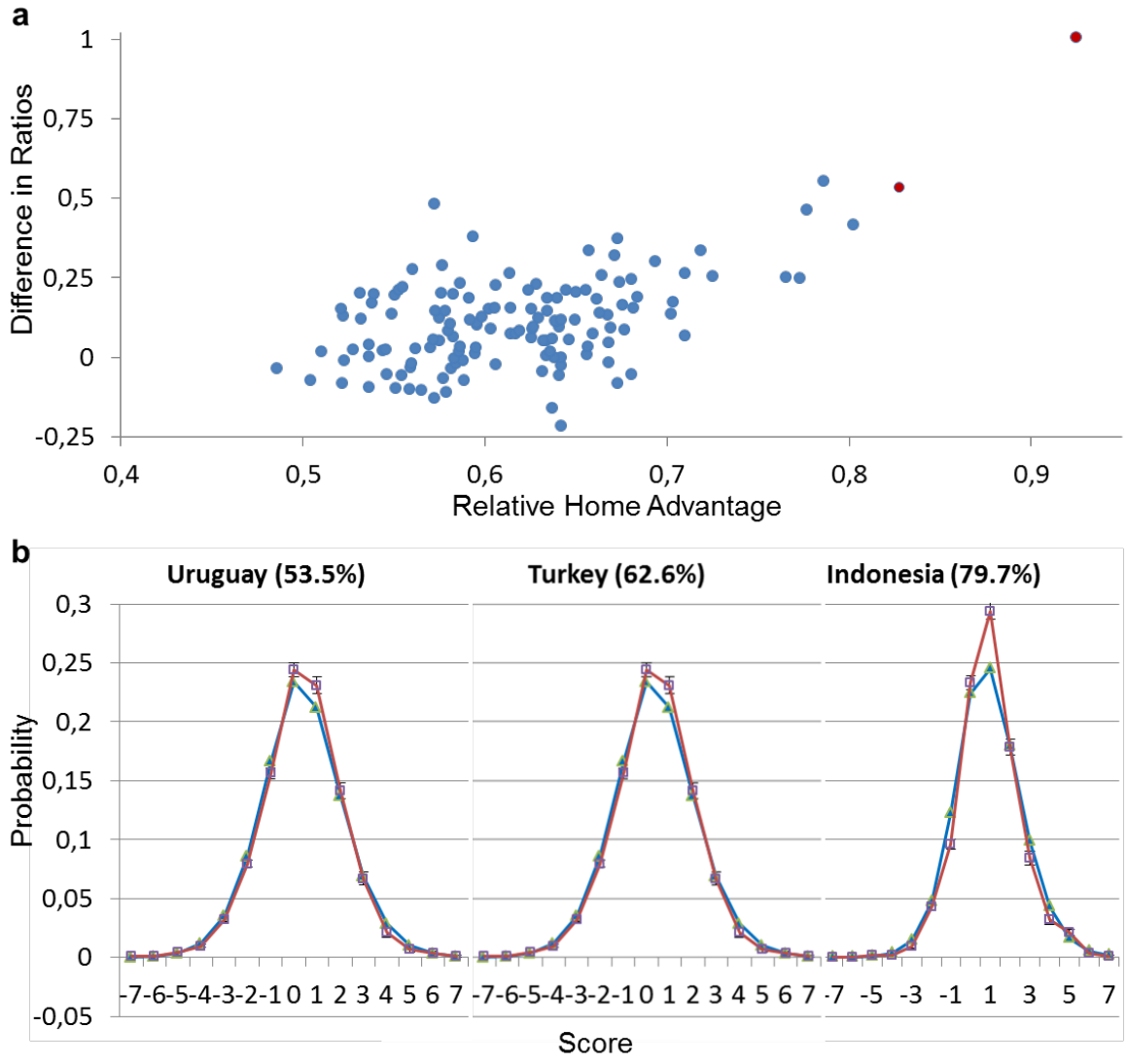
381 based on a model of two independent Poisson distributions (blue line) for three exemplary

382 countries with low, moderate and high relative home advantage. Note that the average home-

383 goal advantage (e.g., 0.93 goals per match in Indonesia) is already incorporated in the Poisson

384 estimation.

385


a
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0,75
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0,25
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-0,25
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0,7
0,8
0,9
Relative Home Advantage
b
Uruguay (53.5%)
Turkey (62.6%)
Indonesia (79.7%)
Probability
0,3
0,25
0,2
0,15
0,1
0,05
0
-0,05
-7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7
-7 -5 -3 -1 1 3 5 7
Score

386

387 **Appendix**

388

389 **Supplementary Table 1.** Global home advantage by different weightings.

390 Global home advantage, determined by the equal weighting of (i) every country, (ii) every

391 season, and (iii) every match.

Weighting	N	Rel. HA	Abs. HA	Points HA	Goals HA
i) Country	164	61.26%	46.21%	59.19%	0.362
		(*SE*=0.53%)	(*SE*=0.42%)	(*SE*=0.44%)	(*SE*=0.019)
ii) Season	1,602	61.91%	46.34%	59.69%	0.382
		(*SE*=0.20%)	(*SE*=0.17%)	(*SE*=0.17%)	(*SE*=0.006)
iii) Match	305,267	63.61%	47.01%	60.70%	0.407
		(*SE*=0.05%)	(*SE*=0.05%)	(*SE*=0.04%)	(*SE*=0.001)

392

393 **Supplementary Table 2.** Overall descriptive statistics of the countries.

394 a) Countries mainly playing in different stadia (home advantage is weighted by season).

395

FIFA abbreviation	No. of seasons (all)	No. of seasons (2000-2011)	Matches (all)	Matches (2000-2011)	Relative HA in % (2000-2011)	Absolute HA in % (2000-2011)	Points HA in % (2000-2011)	Goals HA (2000-2011)	Goals per match	$\sigma^2_{\Delta G}$	h^2_i
ALB	20	12	3,694	2,257	71.93	56.16	68.47	0.68	2.5	0.43	0.01
ALG	22	12	5,018	2,963	78.62	56.97	72.84	0.69	2.15	0.1	0.01
ANG	13	12	2,485	2,275	67.23	48.36	63.70	0.44	2.15	0.26	0.03
ARG	77	12	22,795	4,560	61.34	43.51	58.92	0.32	2.48	0.12	0.01
ARM	17	12	1,878	1,337	55.98	45.37	55.13	0.27	2.97	1.45	0
AUS	31	11	5,373	1,477	59.58	44.85	57.94	0.35	2.83	0.2	0.05
AUT	99	12	15,468	2,160	65.63	48.29	62.63	0.55	2.72	0.36	0.01
AZE	16	11	2,662	1,809	58.59	46.03	57.27	0.35	2.44	0.93	0.03
BEL	15	12	4,292	3,408	63.89	48.18	61.40	0.47	2.83	0.4	0.01
BEN	6	6	881	881	65.11	43.95	61.41	0.33	1.89	0.22	0.05
BER	15	12	1,042	774	55.07	43.92	54.40	0.15	3.47	1.12	0.09
BFA	12	11	1,809	1,700	59.87	41.04	57.51	0.31	2.09	0.43	0.01
BIH	17	12	4,423	3,226	82.98	69.31	79.17	1.09	2.67	0.16	0.03
BLR	20	12	4,370	2,448	57.46	43.93	56.23	0.24	2.59	0.5	0
BLZ	10	8	800	625	60.58	45.90	58.63	0.32	2.92	0.9	0
BOL	18	12	3,071	2,441	76.23	59.78	72.17	0.97	3.14	0.27	0.05
BOT	8	8	1,888	1,888	52.33	39.67	51.93	0.09	2.85	0.47	0.03
BRA	16	12	5,840	4,732	68.22	50.90	64.84	0.56	2.83	0.08	0.01
BRU	4	4	395	395	54.25	47.48	53.88	0.31	4.33	---	---
BUL	17	12	3,855	2,672	66.93	53.63	64.52	0.65	2.66	0.9	0

FIFA abbreviation	No. of seasons (all)	No. of seasons (2000-2011)	Matches (all)	Matches (2000-2011)	Relative HA in % (2000-2011)	Absolute HA in % (2000-2011)	Points HA in % (2000-2011)	Goals HA (2000-2011)	Goals per match	$\sigma^2_{\Delta G}$	h^2_i
CAN	8	8	1,028	1,028	57.75	44.31	56.44	0.31	3.35	1.26	0.03
CAY	6	6	489	489	54.98	42.49	54.12	0.18	3.45	0.75	0.01
CGO	1	1	301	301	52.25	38.54	51.82	0.12	2.42	---	---
CHI	63	12	14,213	3,567	64.38	48.53	61.79	0.48	3.01	0.18	0.03
CHN	18	12	3,370	2,478	67.93	47.78	63.99	0.48	2.46	0.29	0.01
CIV	8	8	1,460	1,460	56.94	39.96	55.43	0.21	2.11	0.25	0.01
CMR	13	11	2,814	2,390	68.04	46.52	63.70	0.44	1.97	0.18	0.03
COD	5	4	298	286	57.72	44.89	56.39	0.41	2.44	---	---
COK	3	3	138	138	57.49	48.96	56.71	0.38	4.54	---	---
COL	20	12	5,388	4,012	70.97	51.46	66.73	0.55	2.48	0.05	0.01
CPV	1	1	57	57	61.70	50.88	60.25	0.56	3.02	---	---
CRC	16	12	3,373	2,461	66.47	48.39	63.13	0.47	2.66	0.23	0
CRO	21	12	3,966	2,214	68.28	52.47	65.22	0.62	2.67	0.44	0.01
CUB	10	10	1,283	1,283	62.21	44.58	59.66	0.40	2.31	0.35	0.01
CYP	15	12	2,730	2,184	59.11	46.02	57.66	0.37	2.98	0.92	0.03
CZE	19	12	4,555	2,880	67.71	48.96	64.05	0.51	2.43	0.25	0.01
DEN	15	12	2,964	2,370	58.65	43.45	57.01	0.30	2.84	0.36	0.01
DOM	4	4	307	307	53.69	42.88	53.20	0.08	2.9	---	---
ECU	48	12	6,664	2,304	69.78	51.59	66.00	0.59	2.64	0.15	0.01
EGY	14	12	2,798	2,434	64.25	45.42	61.18	0.35	2.35	0.38	0.05
ENG	113	12	46,004	4,560	63.42	46.98	60.87	0.42	2.63	0.35	0.01
ESP	81	12	22,306	4,560	64.47	48.33	61.83	0.44	2.67	0.23	0.01
EST	20	12	2,525	1,817	52.07	43.56	51.82	0.23	3.52	3.47	0.03
ETH	12	10	2,196	1,977	66.31	47.17	62.91	0.44	2.35	0.24	0.03
FIJ	8	8	840	840	57.58	47.65	56.67	0.46	3.14	1.72	0.13

FIFA abbreviation	No. of seasons (all)	No. of seasons (2000-2011)	Matches (all)	Matches (2000-2011)	Relative HA in % (2000-2011)	Absolute HA in % (2000-2011)	Points HA in % (2000-2011)	Goals HA (2000-2011)	Goals per match	$\sigma^2_{\Delta G}$	h^2_i
FIN	14	12	2,423	2,156	58.11	43.18	56.56	0.32	2.69	0.37	0.01
FRA	73	12	25,287	4,412	66.26	46.71	62.70	0.44	2.31	0.14	0.01
FRO	19	12	2,021	1,392	57.73	45.94	56.59	0.43	3.32	0.83	0.03
GAB	12	11	1,701	1,612	60.06	43.42	57.99	0.28	2.34	0.34	0.01
GAM	9	9	957	957	54.53	34.98	53.23	0.09	1.73	0.09	0
GEO	21	11	4,114	1,813	63.10	50.02	61.14	0.51	2.44	0.82	0.03
GER	49	12	14,936	3,672	62.62	47.20	60.37	0.45	2.86	0.27	0.01
GHA	13	11	3,025	2,636	77.62	57.70	72.46	0.67	2.07	0.13	0.01
GNB	10	7	1,031	712	61.95	44.89	59.41	0.36	2.56	0.55	0
GRE	64	12	15,004	2,822	65.62	49.28	62.81	0.47	2.43	0.44	0.01
GRN	6	6	558	558	56.74	43.80	55.54	0.22	2.91	---	---
GUA	16	12	2,843	2,316	76.71	56.05	71.41	0.78	2.71	0.24	0.03
GUI	3	3	444	444	62.82	43.15	59.91	0.29	1.73	---	---
GUY	1	1	132	132	56.29	43.94	55.31	0.25	2.89	---	---
HAI	11	11	2,373	2,373	69.24	45.36	64.38	0.45	1.88	0.08	0.01
HKG	11	11	961	961	54.96	42.11	54.13	0.18	3.31	1.52	0
HON	16	12	2,761	2,136	63.24	43.28	60.18	0.33	2.47	0.18	0
HUN	106	12	20,490	2,514	63.28	47.78	60.91	0.46	2.89	0.39	0
IDN	6	6	1,636	1,636	79.67	61.19	74.69	0.93	2.62	0.18	0.01
IND	13	12	1,849	1,730	59.83	42.34	57.70	0.32	2.49	0.36	0
IRL	18	12	3,378	2,190	56.20	40.97	54.92	0.23	2.43	0.45	0.01
IRN	14	12	3,348	2,928	63.41	42.47	60.08	0.33	2.37	0.12	0.01
IRQ	6	4	1,582	1,072	69.12	50.59	65.35	0.64	2.39	---	---
ISL	29	12	2,778	1,248	57.49	43.84	56.15	0.27	3.02	0.27	0.05
ISR	20	12	4,090	2,369	58.89	43.16	57.13	0.27	2.51	0.24	0.01

FIFA abbreviation	No. of seasons (all)	No. of seasons (2000-2011)	Matches (all)	Matches (2000-2011)	Relative HA in % (2000-2011)	Absolute HA in % (2000-2011)	Points HA in % (2000-2011)	Goals HA (2000-2011)	Goals per match	$\sigma^2_{\Delta G}$	h^2_i
ITA	81	12	23,868	4,264	64.95	46.34	61.80	0.41	2.59	0.25	0.01
JAM	13	12	2,308	2,225	60.69	41.43	58.06	0.31	2.27	0.26	0.01
JOR	21	10	2,087	998	55.00	41.92	54.04	0.14	2.86	0.84	0.01
JPN	16	12	4,368	3,342	58.23	43.41	56.69	0.25	2.82	0.2	0
KAZ	17	12	3,355	2,566	67.35	53.06	64.67	0.58	2.4	0.55	0
KEN	8	8	2,002	2,002	64.65	44.92	61.36	0.37	2.01	0.1	0.01
KGZ	18	10	1,917	905	58.80	49.62	57.81	0.50	3.33	2.98	0.01
KOR	25	12	3,586	2,187	57.50	40.08	55.78	0.17	2.51	0.14	0.01
KSA	16	12	2,193	1,667	58.11	43.79	56.71	0.25	2.92	0.59	0
KUW	18	11	1,745	996	52.21	40.64	51.91	0.09	2.72	0.9	0
LBY	18	9	2,908	1,690	59.68	43.09	57.69	0.27	2.41	0.46	0.01
LCA	1	1	27	27	65.22	55.56	63.64	0.74	3.48	---	---
LES	6	6	1,083	1,083	59.05	41.88	57.11	0.26	2.28	0.42	0.01
LIB	14	12	1,773	1,509	52.27	39.18	51.89	0.05	2.75	0.85	0.01
LTU	18	12	2,763	1,824	53.70	41.23	53.08	0.19	2.77	1.4	0
LUX	89	12	10,248	1,884	54.39	43.09	53.75	0.23	3.28	0.92	0
LVA	17	12	1,919	1,409	53.78	44.12	53.32	0.21	3.09	2.45	0.07
MAR	30	12	6,754	2,872	66.83	41.97	62.05	0.34	1.74	0.1	0.01
MAS	15	12	2,208	1,776	63.27	49.58	61.14	0.51	2.85	0.55	0.03
MDA	17	12	2,741	1,822	59.11	44.44	57.46	0.31	2.36	0.97	0
MEX	52	12	15,627	3,856	63.89	45.56	60.94	0.43	2.81	0.07	0.01
MKD	15	12	2,725	2,188	70.51	56.26	67.48	0.73	2.75	0.77	0.03
MLT	18	12	1,797	1,122	50.38	40.02	50.30	0.07	3.23	1.16	0.03
MNE	6	6	1,188	1,188	64.22	48.49	61.68	0.42	2.28	0.4	0.01
MOZ	14	12	1,911	1,821	64.01	43.81	60.69	0.38	1.87	0.42	0.01

FIFA abbreviation	No. of seasons (all)	No. of seasons (2000-2011)	Matches (all)	Matches (2000-2011)	Relative HA in % (2000-2011)	Absolute HA in % (2000-2011)	Points HA in % (2000-2011)	Goals HA (2000-2011)	Goals per match	$\sigma^2_{\Delta G}$	h^2_i
MRI	7	7	747	747	54.56	42.26	53.88	0.17	2.9	1.09	0.01
MWI	7	6	1,260	1,184	58.15	42.36	56.51	0.32	2.46	0.54	0.03
MYA	3	3	390	390	52.51	41.42	52.10	0.02	2.82	---	---
NAM	12	10	1,687	1,440	61.23	45.79	59.17	0.41	2.97	0.41	0.03
NCA	13	12	1,522	1,414	62.55	48.24	60.48	0.55	3.12	1.08	0.01
NED	56	12	16,872	3,672	63.51	49.13	61.27	0.54	3.02	0.6	0.01
NGA	13	11	3,870	3,577	92.31	74.60	86.52	1.08	1.96	0.06	0.01
NIR	17	12	3,307	2,543	52.84	41.12	52.37	0.10	2.92	0.56	0.01
NOR	50	12	7,354	2,358	63.97	48.18	61.46	0.51	3.05	0.28	0.01
NZL	39	12	4,498	1,102	56.38	46.60	55.56	0.32	3.51	0.98	0.03
OMA	13	11	1,664	1,484	57.45	41.56	55.92	0.22	2.53	0.15	0.01
PAK	7	7	1,393	1,393	61.17	46.85	59.22	0.42	2.7	0.61	0
PAN	14	12	1,775	1,602	57.97	41.84	56.41	0.26	2.66	0.35	0
PAR	15	12	2,726	2,304	56.36	40.90	55.05	0.18	2.64	0.28	0
PER	28	12	6,835	3,314	70.14	52.47	66.46	0.64	2.64	---	---
PHI	1	1	118	118	51.88	41.53	51.82	0.03	3.69	---	---
PLE	3	3	398	398	53.61	41.42	53.03	0.20	2.87	0.82	0.07
PNG	4	4	287	287	50.72	41.07	50.64	0.03	3.48	---	---
POL	50	12	11,523	2,580	65.73	48.64	62.71	0.48	2.44	0.35	0
POR	74	12	16,602	3,276	63.91	46.78	61.17	0.37	2.45	0.34	0.01
PUR	5	5	414	414	53.11	45.11	52.80	0.16	4.16	6.99	0
QAT	12	10	1,351	1,207	51.30	39.32	51.09	0.00	2.97	0.63	0.05
ROU	52	12	13,589	3,271	67.57	50.51	64.36	0.51	2.43	0.25	0.03
RSA	18	12	4,495	3,011	58.57	40.84	56.65	0.26	2.34	0.14	0.01
RUS	59	12	13,751	2,880	63.97	46.01	61.07	0.40	2.43	0.26	0

FIFA abbreviation	No. of seasons (all)	No. of seasons (2000-2011)	Matches (all)	Matches (2000-2011)	Relative HA in % (2000-2011)	Absolute HA in % (2000-2011)	Points HA in % (2000-2011)	Goals HA (2000-2011)	Goals per match	$\sigma^2_{\Delta G}$	h^2_i
RWA	8	8	1,146	1,146	57.01	43.52	55.87	0.29	2.35	0.58	0.03
SCO	37	12	7,692	2,376	57.70	44.15	56.39	0.31	2.65	0.59	0.01
SDN	8	8	1,179	1,179	61.71	46.38	59.62	0.46	2.47	1.04	0.03
SEN	13	8	2,218	1,631	61.70	37.62	58.32	0.25	1.53	0.09	0
SEY	8	8	683	683	59.61	47.11	58.16	0.35	3.06	1.79	0
SIN	16	12	2,524	2,098	54.82	43.60	54.11	0.19	3.18	0.96	0
SLV	16	12	2,721	2,147	65.95	44.96	62.15	0.45	2.66	0.2	0.01
SMR	17	12	2,633	1,848	48.60	37.01	48.83	-0.02	3.01	0.94	0
SRB	9	9	1,959	1,959	63.27	47.81	60.94	0.43	2.26	0.49	0.01
SRI	4	4	572	572	56.73	42.66	55.30	0.31	2.77	0.67	0
SUI	34	12	4,289	1,625	63.03	47.34	60.65	0.44	2.96	0.43	0.01
SUR	16	11	2,066	1,491	57.17	45.85	56.17	0.27	3.44	0.64	0
SVK	17	12	3,225	2,136	67.81	50.88	64.57	0.56	2.55	0.32	0.01
SVN	21	12	4,238	2,096	61.57	46.31	59.46	0.39	2.78	0.28	0
SWE	18	12	3,508	2,416	60.17	44.50	58.29	0.34	2.65	0.27	0
SWZ	13	11	1,844	1,481	53.74	39.33	52.90	0.09	2.43	0.32	0.03
SYR	15	11	2,502	1,797	64.00	46.60	61.19	0.40	2.57	0.45	0.03
TAH	8	8	600	600	55.73	47.06	55.09	0.30	3.51	1.38	0
TAN	11	10	1,449	1,213	58.97	41.90	57.09	0.27	2.19	0.4	0.05
TCA	6	5	456	444	53.92	46.79	53.71	0.30	4.03	---	---
TGA	1	1	13	13	50.00	46.15	50.00	-1.38	4.46	---	---
THA	11	11	1,930	1,930	53.05	37.28	52.34	0.13	2.38	0.27	0.01
TJK	8	8	1,118	1,118	62.61	54.26	61.43	0.57	3.39	1.9	0.01
TKM	14	10	1,649	1,208	63.32	51.41	61.49	0.58	2.82	1.36	0.09
TOG	7	7	1,442	1,442	66.06	43.62	62.09	0.38	1.87	0.14	0.03

FIFA abbreviation	No. of seasons (all)	No. of seasons (2000-2011)	Matches (all)	Matches (2000-2011)	Relative HA in % (2000-2011)	Absolute HA in % (2000-2011)	Points HA in % (2000-2011)	Goals HA (2000-2011)	Goals per match	$\sigma^2_{\Delta G}$	h^2_i
TPE	2	2	166	166	54.36	47.57	53.97	0.07	3.52	---	---
TRI	8	8	926	926	53.15	41.94	52.70	0.16	3.05	1.25	0
TUN	30	12	5,110	2,040	65.55	45.46	61.96	0.40	2.15	0.28	0.01
TUR	18	12	5,440	3,671	62.56	47.26	60.32	0.38	2.76	0.34	0.01
UAE	16	11	2,114	1,514	57.82	43.96	56.44	0.30	3.41	0.51	0
UGA	11	11	2,553	2,553	60.10	43.46	58.01	0.33	2.15	0.44	0.03
UKR	17	12	4,024	2,762	62.53	46.82	60.23	0.37	2.36	0.5	0.01
URU	18	12	3,452	2,579	53.54	40.73	52.89	0.16	2.88	0.25	0
USA	13	12	2,532	2,340	65.73	49.05	62.77	0.45	2.76	0.06	0.01
UZB	20	12	4,711	2,769	72.61	60.42	69.89	0.82	2.98	0.72	0.03
VAN	2	2	137	137	52.01	45.57	51.97	-0.07	3.36	---	---
VEN	38	12	6,737	2,681	67.12	47.11	63.32	0.47	2.54	0.21	0.01
VGB	2	2	153	153	60.50	52.12	59.50	0.66	4.65	---	---
VIE	12	11	1,798	1,642	71.37	52.58	67.26	0.57	2.66	0.14	0.01
VIN	1	1	50	50	63.59	50.00	61.87	0.78	3.66	---	---
WAL	16	12	4,632	3,256	55.51	43.51	54.68	0.29	3.09	0.79	0.01
YEM	11	10	1,818	1,680	66.59	48.99	63.41	0.51	2.36	0.19	0.01
ZAM	12	12	2,775	2,775	59.43	41.15	57.25	0.24	1.99	0.21	0.01
ZIM	12	11	2,813	2,519	63.13	46.73	60.60	0.40	2.42	0.18	0.03

398 b) Countries mainly playing in only one stadium (home advantage is weighted by season).

FIFA abbreviation	No. of seasons (all)	No. of seasons (2000-2011)	Matches (all)	Matches (2000-2011)	Relative HA in % (2000-2011)	Absolute HA in % (2000-2011)	Points HA in % (2000-2011)	HA in Goals (2000-2011)
AND	15	12	1,103	687	51.01	43.67	50.85	0.07
ATG	9	9	770	770	55.99	43.60	55.01	0.24
BHR	9	9	941	941	51.73	39.74	51.61	0.06
BAN	5	5	552	552	49.55	36.71	49.66	0.06
BDI	2	2	263	263	55.16	41.05	54.31	0.29
ERI	3	3	442	442	51.44	42.03	51.28	0.20
LAO	1	1	128	128	49.02	39.06	49.16	-0.13
LBR	4	4	387	387	59.16	39.69	56.94	0.23
MLI	2	10	1,862	1,862	1862	53.47	39.83	52.77
MTN	2	2	984	984	984	54.00	37.38	53.01
MGL	4	4	160	160	54.00	37.38	53.01	0.16
NCL	8	8	555	555	52.43	44.50	52.15	0.13
NIG	5	5	467	467	59.86	40.99	57.53	0.28
SLE	3	3	374	374	67.47	44.41	62.83	0.35

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401 c) Countries playing in only one stadium (home advantage is weighted by season).

FIFA abbreviation	No. of seasons (all)	No. of seasons (2000-2011)	Matches (all)	Matches (2000-2011)	Relative HA in % (2000-2011)	Absolute HA in % (2000-2011)	Points HA in % (2000-2011)	HA in Goals (2000-2011)
AIA	1	1	25	25	60.00	60.00	60.00	2.00
ARU	6	6	539	539	48.69	38.58	48.82	-0.14
ASA	1	1	35	35	61.76	60.00	61.54	-0.34
BAH	3	3	221	221	50.90	41.89	50.57	0.03
BRB	7	7	673	673	49.30	38.97	49.37	-0.01
CAM	3	3	270	270	49.21	41.11	49.24	-0.10
CHA	2	2	181	181	46.81	36.47	47.32	-0.06
CUW	8	7	736	668	51.14	37.62	50.94	0.08
DJI	2	2	180	180	48.98	41.67	49.11	-0.27
GUM	4	4	262	262	47.54	43.36	47.68	-0.16
MAC	7	7	518	518	51.95	43.95	51.81	-0.07
MDV	1	1	15	15	63.64	46.67	60.98	0.47
NEP	1	1	132	132	55.45	42.42	54.52	0.16
SAM	2	2	178	178	64.94	56.18	63.53	0.99
SOL	3	3	161	161	55.59	47.16	55.16	0.20
SOM	1	1	94	94	45.77	35.11	46.54	-0.14

402

403

404 **Supplementary Table 3.** Global relative home advantage by venue conditions.

405 The SE refer to the relative home advantage.

	<50% in 1 stadium		>50% in 1 stadium		All in 1 stadium	
matches	305,267	100%	8,572	100%	4,152	100%
home wins	143,467		3,506		1,713	
draws	78,058		2,088		787	
guest wins	83,742		2,978		1,652	
Rel. HA	0.631		0.540		0.515	
SE	0.001		0.009		0.010	

406

Supplementary Table 4. Correlation of the relative home advantage to general variables of the countries.

r is the Pearson Correlation Coefficient, p denotes the p-value, and N is the no. of observations for this variable.

	GGI	GDP_pc	Gini	GPI	DI	Temp	HDI	HPI	Altitude	Popul	Surface
r	-.16	-.249	-.001	.184	-.118	.031	-.163	.186	.256	.143	.111
p	.081	.003	.99	.035	.164	.708	.051	.026	.001	.078	.172
N	120	142	125	131	141	152	144	144	152	152	152

- GGI (2011) = Gender Gap Index.
- GDP_pc (2011) = Gross Domestic Product per capita: value of all final goods and services produced within a country in a given year divided by the average (or mid-year) population.
- Gini (2011): measures the inequality among the income of the citizens in a country. An index of 0 means perfect distribution of income, an index of 1 expresses maximal inequality (i.e. all income for one person).
- GPI (2011): measure the relative position of nations' and regions' peacefulness.
- DI (2011): measures the distribution of power and wealth between people in a nation.
- Temp (1990): Mean of the maximal and minimal temperature value in the country in °C.
- HDI (2011): Index by the UNO, measuring the human development in countries.

- HPI (2011): measures the ecological efficiency with which human well-being is created.
- Altitude (2011): Average height in the Capital City.
- Popul (2011): Population of the country.
- Surface (2011): Surface of the country (in km²).

Supplementary Table 5. Country variables and the home advantage.

We assessed the variables from Supplementary Data 1. Because of multicollinearity, a principal component analysis without rotation was conducted and the three significant orthogonal components (identified by Kaiser criterion with eigenvalue>1) were put into a multiple linear regression.

	Principle component		
Variable	**1**	**2**	**3**
Temperature	.693	-.199	.253
HDI	-.881	.098	.308
Gini	.617	.072	.422
DI	-.783	-.073	.344
HPI	.069	.070	.823
GPI	.766	.262	.090
Surface	-.006	.860	-.067
Altitude	.552	-.080	.253
Population	.117	.796	-.004
GGI	.937	-.066	-.014
GDP_pc	-.841	.078	.175
Explained variation (in %)	43.11	13.85	11.26
Eigenvalue	4.74	1.52	1.24

The multiple linear regression (stepwise, probability to enter: .05, probability for exclusion: .10) yielded no significant predictors.

Supplementary Table 6. The impact of league specific variables.

Multivariate Regression results (N = 142 countries). Only countries with 300 matches or more were included. R is the correlation of the model equation with relative home advantage, β denotes the standardized partial regression coefficient. Error values represent SE.

variable	R	R^2_{adj}	β
League homogeneity	.488	.233	-.469 ± .069
Effective no. of goals	.560	.303	-.268 ± .069
Matchdays*	.600	.346	.215 ± .069

* As more professional leagues typically played longer seasons, the linear influence of the FIFA rank on the matchdays variable was removed.

The FIFA Rank did not enter significantly into the regression (p = .064, β = -.162).

439 **Supplementary Table 7.**

country	G	$\sigma^2_{\Delta G}$	h_i^2	a [$G=a+b*(\Delta G_i-\Delta G_j-h)^2$]
ALB	2.5	0.43	0.01	2.257
ALG	2.15	0.10	0.01	1.858
ANG	2.15	0.26	0.03	1.918
ARG	2.48	0.12	0.01	2.394
ARM	2.97	1.45	0	2.401
AUS	2.83	0.20	0.05	2.589
AUT	2.72	0.36	0.01	2.534
AZE	2.44	0.93	0.03	2.029
BEL	2.83	0.40	0.01	2.601
BEN	1.89	0.22	0.05	
BER	3.47	1.12	0.09	3.132
BFA	2.09	0.43	0.01	
BIH	2.67	0.16	0.03	2.337
BLR	2.59	0.50	0	2.347
BLZ	2.92	0.90	0	
BOL	3.14	0.27	0.05	2.853
BOT	2.85	0.47	0.03	2.646
BRA	2.83	0.08	0.01	2.709
BRU	4.33			
BUL	2.66	0.90	0	2.315
CAN	3.35	1.26	0.03	2.997
CAY	3.45	0.75	0.01	
CGO	2.42			
CHI	3.01	0.18	0.03	2.894
CHN	2.46	0.29	0.01	2.368
CIV	2.11	0.25	0.01	1.916
CMR	1.97	0.18	0.03	
COD	2.44			
COK	4.54			
COL	2.48	0.05	0.01	2.378
CPV	3.02			
CRC	2.66	0.23	0	
CRO	2.67	0.44	0.01	
CUB	2.31	0.35	0.01	
CYP	2.98	0.92	0.03	
CZE	2.43	0.25	0.01	2.202
DEN	2.84	0.36	0.01	2.715
DOM	2.9			
ECU	2.64	0.15	0.01	
EGY	2.35	0.38	0.05	
ENG	2.63	0.35	0.01	2.459
ESP	2.67	0.23	0.01	2.515
EST	3.52	3.47	0.03	2.795
ETH	2.35	0.24	0.03	2.143

country	G	$\sigma^2_{\Delta G}$	h_i^2	a [$G=a+b*(\Delta G_i-\Delta G_j-h)^2$]
FIJ	3.14	1.72	0.13	
FIN	2.69	0.37	0.01	2.536
FRA	2.31	0.14	0.01	2.159
FRO	3.32	0.83	0.03	
GAB	2.34	0.34	0.01	1.991
GAM	1.73	0.09	0	1.646
GEO	2.44	0.82	0.03	2.04
GER	2.86	0.27	0.01	2.736
GHA	2.07	0.13	0.01	1.857
GNB	2.56	0.55	0	2.343
GRE	2.43	0.44	0.01	
GRN	2.91			
GUA	2.71	0.24	0.03	
GUI	1.73			
GUY	2.89			
HAI	1.88	0.08	0.01	
HKG	3.31	1.52	0	
HON	2.47	0.18	0	
HUN	2.89	0.39	0	
IDN	2.62	0.18	0.01	2.335
IND	2.49	0.36	0	2.198
IRL	2.43	0.45	0.01	
IRN	2.37	0.12	0.01	2.306
IRQ	2.39			
ISL	3.02	0.27	0.05	
ISR	2.51	0.24	0.01	
ITA	2.59	0.25	0.01	2.477
JAM	2.27	0.26	0.01	
JOR	2.86	0.84	0.01	
JPN	2.82	0.20	0	2.704
KAZ	2.4	0.55	0	2.064
KEN	2.01	0.10	0.01	
KGZ	3.33	2.98	0.01	
KOR	2.51	0.14	0.01	2.4
KSA	2.92	0.59	0	
KUW	2.72	0.90	0	
LBY	2.41	0.46	0.01	
LCA	3.48			
LES	2.28	0.42	0.01	
LIB	2.75	0.85	0.01	2.429
LTU	2.77	1.40	0	2.319
LUX	3.28	0.92	0	2.985
LVA	3.09	2.45	0.07	2.432
MAR	1.74	0.10	0.01	
MAS	2.85	0.55	0.03	
MDA	2.36	0.97	0	

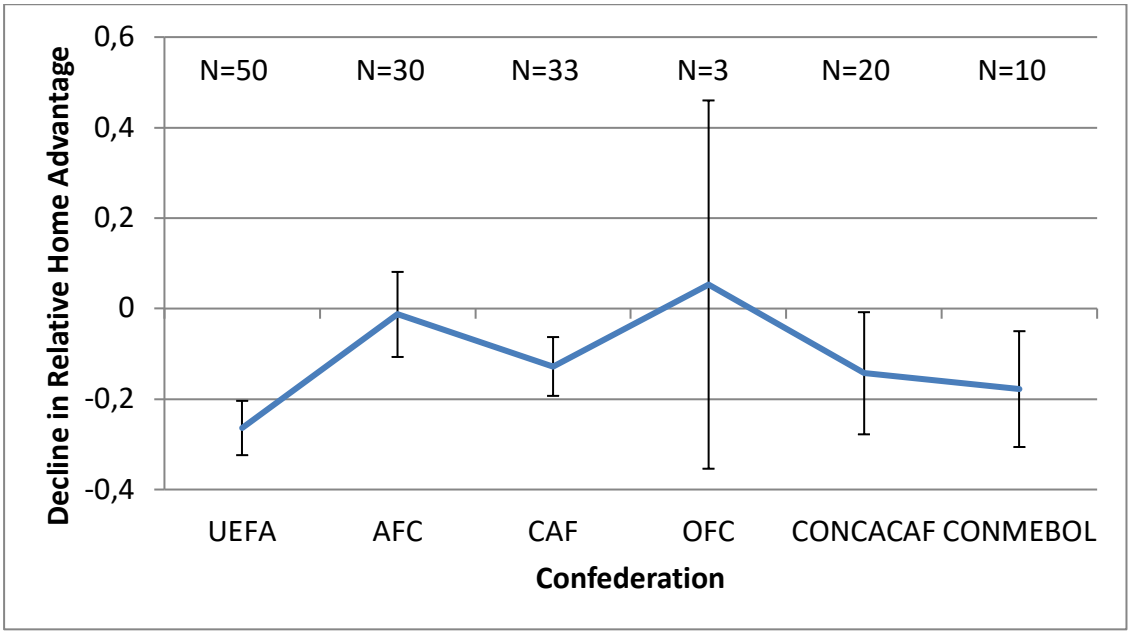
country	G	$\sigma^2_{\Delta G}$	h_i^2	a [$G=a+b*(\Delta G_i-\Delta G_j-h)^2$]
MEX	2.81	0.07	0.01	2.692
MKD	2.75	0.77	0.03	
MLT	3.23	1.16	0.03	2.956
MNE	2.28	0.40	0.01	
MOZ	1.87	0.42	0.01	
MRI	2.9	1.09	0.01	
MWI	2.46	0.54	0.03	
MYA	2.82			
NAM	2.97	0.41	0.03	
NCA	3.12	1.08	0.01	
NED	3.02	0.60	0.01	2.77
NGA	1.96	0.06	0.01	1.467
NIR	2.92	0.56	0.01	2.797
NOR	3.05	0.28	0.01	2.905
NZL	3.51	0.98	0.03	3.326
OMA	2.53	0.15	0.01	
PAK	2.7	0.61	0	
PAN	2.66	0.35	0	
PAR	2.64	0.28	0	
PER	2.64	0.16		
PHI	3.69			
PLE	2.87	0.82	0.07	
PNG	3.48			
POL	2.44	0.35	0	2.303
POR	2.45	0.34	0.01	
PUR	4.16	6.99	0	
QAT	2.97	0.63	0.05	2.815
ROU	2.43	0.25	0.03	
RSA	2.34	0.14	0.01	2.207
RUS	2.43	0.26	0	2.246
RWA	2.35	0.58	0.03	
SCO	2.65	0.59	0.01	2.449
SDN	2.47	1.04	0.03	
SEN	1.53	0.09	0	
SEY	3.06	1.79	0	
SIN	3.18	0.96	0	
SLV	2.66	0.20	0.01	
SMR	3.01	0.94	0	2.684
SRB	2.26	0.49	0.01	
SRI	2.77	0.67	0	2.45
SUI	2.96	0.43	0.01	2.901
SUR	3.44	0.64	0	
SVK	2.55	0.32	0.01	2.252
SVN	2.78	0.28	0	
SWE	2.65	0.27	0	
SWZ	2.43	0.32	0.03	2.231

country	G	$\sigma^2_{\Delta G}$	h_i^2	a [$G=a+b*(\Delta G_i-\Delta G_j-h)^2$]
SYR	2.57	0.45	0.03	
TAH	3.51	1.38	0	
TAN	2.19	0.40	0.05	
TCA	4.03			
TGA	4.46			
THA	2.38	0.27	0.01	
TJK	3.39	1.90	0.01	
TKM	2.82	1.36	0.09	
TOG	1.87	0.14	0.03	1.584
TPE	3.52			
TRI	3.05	1.25	0	
TUN	2.15	0.28	0.01	
TUR	2.76	0.34	0.01	2.629
UAE	3.41	0.51	0	3.241
UGA	2.15	0.44	0.03	
UKR	2.36	0.50	0.01	
URU	2.88	0.25	0	2.699
USA	2.76	0.06	0.01	
UZB	2.98	0.72	0.03	
VAN	3.36			
VEN	2.54	0.21	0.01	
VGB	4.65			
VIE	2.66	0.14	0.01	
VIN	3.66			
WAL	3.09	0.79	0.01	2.775
YEM	2.36	0.19	0.01	
ZAM	1.99	0.21	0.01	
ZIM	2.42	0.18	0.03	

441 **Supplementary Figure 1.** Recent decline in relative home advantage.

442 Seasonal decline in relative home advantage (in %) in the confederations between 2000 and

443 2011. N denotes the no. of countries analysed, error bars represent SE.

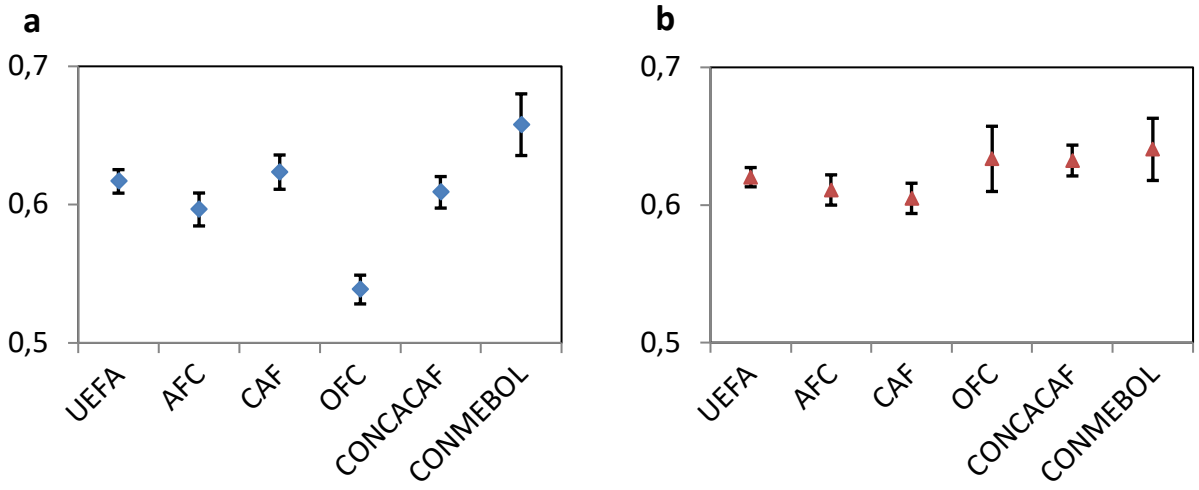


444

445 **Supplementary Figure 2.** Relative home advantage per confederation.

446 The SE stem from the no. of countries within the confederations. a) Raw home advantage, b)

447 home advantage after eliminating the linear influence of the league homogeneity.



448

Supplementary Information 1. Sources of the collected data.

The data were downloaded in September 2012, if not stated differently.

1) Match data: http://www.rsssf.com, http://www.scoresway.com, http://www.weltfussball.de, http://www.soccerway.com (downloaded in June 2013)
2) Level of performance: www.fifa.com, http://www.uefa.com/memberassociations/uefarankings/country/index.html, www.transfermarkt.de
3) Temperature (Temp): http://www.datapult.info/en/content/average-temperature-countries-world
4) Altitude: http://en.wikipedia.org/wiki/List_of_capital_cities_by_altitude
5) Human Development Index (HDI): http://hdr.undp.org/en/media/HDR_2011_EN_Complete.pdf (pp. 127-130)
6) Gross Domestic Product (GDP_pc) per capita, current prices, U.S. dollars:
7) http://www.imf.org/external/pubs/ft/weo/2012/02/weodata/weoselco.aspx?g=2001&sg=All+countries
8) Gini Coefficient (Gini) in 2011: http://wdi.worldbank.org/table/2.9
9) Population (Popul): The World Factbook – https://www.cia.gov/library/publications/the-world-factbook/rankorder/2119rank.html
10) Surface: The World Factbook – https://www.cia.gov/library/publications/the-world-factbook/rankorder/2147rank.html
11) Yearly UEFA coefficients: http://www.uefa.com/memberassociations/uefarankings/country/index.html (downloaded July 2012)
12) Happy Planet Index (HPI) in 2011: http://www.happyplanetindex.org/data/ (downloaded July 2012)

13) Corruption Perceptions Index (CPI) in 2011: http://www.transparency.de/Tabellarisches-Ranking.2021.0.html

14) Democracy Index (DI) in 2011: http://www.kwintessential.co.uk/map/hofstede-power-distance-index.html (pp. 3-8)

15) Market value per team and country: http://www.transfermarkt.de/

16) Global Peace Index (GPI) in 2011: http://www.visionofhumanity.org/wp-content/uploads/2011/05/2011-GPI-Results-Report-Final.pdf (pp. 8+9)

Supplementary Information 2. Conditions on the seasonal data.

- Existence of a uniform first league (i.e., no entirely separated groups)
- Existence of a non-knock-out mode
- In the case of concentration processes during the season: choose the most advanced model that fulfils criteria 1 and 2, but with at least 50 matches played (if existent). Reason: demand of this paper to concentrate on the most prestigious tournament in the individual countries.
- Balance of teams: 2 x $matches_{team\ i} > matches_{team\ j}$ for all teams i,j in the league (exception: teams that aborted a season)
- Balance of venues: 2 x $away\text{-}matches_{team\ i} > home\text{-}matches_{team\ i}$ and 2 x $home\text{-}matches_{team\ i} > away\text{-}matches_{team\ i}$ for all teams in the league
- Include awarded matches (i.e., where the result was decided on a theoretical basis)
- Matches with sole win-loss information were valued 2-1, 1-1 or 1-2, respectively, and are marked explicitly in the raw data file (exact result not relevant for relative home advantage)

- A season is said to take place in the year n if the first match of the season started in the year n (exceptions due to irregularities in a country are marked in the web-based supporting materials)
- Where possible, up to three subsequent seasons were aggregated, if less than 50 matches were played in a season. In this case, the arithmetic mean (weighted by single match) of the seasons was used as a new season variable (rounded on integers). Seasons before and after 2000 were not aggregated to one season due to the distinction in the main text. This aggregation reduced the overall no. of seasons incorporated in the main analysis (164 countries) from 3,394 to 3,285.

For the calculation of the decline in global home advantage between 2010 and 2011, only countries with data of at least 100 matches in both intervals 2000-2005 and 2006-2011 were incorporated. For each country, a linear regression was computed for the seasonal home advantage to estimate the seasonal decline.

Supplementary Information 3. Team-specific home advantages.

The existence of team-specific home advantages can be tested by autocorrelating the match home advantages of the teams. For this, define $h_{ij}(t)$ as the relative home advantage between teams i and j in season t. If e.g. team i wins at home against j and the match at j is a draw, i has a home advantage of $\frac{\#won\ home\ games}{\#won\ home\ games + \#won\ away\ games} = 1$ and j of 0. Let $\bar{h}_{ijk}(t)$ denote the average relative home advantage of a country in a season t without the matches i vs. j and i vs. k. Finally, let N denote the no. of teams and M the no. of matchdays in a season of a country. For every team $i \in \{1, \dots, N\}$, define the correlation function

$$A = < h_{ij} - \bar{h}_{ijk}, h_{ik} - \bar{h}_{ijk} >,$$

where <. , .> denotes the mean across all seasons and teams i,j,k. Due to j≠k, random contributions to home advantage are eliminated in this expression. Considering potential

short-term instabilities in the team fitness of the teams, the variance of team-specific home advantages derives to

$$var(h) = \left(\frac{N-1}{N-4}\right) \cdot \left[A - 2 \cdot a(\Delta t) \cdot f(\Delta t) - a\left(\Delta t + \frac{mM}{2}\right) \cdot f\left(\Delta t + \frac{M}{2}\right) + a\left(-\Delta t + \frac{M}{2}\right) \cdot f\left(-\Delta t + \frac{M}{2}\right)\right],$$

where a(Δt) is the proportion of home-home- and guest-guest-matches for team i in the computation of A as a function of the difference in matchdays Δt, and $f(\Delta t) = b\ exp(-k\Delta t) + c$ is the estimated autocorrelation function of the team-fitness evolution during a season based on the empirical data (Heuer, 2012). The shape of f reflects a league where c>0 indicates a general seasonal fitness level and b>0 short-term fluctuations around this level. Without the correction term for var(h), the team-specific home advantage measure would be biased in the negative direction in case of short-term fitness variations.

Supplementary Information 4. League-specific moderator variables.

Level of performance: In Europe, the performance level can be operationalised by the UEFA coefficient ranks for premier leagues, but an accordant worldwide index does not exist. Therefore, the annual mean of the FIFA rank of the national teams was consulted. This measure is highly correlated with the annual UEFA coefficient rank for the *n* = 51 European premier leagues (*r* = .88, *SE*=.03).

League homogeneity: We assessed team strength based on the goal differences via an empirically well-supported method by Heuer and Rubner (2009), where the intrinsic and random contributions of the team results are separated. First, the variances of the respective terms add to the observable overall variance of the team results, $\sigma^2_{\Delta G(N)} = \sigma^2_{\Delta G} + \sigma^2_{\Delta G(N),stat}$, where $\Delta G(N)$ is the goal difference of team i after *N* matchdays. As the random contribution scales like $\frac{1}{N}$ in case of constant team strengths, the two contributions can be quantified by the

546 calculation for diverse values of *N*. This yields $\Delta G_i = a_N \Delta G_i(N) \pm \varepsilon(N)$ as an estimator for
547 the strength of team i, where a_N accounts for regression to the mean effects and $\varepsilon(N)$ is the
548 appropriate error term accounting for the random contribution. Then, a natural estimator of
549 the league homogeneity is provided by the standard deviation of these team strengths within a
550 league. To compare leagues with varying numbers of scored goals, we divided this measure
551 by the sum of goals ΣG. We denote this measure for the league heterogeneity LH. Its values
552 per country are shown in Table 7.
553 *Sum of goals*: For a sensible determination of the sum of goals per match (subsequently
554 denoted as *effective no. of goals* G_{eff}) in a league, one must remark that matches between
555 heterogeneous teams on average result in more goals than matches between homogeneous
556 teams. The relationship should be of the form $\sum G = a + b(\Delta G_i - \Delta G_j - h)^2$, when team i
557 plays at home against team j and the home advantage in goals is h. We estimated the
558 parameters a and b empirically for every country, and their respective mean values a_{Master} and
559 b_{Master} are computed. Then, G_{eff} is calculated via

560 $$G_{\mathrm{eff}} =< a + b\left(\Delta G_i - \Delta G_j - ha\right)^2 - a_{\mathrm{Master}} + b_{\mathrm{Master}}\left(\Delta G_i - \Delta G_j - ha\right)^2 >,$$

561 where < , > is the mean across all matches in a respective season and country.