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Home advantage revisited. Did COVID level the playing fields?

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Abstract: The COVID-19 pandemic swept fans out of the stadiums, but matches continued to be played in most major leagues. We make use of this natural experiment to investigate if home-field advantage disappears when the home team is not supported by the audience. Focusing on four top European soccer leagues, we find such an effect in the Bundesliga only. We propose this singularity may be related to the special role that the fan associations play in German football.

Keywords: soccer, home-field advantage, COVID-19, fans

JEL codes: Z2, I19

1. Introduction

A number of studies show that – other things being equal – the home team performs better than the visitors. A meta-analysis by Jamieson (2010) summarizing 87 estimates of effect sizes shows that as many as 60.4% of games are won by the home team (draws excluded). This advantage seems to be quite robust over time and across disciplines.

The most commonly proposed explanation for this striking phenomenon is that the home team benefits from the presence of the crowds (e.g. Nevill, Newell, and Gale, 1996; Agnew and Carron, 1994). However, this is not a universal finding (Salminen, 1993; Strauss, 2002); moreover, other factors may clearly play a role (Courneya and Carron, 1992). In particular, the away team is generally less familiar with the specific venue and may be tired or jet-legged after the journey. Distinguishing between the various explanations is important. For one, if it is the crowds, it has been proposed that the effect is mediated by referees' biased decisions, an effect that begs a correction (Nevill et al., 2002). To the extent that cheering affects the players directly, it contributes importantly to the broader discussion of the impact of pressure and motivation on performance (Baumeister and Showers, 1986).

The current COVID-19 crisis with its social distancing rules represents a unique natural experiment that may shed light on the issue. Indeed, after a forced break at the beginning of the pandemic, many major leagues re-opened without the fans. As a result, the part of home-field advantage that is associated with the spectators was removed, whereas all other factors remained intact.

Admittedly, the break and the psychological distress associated with the COVID pandemic could have some impact on players' performance. It is difficult to see a compelling reason why these factors should systematically favor the home team. Still, the unprecedented pandemic situation could have idiosyncratic effects that are as of now unidentified. One desirable response to this challenge is that one tests robustness of the findings in a number of leagues/countries. While it is not easy to identify the reasons, home field advantage itself shows some national differences (Pollard, 2006; Pollard and Gomez, 2014), the same could therefore possibly be true for the extent to which it is reduced by the pandemic.

In our analysis we focus on soccer. This is the discipline in which home field advantage has been studied extensively and is typically found to be large. This effect is sometimes ascribed to the particularly noisy and rowdy fans. In this sense, investigating how the home field advantage is moderated by the *lack* of fans gives this interaction the best chance to show up.

The main finding is that COVID-related absence of supporters only reduces the home-field advantage in the German Bundesliga. It is also the only league in which we find some direct link between attendance and home team's performance. We discuss possible explanations for this pattern.

2. Literature review

In the most systematic review of home field advantage effects has written to date, Jamieson (2010) reports that the home time wins nearly 60% of the time. This fraction depends on the sport somewhat, ranging from 55% for baseball to 65% for soccer. Jamieson also found that the effect seems to be slowly diminishing over time (see also Pollard and Pollard, 2005); still, it appears robust to a large number of plausible mediators, such as sport type (individual vs. group) or level of competition (collegiate vs. professional).

Searching for explanations, literature on home field advantage is largely structured by the conceptual model of Courneya and Carron (1992), which proposes four "game location factors": rule factors (by now largely found irrelevant), travel factors, learning/familiarity factors and crowd factors.

Travel factors find some support. For example, Goumas (2014) and Pollard and Gomez (2014) report that home field advantage increases with distance covered. Then again, there is also evidence that travels matter little (Courneya and Carron, 1991; Pace and Carron, 1992; Pollard and Pollard 2005). Moreover, some researchers (van Damme and Baert, 2019) have suggested that altitude may be much more important than horizontal distance.

Evidence for the importance of **learning/familiarity factors** comes i.e. from Clarke and Norman (1995) who found greater home field advantage in English soccer clubs with non-standard pitch size or surface. However, the role of pitch size is limited as most clubs in top divisions use UEFA club competition pitch size. There are also studies indicating that home field advantage is lower immediately following the construction of a new stadium (Pollard, 2002), suggesting reduced familiarity bonus.

Among **crowd factors**, at least two important mechanisms may be distinguished. First, players may plausibly perform their best when supported by the fans. To investigate it, Boudreaux et al. (2017) looked at the games between Los Angeles Lakers and Los Angeles Clippers. While the two NBA teams share a stadium, so that travel and familiarity play no role, they are supported by a much larger number of own fans when playing "home" than "away".

This turns out to have a sizeable effect on performance. More studies simply correlated attendance with performance, which is questionable, because attendance may grow when there are ex ante reasons – imperfectly observable to the researcher – to expect better performance of the home team. Another conceptual difficulty is that the effects may be non-linear, with athletes choking when pressure grows too high (Wallace et al. 2005).

Second, the referees seem to make decisions biased towards the host to avoid infuriating the fans, see Dohmen and Sauermann (2016) for a review. While comparisons across disciplines, in particular those finding stronger home-field in judged winter Olympic sports than in this with objective criteria (Balmer, Nevill, and Williams, 2001) are telling, referee effects have been investigated most extensively and diligently in soccer. A number of different measures have been used (e.g. number of red cards or number of incorrectly awarded penalties); perhaps the best evidence comes from studies looking at stoppage time. These deliver quite robust evidence that soccer referees tend to add more extra time when the home team is losing (Sutter and Kocher, 2004; Scoppa, 2008). Importantly, some of these studies find the effect to be moderated by attendance (Garicano et al, 2005; Dohmen, 2008), suggesting it is indeed the pressure from the fans that makes the referee help the home team. This effect has also been confirmed in experimental studies (Nevill et al., 2002; Unkelbach and Memmert 2010). Should we identify a robust effect of COVID restrictions, it is of interest if it is mediated by referees' behavior or not.

The studies that are most closely related to ours are those taking advantage of natural experiments preventing the fans from showing up. Until the COVID-19 outbreak these were typically small-scale occurrences. For example, Moore and Brylinsky (1993) observed that lack of spectators caused by a measles epidemic improved performance of both home team and guests in 11 North Atlantic Conference basketball games. A larger sample of European soccer games played – for various reasons – with no fans between 2002 and 2020 was investigated by Reade et al. (2020). They found that the away team did relatively well in these games, but the difference was not significant when controlling for characteristics of teams that happened to play in these special circumstances. The current pandemic opens up a much better opportunity in this respect. We are aware of an independent investigation (but our guess would be that many more show up in the weeks and months to come) in which Fischer and Haucap (2020) found that COVID reduced home field advantage in Bundesliga 1, but not in two lower divisions. They interpreted these results in terms of the effect of attendance, which had been lower in the lower divisions to begin with, so that reducing it to zero had a less dramatic effect.

3. Data and models

The governing boards of four out of five top European soccer leagues according to UEFA association club ranking decided to continue league games after the outbreak of the pandemic, only in France the government decided to simply finish the 2019/20 season prematurely. The matches after the forced break were played without spectators for epidemic safety reasons.

To investigate the impact of COVID spectators restrictions in top European leagues on match results and especially on the home ground team advantage, we build a database of matches from four European leagues: English *Premiership*, German *Bundesliga*, Italian *La Liga* and Spanish *Primera Division*. Thus, the analysis covers top soccer division in top European leagues. To create the database we combine information from three reliable sources and make additional own calculations. The match-related data are retained from soccerstats.com, stadium data from transfermarkt.de and finally stadium distance data from sportmapworld.com. The complete list of indicators used and their descriptions can be found in Table 3. The database covers the last three seasons from 2017/18 to 2019/20. There are overall 4388 matches, of which 409 were played during epidemic restriction period.

The first look at the numbers presented in Table 1 suggests that the impact of coronavirus-related restrictions varies between the top European leagues. In all but the German Bundesliga there is no indication of attendance restriction impact on match results. The home team win percentage is on similar level as it was in pre-COVID period and the two previous seasons.

Table 1. Home team win percentage

Season		ENG	GER	ITA	SPA
2017/18	Before COVID (placebo)*	0.465	0.429	0.432	0.469
	COVID (placebo)*	0.422	0.533	0.431	0.476
2018/19	Before COVID (placebo)*	0.482	0.442	0.425	0.415
	COVID (placebo)*	0.457	0.476	0.464	0.509
2019/20	Before COVID	0.448	0.430	0.402	0.478
	COVID	0.467	0.325	0.444	0.409

COVID (placebo) refers to the period after March 10 in the seasons in which no pandemic took place. Source: own calculation based on soccerstats.com.

This pattern would be understandable if the three other leagues had had much lower attendance than the Bundesliga before the pandemic already, the preferred explanation of the heterogeneity of results reported by Fischer and Heucap (2020) comparing different German divisions. Relevant data displayed in Table 2 gives very limited support to this conjecture.

Admittedly, Italy and Spain typically see smaller crowds, but the difference is not dramatic. In England, by contrast, the stadiums are almost as big as in Germany and there are virtually no empty seats.

Table 2. Average attendance per match and stadium capacity utilization

	Attendance	Utilization
England	38,609	97%
Germany	43,030	91%
Italy	26,636	68%
Spain	27,858	74%

Source: own calculation based on soccerstats.com data from 11.08.2017 to 10.03.2020.

To estimate the impact of COVID restrictions and its moderators more systematically, we use the following general model:

$$M\ \ ijt = COVID\ \ t\beta + X\gamma\ \ ijt + \varepsilon\ \ ijt$$

where $M\ \ ijt$ is a match result measure of home team *i* playing against away team *j* at time *t*, is a $COVID\ \ t$ dummy variable taking value 1 for coronavirus spectators restriction period, *X* is a matrix of control factors and $\varepsilon\ \ ijt$ an error term.

As dependent variable $M\ \ ijt$ we use three different measures. The first is the *outcome*, taking the value of 1 if the home team wins the match, 0 if there is a draw and -1 if the away team wins. The second is *match goal difference*, equal to the number of goals scored by home team minus the number of goal scored by away team. Lastly, we use *win* dummy, equal to 1 if home team wins a match and 0 otherwise. In either case thus, higher values correspond to better performance of the home team and all three measures are highly correlated.

On the right-hand side, next to the COVID dummy, we include a large number of control factors that could affect match results. The first group of factors is related to match date. We control for weekend vs. mid-week matches, as usually the latter attract significantly less audience. Also, we control for the number of rest days. Matches are usually played once a week; by contrast, after the COVID break, the match schedule was more intense, typically involving three games per fortnight. We also control for the distance between the stadiums, as a measure of travel burden. The distance is measured as air (straight line) distance. We also control for each team's (recent) performance, operationalized as the total number of points won in the last four games. Additionally, we control for capacity of utilization, so that we allow for the possibility that the teams which typically saw more seats occupied before the pandemic, were more negatively affected by the restrictions. We also control for derby matches, which, in line

with previous literature, we define as games between teams whose stadiums are closer than 50 kilometers (thus approximately one hour of driving) apart.

Table 3. Data description and sources

Variable	Description	Own calculation involved?
www.soccerstats.com		
day, year, matchday	Match date and matchday number	No
weekend dummy	Weekend dummy	Yes
Rest	Number of rest days since last league match of the home team (virtually always identical to that of the away team)	Yes
COVID	COVID period indicator	Yes
H, A,	Home team and away team	No
H points season	Season points team of the home team	Yes
A points season	Season points team of the away team	Yes
Outcome	1 if H wins the match, 0 if there is a draw, −1 if A wins	No
Win	1 if H wins, 0 otherwise	No
match goal diff.	number of goals scored by H minus goals scored by A	No
www.transfermarkt.de		
Attendance	Average season attendance	No
Capacity	Stadium capacity	No
Capacity utilization	Season average capacity utilization	Yes
www.sportmapworld.com		
Air distance	Air distance between team stadiums in km	Yes
Derby	1 if distance <=50 km, 0 otherwise	No

4. Results

In the first step we use match result as dependent variable in a linear regression model, see Table 4. For each league we use two specifications, differing in terms of the proxy of team strength. In the first one, labelled "total", we use the number of points gained during the entire season by the home and the away team. In the second specification, labelled "last4" we include the points gained in the last four matches only. The advantage of this approach is that the proxy for team strength is pre-determined; we may also be better able to account for the team's current shape. The obvious drawback is that we cannot use the first four matchdays, thus the number of observations is reduced.

Table 4. Regression for match outcome

Variable	ENG_total	ENG_last4	GER_total	GER_last4	ITA_total	ITA_last4	SPA_total	SPA_last4
H points season	0.016***		0.016***		0.016***		0.017***	
A points season	-0.016***		-0.019***		-0.018***		-0.016***	
H points last 4		0.045***		0.043***		0.064***		0.040***
A points last 4		-0.061***		-0.060***		-0.067***		-0.038***
COVID period indicator	0.027	-0.007	-0.252***	-0.265***	0.025	0.009	-0.102	-0.141

weekend dummy	-0.023	-0.074	0.014	0.034	0.011	0.005	-0.027	-0.019
Rest	0.000	0.000	-0.003	-0.007*	-0.001	0.000	-0.002	-0.002
capacity utilization	0.536	0.790	0.176	1.202***	-0.092	0.131	-0.092	0.463*
air distance (km)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Derby	-0.036	-0.014	0.166	0.180	0.043	0.095	-0.069	-0.150
Constant	-0.331	-0.438	-0.076	-0.904***	0.130	-0.020	0.302*	-0.116
N	1140	1020	918	810	1140	1018	1140	1019
log lik	-1276.75	-1255.91	-1046.52	-987.26	-1275.28	-1239.49	-1285.02	-1241.76

We find a clear confirmation of previously reported results: a significant effect of COVID in Germany and none elsewhere. While this is unlikely, also in view of the numbers reported in Table 1, we want to make sure that these results do not reflect some (country-specific) calendar effects, with German home teams performing less well in the spring. We thus we repeat the estimation, replacing the genuine COVID period dummy with a dummy variable taking value 1 for period between March 10 and July 1 *each year*, thus "COVID placebo". As expected, it has no significant effect on our home team performance measure for any league or specification, see Table 5. We also perform several robustness tests, see the Appendix. We include the results of OLS regressions using goal difference as dependent variable (Table A1), OLS regression for goal difference with placebo (Table A2) and logit regressions using home team victory dummy as dependent variable, again using real COVID period (Table A3) and COVID placebo (Table A4). All these analyses show exactly the same picture: significant effect of COVID restrictions in Germany (which cannot be explained by pure calendar effects) and no effects in other countries or for placebo treatment. Control variables are not significant either, except (not surprisingly) for our measures of competing teams' quality and, interestingly, capacity utilization, but only in the case of Germany.[1] This suggests that that crowds play a special role in this country, which might explain its singularity in the wake of the COVID pandemics.

Table 5. Regression for match outcome with placebo for COVID

Variable	ENG_total	ENG_last4	GER_total	GER_last4	ITA_total	ITA_last4	SPA_total	SPA_last4
H points season	0.016***		0.016***		0.016***		0.017***	
A points season	-0.016***		-0.019***		-0.018***		-0.016***	
H points last 4		0.045***		0.043***		0.064***		0.040***
A points last 4		-0.061***		-0.059***		-0.068***		-0.037***
COVID placebo	-0.042	-0.068	-0.014	-0.006	0.061	0.065	-0.005	-0.025
Weekend	-0.032	-0.079	0.068	0.090	0.018	0.015	-0.004	0.009
Rest	0.000	0.001	-0.005	-0.009**	0.000	0.000	-0.002	-0.003

[1] This effect is only significant in the case of specification including all the games.

capacity utilization	0.531	0.796	0.211	1.155***	-0.067	0.130	-0.121	0.436*
air distance (km)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Derby	-0.037	-0.013	0.144	0.148	0.051	0.094	-0.067	-0.144
Constant	-0.349	-0.430	-0.034	-0.917***	0.193	-0.047	0.242	-0.125
N	1140	1020	918	810	1140	1018	1140	1019
log lik	-1276.49	-1255.28	-1050.36	-990.85	-1274.55	-1238.78	-1285.83	-1242.95

5. Discussion and conclusion

While the COVID pandemics is disastrous for the public health, for the economy and for the world of sports, it comes with a silver lining of an unprecedented research opportunities. We make us of one such special opportunity, finding that the crowds seem to play a limited role in the emergence of home-field advantage in soccer. Indeed, there is some effect in Germany only.

We do not have a definite answer why the Bundesliga is special. A sceptic's answer is that this is a random blip in the data, with the number of games in each specific league being relatively low. We should hope that the pandemic does not come back with a full force, but if it does, the number of observations with exogenously forced empty stadiums will grow in subsequent seasons, rendering this consideration irrelevant. As for Fischer and Haucap's (2020) preferred explanation of 1. Bundesliga singularity when compared to the lower tiers, namely that it sees more spectators, our data contradicts it, as other European top leagues show no effect either.

What seems to remain as a possible explanation is that the fans pla a special role in the Bundesliga. This is consistent with the observation that capacity utilization only affects the game result in Germany. An institutional factor that might have led to this special situation is that, unlike elsewhere, German clubs (with a few rare, historically motivated exceptions) are owned by associations of fans (Ward and Hines 2017). This has a number of important consequences for the organization of the club (management being elected by the fans) and pricing policies (relatively cheap tickets, beer, wursts and pretzels, facilitating attendance) to name two important domains. This might create a special bond between the team and the fans. An obvious asset under normal circumstances, its removal appears to have hurt German teams as the pandemic cleared the stadiums.

6. References

Agnew, G. A., & Carron, A. V. (1994). Crowd effects and the home advantage. International Journal of Sport Psychology, 25(1), 53–62.

Baumeister, R. F., & Showers, C. J. (1986). A review of paradoxical performance effects: Choking under pressure in sports and mental tests. European Journal of Social Psychology, 16(4), 361-383.

Boudreaux C. J., Sanders, S. D., & Walia, B. (2017). A natural experiment to determine the crowd effect upon home court advantage. Journal of Sports Economics, 18(7), 737-749.

Clarke, Stephen R. and Norman, John M. (1995) Home Ground Advantage of Individual Clubs in English Soccer, Journal of the Royal Statistical Society. Series D (The Statistician), 44(4), 509-521.

Courneya, K. S., & Carron, A. V. (1991). Effects of Travel and Length of Home Stand/Road Trip on tie Home Advantage. Journal of Sport and Exercise Psychology, 13(1), 42-49.

Courneya, K. S., & Carron, A.V. (1992). The home advantage in sport competitions:Aliterature review. Journal of Sport Exercise Psychology, 14, 13-27.

van Damme, N., & Baert, S. (2019). Home advantage in European international soccer: Which dimension of distance matters?.

Dohmen, T. J. (2008). The influence of social forces: Evidence from the behavior of football referees. Economic inquiry, 46(3), 411-424.

Fischer, K., & Haucap, J. (2020). Does crowd support drive the home advantage in professional soccer? Evidence from German ghost games during the COVID-19 pandemic (No. 344). DICE Discussion Paper.

Garicano, L., Palacios-Huerta, I., & Prendergast, C. (2005). Favoritism under social pressure. Review of Economics and Statistics, 87(2), 208-216.

Goumas, C. (2014). Home advantage and referee bias in European football. European journal of sport science, 14(sup1), S243-S249.

Goumas, Chris (2017) Modelling home advantage for individual teams in UEFA Champions League football, Journal of Sport and Health Science, 6(3), 321–326.

Jamieson, Jeremy (2010) The Home-Field advantage in Athletics: A Meta-Analysis, Journal of Applied Social Psychology, 40(7), 1819–1848.

Moore, J. C., & Brylinsky, J. A. (1993). Spectator effect on team performance in college basketball. Journal of Sport Behavior, 16(2), 77.

Nevill, A. M., Newell, S. M., & Gale, S. (1996). Factors associated with home advantage in English and Scottish soccer matches. Journal of sports sciences, 14(2), 181-186.

Nevill, A. M., Balmer, N. J. & Williams, A. M. (2002), 'The Influence of Crowd Noise and Experience upon Refereeing Decision in Football', Psychology of Sport and Exercise 3(4), 261–272.

Pace, A., & Carron, A. V. (1992). Travel and the home advantage. Canadian Journal of Sport Sciences, 17(1), 60–64.

Pollard, Richard, Pollard, G. (2005) Long-term trends in home advantage in professional team sports in North America and England (1876 – 2003), Journal of Sports Sciences, 23(4), 337-350, DOI: 10.1080/02640410400021559

Pollard, Richard (2006) Worldwide regional variations in home advantage in association football, Journal of Sports Sciences, 24(3), 231-240, DOI: 10.1080/02640410500141836

Pollard, Richard, Gómez, Miguel 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

Reade, J. J., Schreyer, D., & Singleton, C. (2020). Echoes: what happens when football is played behind closed doors?. Available at SSRN 3630130.

Scoppa, V. (2008) Are subjective evaluations biased by social factors or connections? An econometric analysis of soccer referee decisions. Empirical Economics 35(1), 123–140.

Sutter, M., & Kocher, M. G. (2004). Favoritism of agents–the case of referees' home bias. Journal of Economic Psychology, 25(4), 461-469.

Unkelbach, C. & Memmert, D. (2010), 'Crowd Noise as a Cue in Referee Decisions Contributes to the Home Advantage', Journal of Sport and Exercise Psychology 32(4), 483–498.

Ward, S. & Hines, A. (2017). The demise of the members' association ownership model in German professional football, Managing Sport and Leisure, 22(5), 358-373, DOI: 10.1080/23750472.2018.1451359

Wallace, H. M., Baumeister, R. F., & Vohs, K. D. (2005). Audience support and choking under pressure: A home disadvantage?. Journal of sports sciences, 23(4), 429-438.

Appendix. Additional results.

Table A1. Regression for goal difference

Variable	ENG_total	ENG_last4	GER_total	GER_last4	ITA_total	ITA_last4	SPA_total	SPA_last4
H points season	0.042***		0.041***		0.036***		0.038***	
A points season	-0.035***		-0.047***		-0.037***		-0.033***	
H points last 4		-0.148***		-0.157***		-0.141***		-0.085***
A points last 4		0.127***		0.098***		0.154***		0.088***
COVID period indicator	0.085	0.011	-0.521**	-0.587**	0.096	0.073	-0.220	0.311*
weekend dummy	-0.009	-0.144	0.265	0.308	-0.008	-0.007	-0.122	0.115
rest	0.004	0.005	-0.007	-0.012	-0.004	-0.004	-0.004	0.004
capacity utilization	0.807	1.369	1.124*	3.295***	-0.316	0.106	-0.608	0.669
air distance (km)	0	0	0	0	0	0	0	0
derby	0.056	0.115	0.173	0.128	0.186	0.295	-0.154	0.332
Constant	-0.501	-0.74	-0.764	-2.483***	0.422*	0.016	0.964***	0.038
N	1140	1020	918	810	1140	1018	1140	1019
log lik	-2144.42	-2054.22	-1830.95	-1696.73	-2085.43	-1979.31	-2065.49	-1953.84

Table A2. Regression for goal difference with placebo for COVID

Variable	ENG_total	ENG_last4	GER_total	GER_last4	ITA_total	ITA_last4	SPA_total	SPA_last4
home team points	0.042***		0.042***		0.036***		0.038***	
away team points	-0.035***		-0.047***		-0.037***		-0.033***	
home team form		0.127***		0.099***		0.154***		0.089***
away team form		-0.148***		-0.155***		-0.141***		-0.084***
COVID period	0.035	-0.011	0.058	0.050	0.086	0.101	-0.084	0.131
weekend dummy	-0.018	-0.147	0.386*	0.435*	-0.012	-0.005	-0.090	0.070
rest	0.005	0.006	-0.010	-0.016*	-0.004	-0.004	-0.005	0.006
capacity utilization	0.792	1.368	1.039	3.188***	-0.304	0.114	-0.647	0.608
air distance (km)	-0.000	-0.000	0.000	-0.000	0.000	0.000	-0.000	0.000
derby	0.057	0.115	0.112	0.054	0.184	0.293	-0.148	0.322
Constant	-0.485	-0.735	-0.815	-2.530***	0.399*	-0.017	0.971***	0.053
N	1140	1020	918	810	1140	1018	1140	1019
log lik	-2144.48	-2054.22	-1833.86	-1699.73	-2085.24	-1979.00	-2066.11	-1954.71

Table A3. Logits for win indicator

Variable	ENG_total	ENG_last4	GER_total	GER_last4	ITA_total	ITA_last4	SPA_total	SPA_last4
H points season	0.048***		0.042***		0.043***		0.046***	
A points season	-0.038***		-0.043***		-0.048***		-0.042***	
H points last 4		0.102***		0.087***		0.168***		0.092***
A points last 4		-0.118***		-0.137***		-0.164***		-0.096***
COVID period indicator	0.193	0.060	-0.627**	-0.581**	0.126	0.074	-0.281	-0.331
weekend dummy	0.032	-0.103	0.173	0.219	-0.050	-0.099	-0.089	-0.035
rest	-0.004	-0.003	-0.009	-0.022*	-0.004	-0.002	-0.004	-0.004
capacity utilization	2.043	2.220*	0.766	3.004***	-0.220	0.117	-0.365	1.163*
air distance (km)	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.000
derby	-0.191	-0.135	0.755**	0.661*	0.025	0.074	-0.299	-0.497*
Constant	-2.723**	-2.082*	-1.246	-2.923***	-0.028	-0.466	0.015	-0.878*
N	1140	1020	918	810	1140	1018	1140	1019
log lik	-649.71	-674.9	-542.76	-519.68	-630.61	-644.64	-678.03	-681.97

Table A4. Logits for win indicator with placebo for COVID

Variable	ENG_total	ENG_last4	GER_total	GER_last4	ITA_total	ITA_last4	SPA_total	SPA_last4
H points season	0.048***		0.042***		0.043***		0.046***	
A points season	-0.038***		-0.043***		-0.048***		-0.042***	
H points last 4		0.102***		0.087***		0.168***		0.092***
A points last 4		-0.117***		-0.135***		-0.164***		-0.095***
COVID placebo indicator	-0.020	-0.071	0.030	0.053	0.150	0.156	0.026	-0.011
weekend dummy	-0.003	-0.119	0.309	0.337	-0.047	-0.088	-0.019	0.042
rest	-0.003	-0.002	-0.012	-0.024**	-0.004	-0.002	-0.006	-0.006
capacity utilization	2.008	2.214*	0.681	2.892***	-0.206	0.126	-0.418	1.096*
air distance (km)	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.000
derby	-0.191	-0.135	0.755**	0.661*	0.025	0.074	-0.299	-0.497*
Constant	-2.656**	-2.053	-1.306	-2.972***	-0.080	-0.525	-0.039	-0.920*
N	1140	1020	918	810	1140	1018	1140	1019
log lik	-649.98	-674.82	-545.37	-522.11	-630.27	-644.10	-678.71	-683.09

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