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The Role of Fan Ownership in Enhancing Home Performance in European Football

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Abstract

This paper studies the effect of fan ownership on home field advantage in the European Top-4 football leagues. This paper follows the idea that fans who are not only stakeholders in their club, but also act as shareholders, exert higher quality support in the stadium and thus increase their team's home advantage. To test this, a model has been estimated via a club fixed effects regression. Results from the 2017/18 season until the 2020/21 season are used to study the absence of fans due to the Covid-19 pandemic. A significant decrease in the home advantage of fan owned teams without live support would be evidence for a competitive advantage through fan ownership. The study finds increased levels of home advantage for fan owned teams, but does not find a significant decrease when fans were not allowed in the stadiums. The findings suggest that improved quality of in-stadium support is not the main driver behind fan owned teams performing better at home than non fan owned teams. Further research is needed to identify the underlying factors contributing to the competitive advantage of fan-owned clubs.

Contents

1   Introduction

"Created by the poor, stolen by the rich."

This banner, displayed by fans of Tunisian club *Africain* during a pre-season friendly match against French Champions *Paris Saint-Germain* in 2017, has since become a widespread symbol in the debate of who "owns" football. The increasing commercialization in modern football has sparked conflict between fans on one side, and owners with different interests on the other side. From the involvement of Russian oligarchs (Roman Abramovich at English *Football Club Chelsea*) to authoritarian regimes using investment into football clubs as a means of improving their public image (Bianco & Sons, 2023; Ettinger, 2023; Koch, 2019), recent developments in the world of football have led to calls for improved governance mechanisms in the sport (Acero et al., 2017; Walters & Taron, 2010). However, the issue of a lack of governance is not only noticeable when looking at the prominent cases of questionable high net-worth individuals or state investments, but also when considering financial sustainability. Clubs with highly concentrated ownership have less financial stability, whilst dispersed ownership structures and the existence of accountability mechanisms lead to improved financial performance (Acero et al., 2017). The majority of European football clubs have moved away from their original membership ownership structure towards high concentration ownership models. The German Bundesliga and parts of the Spanish LaLiga stick out from the rest, as they are still membership associations that run the club.

Whilst fan owned clubs might be more financially stable, one might argue that the main aim of some investors is not to maximize profits, but to use football as a tribune to improve their public image, disregarding the costs connected in an effort to achieve maximum sporting outcomes (Bianco & Sons, 2023; Ettinger, 2023; Koch, 2019).

However, what if fan ownership actually translates into a competitive advantage on the pitch? Based on the idea that fans, who are owners of their club and not purely customers, exert better quality of support, and through this, increase the teams performance when playing at home, this paper aims to answer the following research question:

Does fan ownership of clubs in the European Top-4 leagues result in higher levels of home advantage through better home crowd support?

To answer the research question, the following hypothesis will be analyzed:

H1: *Fan owned clubs have higher home-advantage levels than non-fan owned clubs*

H2: *There is a negative effect of playing behind closed doors on home advantage in the sample*

H3: *The negative effect of playing behind closed doors is larger for fan-owned clubs compared to non fan-owned clubs*

This paper contributes to existing literature in two ways. The approach offers a potential explanation for the unsolved puzzle of the home field advantage. Scholars have found clear evidence for the existence of a home field advantage in a large variety of sports, events and countries (Balmer et al., 2001, 2003; Koning, 2010; Pollard, 2006; Schwartz & Barsky, 1977). The mechanisms behind these findings however are still not clear. Familiarity with the venue is one explanation, but can only explain a fraction of the phenomenon (Barnett & Hilditch, 1993; van Ours, 2019; Wunderlich et al., 2021). Crowd effects are the most prominent explanation for the home advantage, since a large crowd in favor of the home team can influence results by motivating their team, intimidating the opponent and pressuring the referee (Boyko et al., 2007; Dohmen, 2008; Goumas, 2012). However, studies using data from the Covid-19 pandemic, when fans were not allowed inside stadiums, show that the home advantage only decreased in some leagues, such as the German Bundesliga (Fischer & Haucap, 2021; Hill & Yperen, 2021; Tilp & Thaller, 2020). The mechanisms behind this finding however remain unexplored. This indicates that other factors have an influence on results at home. By looking at how fan owned clubs perform at home in the absence of fans compared to non fan-owned teams, an approach to explaining the phenomenon of home field advantage that has not yet been explored, is being analyzed.

Additionally, the findings of this study can be used in the debate for improved governance structures in the domain of professional football. Football clubs with dispersed ownership structures are more financially stable (Acero et al., 2017). Using stakeholder theorem, this paper will assess the role of the fans, who are a primary stakeholder in fan owned football clubs (Freeman et al., 2010). Clubs need to consider the interests of all their stakeholders (Walters & Taron, 2010) in their decision making to avoid conflict within the club. Committed fans foster positive relations in the club and through this have a positive influence on sporting outcomes (Cocieru et al., 2019). The emotional factor connected to the sport, as well as the high uncertainty and unpredictability make professional football a unique industry (Farquhar et al., 2005). With millions of viewers every year, football clubs are exposed to the public like few other businesses. This highlights the social relevance of this study, as a large group within society is negatively affected by poor stakeholder management and governance structures. This study helps understand the value fans bring to their club when they are active shareholders instead of purely customers.

The paper analyses match data spanning over 4 seasons (2017/18 to 2020/21) from the four highest ranked European Leagues. These four leagues are the English Premier League, the German Bundesliga, the Italian Serie A and the Spanish LaLiga (Union of

European Football Associations, n.d.). For the analysis, a club fixed effects regression will be used. This methodology allows to account for unobserved differences between clubs such as lineup strength, club history and culture, financial capabilities and more. To assess the robustness of the model, several checks will be conducted. The analysis will be repeated on indirect outcome measures, and results will be estimated per league. The analysis will also be repeated considering only the 2019/20 season, in which the last part of the season was delayed and played behind closed doors due to the Covid-19 outbreak. The interaction term between home game, fan ownership, playing behind closed doors will be used to answer the research question.

From the analysis conducted, it can be seen that in all models and robustness checks, fan ownership increases a teams' home advantage. However, there is not sufficient evidence to observe a significant decrease in the absence of fans in the stadium. The hypothesis of fan ownership increasing the quality of support in the stadium cannot be backed up by empirical evidence. There seem to be other mechanisms at play that can explain the findings. Future research is required to answer the question of why fan owned teams are stronger at home than non fan owned teams.

The paper will be structured as follows: First, relevant literature will be presented to construct the theoretical framework. The framework is split into the three aspects relevant for this research: Home Advantage, Playing behind Closed Doors and Ownership Structures. Afterwards, the data used for the analysis will be explained, and the methodology used to test for the hypothesis will be discussed. Then, statistical results will be presented, interpreted and discussed, and a conclusion will be drawn.

2   Theoretical framework

This chapter aims to present an overview of relevant literature on the topic. The theoretical framework will be split into three subsections. First, studies looking into the phenomenon of home field advantage will be presented. Afterwards, recent literature regarding the effect of playing behind closed doors will be discussed. Lastly, an overview of literature regarding different ownership and governance structures will be presented.

2.1   Home Field Advantage

The phenomenon of sports teams performing better in front of their home crowd has drawn attention of a large number of researchers. Courneya and Carron (1992) define home advantage as "the consistent finding that home teams in sports competitions win over 50 percent of the games played under a balanced home and away schedule". Early research dates back to Schwartz and Barsky (1977), who looked at outcomes in Baseball,

Basketball and College (American) Football. They propose three factors contributing to the home field advantage: Familiarity with the venue, travel fatigue by the opponent and the moral support of supporters. Based on their results and theory, they conclude that the support of the home crowd is the main driver for home field advantage (Schwartz & Barsky, 1977). Over the years, several studies confirm the existence of home advantage in different sports. Balmer et al. (2001) analyze the existence of home advantage in the Winter Olympic games. In addition to finding a statistically significant home advantage when looking at all events, they also find that competitions in which the athlete is assessed by judges, athletes from the hosting country score higher ratings, indicating a referee bias. In a followup study considering the Summer Olympic Games, Balmer et al. (2003) find similar results, which strengthens the hypothesis of home field advantage originating from crowd effects influencing officials. Majority of papers published analyze home advantage in team sports settings, but there is also evidence for the existence in individual sports such as Tennis and Speed Skating (Koning, 2005, 2010). Home Advantages exist in various sports, and football is no exception (Pollard, 2006). The existence of home advantage is well documented across sports and time frames, however the causes behind the phenomenon remain disputed. Whilst the magnitude of the home advantage has decreased over time (Koyama & Reade, 2009; Peeters & van Ours, 2021), it is still very prevalent in modern football. Various scholars have proposed potential explanations. One potential origin lies within the players and coaches. Carron et al. (2005) propose that coaches adjust their tactics to the game location and through this influence match outcomes. Carmichael and Thomas (2005) support this, suggesting that visiting teams take a more defensive approach, whist home teams play more attacking, mainly due to crowd effects and familiarity with the venue. Neave and Wolfson (2003) find higher levels of testosterone for male footballers before home games compared to away games, suggesting better performance through territorial instincts. The argument of familiarity is supported by the findings that teams playing in stadiums with artificial grass enjoy an additional home advantage (Barnett & Hilditch, 1993; van Ours, 2019). Wunderlich et al. (2021) argue that home advantage exists in low league amateur football as well, which is typically characterised by the absence of fans, and mainly attribute this finding to familiarity with the venue. Whilst these explanations exist and explain a part of the home field advantage, most scholars agree that crowd effects are the main driver behind it. Fans themselves agree with this point of view, according to Wolfson et al. (2005). She finds that 59% of fans see themselves as the primary reason for their team's home performance, with even higher percentages amongst regular stadium attendees. 93% of fans surveyed agreed that a better home support translates into better performance on the pitch. Fans also believe that crowd noise has an effect on the referee (Wolfson et al., 2005). The decision making of the referee in favor of the home team has been proposed as a source of home advantage in other sports as well (Balmer et al., 2001, 2003). With

regards to football, Boyko et al. (2007) study how different referees in England make decisions in favor of the home team. They find that referees tend to favor the home team, whilst more experienced referees display lower levels of home advantage. Based on this, they conclude that large crowds (subconsciously) influence official's decision making. As referees gain more experience, the level of home bias decreases, indicating crowd pressure as the origin. Further research confirms the existence of referee bias (Goumas, 2012), whilst literature opposing this view is also present (Johnston, 2008). Dohmen (2008) provides further evidence to this. He finds that referees systematically give more injury time if the home team is behind by one goal.

Despite various approaches to the puzzle of home field advantage, it remains unsolved overall. Aspects such as the psychological impact on players and indirect, hard-to-quantify factors such as atmosphere around the club, quality of support etc. remain under-researched in the literature.

2.2 Playing behind closed doors

The Covid-19 pandemic and the connected ban on supporter attendance in stadiums provide a unique opportunity to assess the proportion of the home field advantage that can be explained by crowd effects. Previous research such as de Ven (2011) was limited by the small sample size of games played behind closed doors. In this small sample, de Ven (2011) finds that the home advantage persists without supporters in the stadium, concluding that in-stadium support is not the main driver behind home field advantage. The outbreak of the Covid-19 pandemic gave the opportunity of a larger scale natural experiment, which has been analysed by various scholars.

Wunderlich et al. (2021) look at pre-Covid matches and compare them to the 2019/20 outbreak season. They find a significant decrease in match dominance by the home team, quantified by shots and shots on target, as well as a decrease in referee decisions against the away team and in favor of the home side. Sors et al. (2021) also find no referee bias in the absence of live supporters, indicating that this factor is induced by crowd effects. However, despite these changes, Wunderlich et al. (2021) do not find a significant effect on home advantage when games are played behind closed doors, concluding that home advantage is dependent on other factors than just crowd effects. These findings are consistent with the pre-Covid findings of de Ven (2011). However, Wunderlich et al. (2021) does not account for differences between countries, which can be seen as a limitation to this study.

Ramchandani and Millar (2021) also compare results with and without stadium attendance. They split their analysis into two parts, first considering only the 2019/20 season in an inter-season analysis, and then repeat the same analysis between seasons. In their

comparison between the Top-4 leagues, they find a statistically significant decrease for Bundesliga and Serie A over the span of two seasons, and a significant decrease only in the Bundesliga when restricting the findings to the 2019/20 season. The findings are consistent with other studies looking at the Bundesliga during the Covid-19 pandemic (Fischer & Haucap, 2021; Tilp & Thaller, 2020). Hill and Yperen (2021) also find a decrease in games won at home in the German Bundesliga when looking at the 2019/20 season through a randomized sample analysis. In their study, the Bundesliga is the only league showing significant decreases in the points won at home, which is mainly driven by an increase in goals scored by the away team. The study of Destefanis et al. (2022) offers an explanation for this mechanism. They find significant increases for offensive and defensive efficiency in away games, whilst home games show a small increase in attacking efficiency, with defending remaining largely unchanged. The efficiency scores are estimated via a novel order-m methodology. This leads to the conclusion that due to the lack of home support, the adverse psychological effects on the away team disappear, which levels the playing field. This is consistent with Carmichael and Thomas (2005), who suggests that teams take a more defensive approach when playing away and against the home crowd.

Whilst a lot of papers find differences in the effect of Covid-19 on home advantage between European leagues, one factor sticks out: The German Bundesliga is the only league where scholars consistently find a significant decrease in home team performance. The phenomenon is established through several studies, however no explanation for the differences is provided. The unique ownership model existing in German football, the so called *50+1 rule*, which requires clubs to maintain a 51% fan ownership share, will be explored as a potential explanation for the findings in literature looking at home advantage behind closed doors.

While existing research has documented factors contributing to home field advantage, such as crowd effects and stadium familiarity, the matches played behind closed doors due to the pandemic provide a unique opportunity to isolate these effects. This scenario is especially useful for understanding how ownership models, primarily fan-owned versus non-fan owned clubs, influence the impact of fan absence on the performance of their team. Given that fan-owned clubs often exhibit stronger community ties and greater fan engagement, the effect of governance structures on home field advantage is explored, highlighting the critical role of fans as a stakeholder of their club.

2.3   Ownership models in professional football

The professional football industry is very different from other industries. The dependence on short-term results, limited ability to forecast financial results and the public exposure make the football business a unique case (Farquhar et al., 2005). For these rea-

sons, ownership in the football industry differs from other industries, with the emotional attachment of fans and business interests of investors clashing regularly (Cocieru et al., 2019; Connolly, 2024).

Over the years, the club ownership landscape has changed quite drastically. Initially founded by factory workers, most clubs have a rich history of 100+ years, originating from working class backgrounds. From this point onwards, ownership of these clubs developed differently across European countries.

Clubs in the United Kingdom started transitioning from members associations to companies with limited liability already before World War I. Early owners and shareholders were local individuals and businesses, and ownership was characterized by fandom of the team and eagerness to contribute to it's sporting success, rather than pure business interests (Lech & Szymanski, 2015). Towards the end of the 20th century, European football underwent a transformation, with most countries opening up the doors for private majority investors. Italy followed the English model of a free market for investors, whilst Spain transformed most of its clubs into *Sociedad Anonima Deportivo* (sporting limited companies) (Barajas & Rodríguez, 2010) and Germany allowed member associations to sell up to 49% of their voting rights. Despite Germany opening up to outside investments, they installed the *50+1 rule*. This rule prevents the *Verein* (member association) from giving up more than 49% of voting rights, ensuring that the fans ultimately have the final say in every decision. This transformation means that investors can take over majority control over clubs in all of the Top-4 leagues except Germany (Rohde & Breuer, 2017).

This liberalization has opened up the issue of corporate governance in European football. Based on stakeholder theorem, it is crucial for clubs to navigate the interest of various stakeholder groups ranging from sponsors to players and fans. All participants have different interests, and club officials need to consider all stakeholder groups to ensure long-term success (Walters & Taron, 2010). Regarding financial stability, Acero et al. (2017) finds that highly concentrated ownership in football clubs has adverse effects on the financial performance of clubs, whilst clubs with dispersed ownership are financially more sustainable.

Recent developments in the landscape of club owners raise the question whether financial sustainability is the main target of some owners. The involvement of state actors, such as Saudi-Arabia's Public Investment Fund's purchase of Newcastle United in 2020 or Qatar's investment into Paris Saint-Germain bring up the issue of *Sportswashing*, meaning that authoritarian governments use their ownership in an effort to improve their image and build relations through "sports diplomacy" (Ettinger, 2023). By bringing some of football's biggest names into the club, such as PSG's record-breaking purchase of Neymar Jr. for 222 million Euros, the state actors use football as a mean of achieving the "goal of consolidating power and expanding political and economic influence" (Bianco & Sons, 2023; Chadwick & Anagnostopoulos, 2023). This practice is not only limited to

Ownership, but also represented in sponsorship deals such as Arsenal's Deal with UAE based Airline *Emirates* (Koch, 2019) or *Qatar Airways* partnership with Bayern Munich, an agreement that caused large backlash in Germany, which caused large internal conflict at the member summit in 2021 and ultimately ended in 2023. According to Catuogno and Kistner (2023), it was also the fan resistance within the member-owned club that led to the end of the agreement.

The German *50+1 rule* sticks out as a governance model in European football. Acero et al. (2017) finds that the Bundesliga enjoys the highest average stadium attendance and clubs are financially healthier than in other European leagues. The fans are not purely customers of the club, but active stakeholders and shareholders. Based on this, more committed fans have a larger influence on social relations within the club and through this influence sporting results (Cocieru et al., 2019).

All in all, the origins of home advantage are still not clear in the literature. There have been contradicting results when looking at games played behind closed doors. Researchers consistently find a significant drop in home advantage for German teams, who are predominantly fan-owned, highlighting the potential role of governance and ownership models. Research into the role of fans in professional football is mainly limited to analyzing direct crowd effects in the stadium, whilst indirect effects through fan involvement in club governance are not yet explored sufficiently. This research will contribute to covering this gap in the literature.

Based on the existing literature, fan ownership will be explored as a potential explanation to the phenomenon of home advantage. Should fan owned clubs show higher levels of home advantage and be more affected by the absence of fans, this would prove to be an argument to improve the role of fans in the governance of clubs across Europe to improve fan support and sporting results.

3   Data

This chapter covers the data used for the analysis. The data collection is split into two parts: First, the outcomes of matches have been collected. Afterwards, the dataset has been extended with information on the ownership structures of the clubs in question.

3.1   Match results

For the analysis, a dataset including all results from the European Top Four Leagues has been constructed. These leagues include the English Premier League, the German Bundesliga, the Italian Serie A and the Spanish LaLiga (Union of European Football

Associations, n.d.). Due to the French Ligue 1 not resuming the 2019/20 season after the initial suspension (LFP, 2020), the dataset has been limited to only include the Top 4 leagues. Other, smaller European leagues have been left out of the dataset due to low average support numbers, which hinder the comparison when fans were not allowed in the stadium. The dataset spans over four seasons, starting with the 2017/18 season and ending with the 2020/21 season. The timeframe is chosen to include two full seasons without any Covid-19 restrictions in addition to the 2019/20 and 2020/21 seasons, which were (partially) played behind closed doors. There have been no major regulatory changes such as the introduction of the Video Assistent Referee (VAR) or Goal Line Technology that could bias outcomes between seasons in the time of consideration. The dataset was built based on publicly available match data. The data per league per season was collected from *www.football-data.co.uk*. The dataset includes 5784 games played by 104 different teams. Every game is included twice in the dataset for the performance of both teams, resulting in 11,568 observations. To avoid multicollinearity, the data per game includes only statistics regarding that team. The dataset includes direct result data such as game won, points won and goals scored, and also indirect match data such as shots, shots on goal and yellow and red cards conceded.

3.2   Ownership structures

The dataset has been extended with information on the ownership structures of all 104 clubs. Ownership has been characterised in a binary setting, with the variable *Fan Owned* taking the value of 1 if fans hold more than 51% of voting rights, and 0 otherwise. In the German Bundesliga, the *50+1 rule* prevents investors to gain more than 49 percent of a club's voting rights. Three clubs are exempted from this rule. Bayer 04 Leverkusen, VfL Wolfsburg and TSG 1899 Hoffenheim have been granted a special status, since the clubs have been promoted and supported by a business entity without interruption for more than 20 years (Bauers et al., 2020). TSG 1899 Hoffenheim only returned to compliance with the *50+1 rule* in 2023, which has no effect on this dataset. In addition to these three clubs, RB Leipzig will not be considered fan-owned. Whilst the club officially compiles with the *50+1 rule*, voting rights are limited to a handful of Red Bull employees. The club operates through a circumvention of the rule, as noted by Andreas Mundt, president of the *Bundeskartellamt*, the German antitrust agency (Poppe, 2023). Since 1991, Spanish football clubs are required by law to be organized as a *Sociedad Anónima Deportiva (S.A.D.)*, which translates to Sporting Limited Companies. Four teams were exempted from this regulation due to their sporting history and remained fan-owned member clubs. These clubs are Real Madrid, FC Barcelona, CD Ossasuna and Athletic Club de Bilbao (Barajas & Rodríguez, 2010). Additionally, SD Eibar and Real Sociedad will be considered fan-owned. Both clubs are organized as a S.A.D., but have limited the amount

of voting rights that can be purchased per external entity, making sure the club is run by its fans, who are shareholders in the club (Minder, 2014). Real Betis is considered fan-owned, as members bought 55 percent of the clubs shares in 2017 after the previous owner was sanctioned and forced to sell his shares, which led to the democratization of the club (Real Betis, n.d.). In addition to these 7 clubs, both SD Huesca and UD Levante will be considered fan-owned. Both clubs are owned by local, non-profit foundations aimed at developing the local community. In the English Premier League and the Italian Serie A, no fan-owned clubs operated during the time period in question. Overall, there are 28 teams in the dataset that are considered fan-owned for this analysis.

Table 1 shows the descriptive statistics for this dataset.

Table 1: Descriptive Statistics

Variable	Mean	SD	Min	Max
Win	0.38	0.48	0	1
Points	1.38	1.32	0	3
Goals Scored	1.4	1.25	0	9
Shots	11.93	5.05	0	37
Shots On Goal	4.53	2.61	0	18
Yellow Cards	2.04	1.41	0	9
Red Cards	0.09	0.3	0	2
Home Game	0.5	0.5	0	1
Closed Doors	0.32	0.47	0	1
Fan Owned	0.27	0.44	0	1
Observations	11,568			

From Table 1, it can be seen that fan owned teams make up 27% of the observations in the dataset. About one third of the games included in the dataset have been played behind closed doors. All variables that show match statistics are logical, so there is no risk of measurement errors in the dataset.

4   Methodology

This chapter will present the econometric techniques used to establish a causal effect between fan ownership and home advantage. The effect will be established via a club fixed effects regression. Football clubs are unique in their history, fanbase, and financial and sporting capabilities. Using the team's performance with fan attendance as a counterfactual to the performance behind closed doors allows to account for all time-invariant variation and underlying differences between teams. For the analysis, panel data will be used. The panel dataset will be defined via the unique identifier of the team in question

and the season-continuous matchday variable. Due to teams getting promoted/relegated every season, there will be gaps in the season-continuous matchday variable for some teams, which does not influence the coefficients estimated.

To establish a causal relationship between fan ownership and home advantage, the following model will be used to test for the respective hypothesis:

$$Y_c = \alpha_c + \beta_1 \cdot HG_c + \beta_2 \cdot HG_c \cdot FO_c + \epsilon_c \tag{1}$$

$$Y_c = \alpha_c + \beta_1 \cdot HG_c + \beta_2 \cdot CD_c + \beta_3 \cdot HG_c \cdot CD_c + \epsilon_c \tag{2}$$

$$\begin{aligned} Y_c = \alpha_c + \beta_1 \cdot HG_c + \beta_2 \cdot CD_c + \beta_3 \cdot HG_c \cdot CD_c + \beta_4 \cdot HG_c \cdot FO_c \\ + \beta_5 \cdot FO_c \cdot CD_c + \beta_6 \cdot HG_c \cdot CD_c \cdot FO_c + \epsilon_c \end{aligned} \tag{3}$$

HG = Home Game, FO = Fan Owned, CD = Closed Doors, c = club subscript

The analysis will be done on three different metrics of sporting success represented by Y in the equations above. First, the regression will be conducted using the binary outcome variable *Win*, taking the value of 1 if the team in question won the game and 0 otherwise. Secondly, the analysis will be repeated for *Points Won*. The results are expected to be very similar to those of the first regression, however this measure allows to also account for draws. Lastly, the regressions will be run on *Goals Scored* by the team in question. All of these measures are directly related to another. *Points Won* will be used as the main variable of interests, with the others being used to ensure consistent results. Consistency in the results across the different dependent variables will increase the validity of the model. By first establishing the relationship between home advantage and fan ownership without the treatment in model (1), the foundation for upcoming analysis is being laid. The existence of an overall home field advantage in the dataset is being tested, and the interaction term indicates how fan ownership influences the level of home advantage. In model (2), the second hypothesis is being tested. The effect of the treatment variable of whether the game was played behind closed doors is being assessed. The interaction term between *Home Game* and *Closed Doors* shows how the treatment influences the home field advantage. Lastly, model (3) combines models (1) and (2). By assessing the interaction term between *Home Game*, *Fan Ownership* and *Closed Doors*, a causal relationship can be established. The significance and sign of this term indicates

whether fan ownership has an influence on Home Advantage in the absence of fans in the stadium. This effect can then be used to answer the research question of whether fan ownership is a source of home advantage through improved in-stadium fan support.

4.1 Robustness Checks

To assess the consistency of the findings, several robustness checks based on findings in previous research will be conducted. By doing so, the validity of the model and the conclusions drawn from these can be increased. For all robustness checks, only the full model testing for hypothesis 3 will be run.

Based on Wunderlich et al. (2021) findings, a robustness check will be conducted by looking at variables that indirectly have an effect on the sporting outcome. The metrics used for this are *Shots* and *Shots on Goal* to look at match domination (Wunderlich et al., 2021), and *Yellow Cards* to analyze the existence of a referee bias (Dohmen, 2008; Goumas, 2012). Red cards will be disregarded, as a red card is a rare event (van Ours, 2024). Additionally, every red card is being checked by a Video Assistant Referee (VAR) in all leagues and seasons in the dataset. Therefore, the measure of giving a red card can be seen as objective and is not influenced by subconscious referee bias induced through crowd effects. Based on the findings of Wunderlich et al. (2021) and Sors et al. (2021), the interaction term between home game and closed doors is expected to be positive, meaning that referees give more yellow cards to the home team in the absence of fans in the stadium due to decreased crowd effects. *Shots* and *Shots on Goal* should behave in similar fashion to *Goals Scored*.

Existing literature shows differences in the outcomes when comparing between leagues (Hill & Yperen, 2021; Ramchandani & Millar, 2021). Based on their findings, the analysis will be repeated for every league individually. Results are expected to slightly differ per league due to differences in domestic fan culture.

Ramchandani and Millar (2021) found variation in the effect of playing behind closed doors on home performance when comparing results within the 2019/20 season and results between seasons. Based on their findings, the analysis will be repeated for a data subset consisting of results from the 2019/20 season only. Performing this robustness check allows to check for differences across seasons. This robustness check will be performed for each league individually, as well as pooled across all four leagues.

5 Results

The following chapter covers the results obtained from statistical analysis. All regressions have been repeated on three different outcome variables to ensure consistency of the results. The results of the regression of percentage of games won and goals scored

can be found in the appendix of this paper. *Points Won* has been chosen as the most representative metric of sporting success, since points are the primary determinant factor of position in the league, with games won and goals scored only being used in the event of two teams sharing the same amount of points. The analysis only uses league games, so using *Points Won* as the main metric also allows to account for draws. Table 2 shows the results of the statistical analysis of all three hypothesis.

Table 2: Regression results for all three hypothesis

	(1) Points Won	(2) Points Won	(3) Points Won
Home Game	0.34***	0.43***	0.40***
	(0.03)	(0.03)	(0.03)
Closed Doors		0.09*	0.08
		(0.05)	(0.06)
Home Game x Closed doors		-0.24***	-0.21***
		(0.05)	(0.07)
Home Game x Fan Owned	0.09*		0.12**
	(0.05)		(0.06)
Fan Owned x Closed doors			0.04
			(0.1)
Fan Owned x Home Game x Closed doors			-0.11
			(0.11)

Notes. Results obtained via club fixed effects regression using data from the 2017/18 season until the 2020/21 season. Every column shows the results for the respective hypothesis. Significance levels: *p < .1, **p < .05, ***p < .01. Standard errors in parentheses. Sample size of 11,568 observations. Constant not reported.

Column 1 gives the results of H1 (*Fan owned clubs have higher home-advantage levels than non-fan owned clubs*). The effect of playing in front of a home crowd is statistically significant at the 1% significance level, with teams on average winning 0.34 points more when playing on home ground. Additionally, the interaction term between home game and fan ownership is positive and statistically significant at a 10% level. Based on this, there is enough statistical evidence to support the first hypothesis. There is clear evidence for the existence of home advantage in the dataset, and sufficient evidence to conclude that fan ownership gives these teams an additional home advantage. The same mechanism can be seen when looking at the percentage of games won and goals scored, as seen in Table 6 and Table 7 (Appendix).

H2 (*There is a negative effect of playing behind closed doors on home advantage in the sample*), is displayed in the respective column, introduces the treatment variable of playing behind closed doors. Playing behind closed doors has a positive, statistically significant effect on points won (as well as wins and goals). The increase in points won behind closed doors likely stems from a decrease in games ending in a draw, and will not be interpreted further. From the negative interaction term between playing at home and

playing behind closed doors, it can be seen that closed doors eliminate about 1/2 of the initial advantage of playing on home soil. The second hypothesis has been proven and the result provides clear evidence that crowd effects influence game outcome, but are not the only determinant factor for home advantage. Other factors such as familiarity with the venue or travel fatigue of opponent teams, as suggested by Schwartz and Barsky (1977) might be playing a factor as well as home crowd support.

The third column shows the results testing for H3 (*The negative effect of playing behind closed doors is larger for fan-owned clubs compared to non fan-owned clubs*). The effect of playing at home is significant at the 1% level, as well as the interaction terms of playing a home game behind closed doors and playing a home game as a fan owned team (at 5% level). Similar to the results of hypothesis 2, closed doors eliminate about 1/2 of the gain of playing at home. Fan Owned teams display larger levels of home advantage, winning on average an additional 0.12 points in front of their home crowd. When looking at the interaction term between fan ownership and closed doors, there is not enough statistical evidence to assume it to be different from zero. The same counts for the triple interaction term between all variables. For this reason, there is not sufficient statistical evidence to support hypothesis 3. It can not be concluded that fan owned teams suffered an additional loss of home advantage when playing behind closed doors compared to non-fan owned clubs. The same results hold when looking at games won and goals scored.

5.1 Robustness Checks

This section covers the regression results of the robustness checks performed.

Table 3: Robustness Check - Indirect outcome variables

	(1) Shots	(2) Shots on Goal	(3) Yellow Cards
Home Game	2.61***	0.89***	-0.26***
	(0.12)	(0.07)	(0.04)
Closed Doors	-0.01	0.18**	-0.3***
	(0.19)	(0.09)	(0.05)
Home Game x Closed doors	-1.37***	-0.35***	0.24***
	(0.19)	(0.09)	(0.06)
Home Game x Fan Owned	0.29	0.14	0.00
	(0.23)	(0.14)	(0.07)
Fan Owned x Closed doors	-0.15	-0.2	0.08
	(0.38)	(0.18)	(0.12)
Fan Owned x Home Game x Closed doors	-0.07	-0.11	-0.00
	(0.38)	(0.22)	(0.02)

Notes. Results obtained via club fixed effects regression using data from the 2017/18 season until the 2020/21 season. Significance levels: *$p < .1$, **$p < .05$, ***$p < .01$. Standard errors in parentheses. Sample size of 11,568 observations. Constant not reported.

Table 3 shows the results of the first robustness check. All variables behave as expected. The results for *Shots* and *Shots on Goal* in regressions (1) and (2) are similar to *Goals Scored*. Playing behind closed doors removes about 1/2 of the initial home advantage. When repeating the regression using *Yellow Cards* as the dependent variable, it can be seen that playing behind closed doors almost entirely cancels out the previous home advantage. This finding can be interpreted as evidence towards a crowd-effect induced referee bias. Whilst this is not the primary focus of this paper, it could be used as a basis for future research.

Table 4: Robustness Check - Outcomes per League

	ENG	ITA	ESP	GER
	(1) Points	(2) Points	(3) Points	(4) Points
Home Game	0.46***	0.29***	0.54***	0.21***
	(0.06)	(0.05)	(0.06)	(0.07)
Closed Doors	0.18*	0.02	-0.02	0.11
	(0.09)	(0.09)	(0.16)	(0.14)
Home Game x Closed doors	-0.42***	-0.05	-0.12	-0.12
	(0.11)	(0.11)	(0.11)	(0.1)
Home Game x Fan Owned			0.07	0.26***
			(0.07)	(0.09)
Fan Owned x Closed doors			0.21	-0.04
			(0.18)	(0.18)
Fan Owned x Home Game x Closed doors			-0.26	-0.15
			(0.16)	(0.16)
N	3,040	3,040	3,040	2,448

Notes. Results obtained via club fixed effects regression using data from the 2017/18 season until the 2020/21 season. Sample size smaller for GER due to Bundesliga consisting of 18 teams, whilst all other leagues consist of 20 teams. Fan Ownership omitted for ENG and ITA since there are no fan owned teams in these two leagues. Significance levels: *p < .1, **p < .05, ***p < .01. Standard errors in parentheses. Constant not reported.

Table 4 shows the results of model (3) performed individually for every league in the dataset. The results differ substantially per league. Whilst all leagues show positive coefficients for home advantage at the 1% level, the magnitude of the home advantage differs quite substantially. Germany has the lowest level of home advantage for non fan-owned teams, however only four teams out of the 23 teams that played in the first division over the four seasons in question are not fan-owned. For majority of teams in Germany, playing at home on average increases the points gained by 0.47. Excluding the four teams in Germany, Italian teams display the lowest levels of home advantage, whilst Spanish teams show the highest levels of home advantage. In contrast to Germany, there is not sufficient statistical evidence for increased home advantage of fan owned teams in the first division of Spanish football.

Another notable result from this robustness check is the influence of playing behind closed doors. Whilst the absence of fans did not have a statistically significant effect on points won in Italy, Spain and Germany, it eliminates almost all home advantage in the English Premier League.

Table 5: Robustness Check - Within-Season Comparison

	ENG	ITA	ESP	GER	
	(1) Points	(2) Points	(3) Points	(4) Points	(5) Points
Home Game	0.42***	0.09	0.6***	-0.06	0.32***
	(0.08)	(0.09)	(0.13)	(0.1)	(0.06)
Closed Doors	-0.03	0.11	0.09	0.67***	0.02
	(0.18)	(0.14)	(0.22)	(0.18)	(0.1)
Home Game x Closed doors	0.08	0.23	-0.23	-1.34***	-0.03
	(0.24)	(0.19)	(0.25)	(0.45)	(0.13)
Home Game x Fan Owned			0.29	0.38**	0.22*
			(0.18)	(0.17)	(0.12)
Fan Owned x Closed doors			0.38	-0.5	0.26
			(0.29)	(0.29)	(0.18)
Fan Owned x Home Game x Closed doors			-0.59	0.96	-0.52**
			(0.34)	(0.55)	(0.25)
N	760	760	760	612	2,892

Notes. Results obtained via club fixed effects regression using data from the 2019/20 season. Sample size smaller for GER due to Bundesliga consisting of 18 teams, whilst all other leagues consist of 20 teams. Fan Ownership omitted for ENG and ITA since there are no fan owned teams in these two leagues. Significance levels: *$p < .1$, **$p < .05$, ***$p < .01$. Standard errors in parentheses. Constant not reported.

Table 5 shows the results of the final robustness check, which limits the dataset to the 2019/20 season in which the outbreak of the Covid-19 pandemic caused games to be played behind closed doors. As seen before when considering the full dataset in Table 4, the results differ substantially per league. In England and Italy, the two leagues without any fan-owned teams, only the Premier League shows a significant home advantage. Compared to the across-season analysis in Table 4, there is no statistically significant impact of playing behind closed doors in the Premier League in the short-term.

In the German Bundesliga, home advantage can only be observed for the fan owned clubs during the 2019/20 season. Additionally, when playing without fans being present in the stadium, playing at home did not only eliminate the home advantage, but actually turned into a home disadvantage, a phenomenon only observed in the Bundesliga.

When pooling across leagues, the triple interaction term between fan ownership, playing at home and playing behind closed doors is statistically significant at the 5% level. This stands in contrast to the previous findings from the full dataset in Table 2, which did not find any statistically significant effect. This difference indicates differences between

the abrupt within-season effect of the Covid-19 pandemic, and the long-term effects across seasons. For the 2019/20 season, hypothesis (3) can be proven since there is sufficient statistical evidence to conclude that compared to non-fan owned teams, fan owned teams lost more points at home. Almost the entire home advantage of these teams is eliminated when playing home games behind closed doors.

To summarize, the analysis conducted in this paper gives clear evidence for a positive effect of playing at home and a negative impact on this when playing behind closed doors. Fan owned teams generally show higher levels of home advantage. The results of the effect of fan ownership on home advantage when fans were not allowed in the stadium are ambiguous. When considering only the 2019/20 season, fan owned teams showed an additional negative decrease, whilst this effect did not show when including all four seasons in the analysis.

6   Discussion and Conclusion

This paper investigated whether fan-owned football teams gain additional home advantage from the support of home crowds who are owners, not merely customers, of their team. Using data from the Top 4 European leagues from the 2017/18 to the 2020/21 domestic season, three hypothesis have been studied: (1) *Fan owned clubs have higher home-advantage levels than non-fan owned teams*; (2) *There is a negative effect of playing behind closed doors on home advantage in the sample*; (3) *The negative effect of playing behind closed doors is larger for fan owned clubs compared to non fan owned clubs.*

Through the club fixed effects model, hypothesis (1) and (2) have been supported and lay the groundwork for analyzing the effect of fan ownership on sporting performance. The match results of fan owned teams playing in front of their crowd show an additional home advantage over non-fan owned teams. The impact of Covid-19, as proven by the results for hypothesis (2) was severe, eliminating almost 1/2 of the home advantage when fans were not allowed in the stadiums. This finding shows that the natural experiment of games having to be played behind closed doors can be used to assess the impact of live supporters in sporting events.

Hypothesis (3) could not be proven when looking at both direct and indirect outcome variables, as well as analysis per league when considering all four seasons included in the dataset. From this, it appears that better in-stadium support is not the reason behind fan owned teams having an additional home advantage. Fan owned teams seem to differ from non-fan owned teams in other ways, and gain a competitive advantage through this. However, it can be seen from Table 5 that when limiting the analysis to only include the 2019/20 season and pooling across all four leagues, the interaction term between fan ownership, home game and closed doors is negative and statistically significant at

the 5% significance level. This effect indicates that in the short-run (over one season), fan-owned teams are more negatively impacted by a lack of home support than their non fan-owned counterparts. A potential explanation for this finding is that in the short-term, teams are more reliant on fan support to either turn around a run of bad form, or keep up a run of good form. In the long-run (across multiple seasons), form is less relevant and overall quality of the players, staff, and financial capabilities of the club play a larger role. Through this, so called "One-Season-Wonders" and other abnormal over-/underperformances average out. There seems to be a difference between short-term and long-term influence of fan support and fan ownership. This is consistent with Ramchandani and Millar (2021), who also find different results when limiting their research to the Covid outbreak season. The effect of current form on quality of fan support could be explored in future research.

Due to the contradicting findings from the initial analysis and the subsequent robustness check, it is not possible to confidently accept or reject hypothesis (3). A clear causal relationship between fan ownership and sporting success due to better in-stadium support cannot be established, but can also not be ruled out. Further research into this contradiction is needed.

It is important to acknowledge the limitations of the study. First up, generalizing fan ownership into a yes-or-no scenario is a very broad definition. The German *50+1 rule* differs from the clubs excepted from the S.A.D. transformation in 1991, which again is different to the SD Eibar, Real Sociedad and Real Betis, who are S.A.D. companies, but retain fan ownership within this legal structure. Due to football clubs having rich, unique histories and supporters feeling strong emotional connections, it is difficult to generalize ownership structures to fit in a binary setting. Additionally, some of the mechanisms that are assumed to connect fan ownership and sporting outcomes, such as fans being involved in club governance and thus exercising better support could be achieved through other forms of fan involvement and are not limited to fans being the owners of the club. Football is characterized by emotions, unpredictability and irrationality, which hinders the applicability of concepts usually used in other industries (Farquhar et al., 2005).

The research also suffers from the fact that real experiments are not feasible due to the large scale nature of professional sporting events, as well as concerns regarding fairness and sporting integrity. Due to this, research into home advantage and other factors is limited to natural experiments such as the one explored in this paper. With regards to using the natural experiment of games being played behind closed doors due to the Covid pandemic, potential omitted variables are differences in local anti-Covid measurements that impact teams ability to train, recover, travel to games and more. This negatively impacts the external validity of the findings and hinders clear policy implications.

Although the findings of this paper need to be taken with caution due to these lim-

itations, some policy implications can be drawn. Throughout all models estimated, fan ownership consistently increases the home advantage. Whilst it cannot be concluded that this effect is caused by better support at home games due to supporters being more involved, there is clear evidence for the existence of an competitive advantage originating from improved governance structures. Combined with the findings of Acero et al. (2017) that dispersed ownership improves the financial sustainability of football clubs, a call for improvement in the governance of professional football clubs can be made. Whilst it is unrealistic to implement fan ownership models all across European football, the involvement of fans in the clubs governance should be improved.

Future research is required to understand the exact mechanisms that cause fan owned teams to have higher levels of home advantage than non fan owned teams. For this, a larger pool of leagues could be analyzed. Future research could include more leagues, such as the Swedish Fotbollsallsvenskan, which requires teams to be fan owned in similar fashion to Germany's *50+1 rule*. There are also fan owned teams to be found in Portugal's top flight, and other professional leagues across Europe. It could also be interesting to repeat the analysis for international club competitions in the UEFA Champions League and the UEFA Europa League. This would allow to eliminate country specific factors such as differences in pandemic management.

Qualitative research could add valuable insights into how fan owned football clubs differ from non fan owned clubs and how internal club politics or other governance related factors impact players, managers and the way fans feel about their club. Case studies and semi-structured interviews could help to fill the gap in the literature. Additionally, other events impacting ownership structures could be analyzed. Potential event studies could be changes in ownership on a club level, or legislative changes on an association level such as the 1991 S.A.D. reform of Spanish football clubs. The finding of referee bias, measured through yellow cards, disappearing almost entirely when playing behind closed doors can also be used as a basis for further research into this topic.

Coming back to the research question of this paper: *Does fan ownership of clubs in the European Top-4 leagues result in higher levels of home advantage through better home crowd support?*, it appears that fan ownership is a partial source of home advantage, as fan ownership consistently increased sporting results in front of home crowds. However, there has not been a significant drop during games played behind closed doors, indicating that the quality of home support is not the main driver of the increased home advantage found in this paper. The findings of this paper add a piece to the puzzle of the Home Advantage, which remains unsolved overall.

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A Appendix

Table 6: Results using percentage of Games Won

	(1) Win	(2) Win	(3) Win
Home Game	0.11***	0.15***	0.13***
	(0.01)	(0.01)	(0.01)
Closed Doors		0.03*	0.02
		(0.02)	(0.02)
Home Game x Closed doors		-0.08***	-0.06***
		(0.02)	(0.02)
Home Game x Fan Owned	0.03*		0.05**
	(0.02)		(0.02)
Fan Owned x Closed doors			0.02
			(0.03)
Fan Owned x Home Game x Closed doors			-0.05
			(0.04)

Notes. Results obtained via club fixed effects regression using data from the 2017/18 season until the 2020/21 season. Significance levels: *$p < .1$, **$p < .05$, ***$p < .01$. Standard errors in parentheses. Sample size of 11,568 observations. Constant not reported.

Table 7: Results using Goals Scored

	(1) Goals Scored	(2) Goals Scored	(3) Goals Scored
Home Game	0.25***	0.33***	0.28***
	(0.02)	(0.03)	(0.03)
Closed Doors		0.08**	0.08*
		(0.04)	(0.05)
Home Game x Closed doors		-0.14***	-0.11*
		(0.05)	(0.06)
Home Game x Fan Owned	0.13**		0.18***
	(0.05)		(0.07)
Fan Owned x Closed doors			-0.01
			(0.08)
Fan Owned x Home Game x Closed doors			-0.15
			(0.11)

Notes. Results obtained via club fixed effects regression using data from the 2017/18 season until the 2020/21 season. Significance levels: *p < .1, **p < .05, ***p < .01. Standard errors in parentheses. Sample size of 11,568 observations. Constant not reported.

Table 8: Variables used in Analysis

Variable	Definition
Division	ENG = Premier League; GER = Bundesliga; ITA = Serie A; ESP = LaLiga
Date	Date at Which Game Was Played
Season	Season in Which Game Was Played
Matchday	Matchday at Which Game Was Played
MDcon	Season-Continuous Matchday Variable
TeamID	Unique Team Identifier
Points	Points Won by Team
Win	1 = Team Won; 0 = Team Did Not Win
GoalsScored	Goals Scored by Team
Yellow	Yellow Cards Given Against Team
Red	Red Cards Given Against Team
Shots	Shots Taken by Team
ShotsOnGoal	Shots on Goal Taken by Team
HomeGame	1 = Team Played at Home; 0 = Team Played Away
FanOwned	1 = Team is Fan Owned; 0 = Team is not Fan Owned
ClosedDoors	1 = Game Played Behind Closed Doors; 0 = Game Played With Fans