



Master's degree thesis

IDR950 Sport Management

**The effect of Covid-19 in Scandinavian Elite Football
(Men & Women) - *A study on home advantage***

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Preface

Initially, I would like to thank my supervisor Professor Alex Krumer for his availability and guidance on how to use and understand my data. His knowledge of similar research in this field was of great use during the project.

Writing this thesis has been a good experience in terms of being able to learn more about economic theory while simultaneously working in the context of sport that I find particularly interesting. The research process has made me especially aware of the importance of reliable sources in order to receive reliable results and also taught me using statistical software that might be useful knowledge for me in the future perhaps also outside the context of economic theory.

For the eventual future readers of this paper, I hope you, like me, find it informing and interesting.

Have a nice reading!

Summary

This project looks into two seasons, the 2019 and 2020 season, of Scandinavian elite football (soccer) for both men and women. The 2020 season was entirely affected by restrictions and regulations related to the coronavirus, while the 2019 season was a normal season. By comparing the two seasons we can look into what the restrictions, mainly on attendance, meant for match outcomes.

As expected, related to similar studies, the analyzes points towards an eroding home advantage for the men's leagues for the variables of yellow cards, goals and points. This suggests that referees favor the home team less when social pressure from spectators disappears.

Although it seems like the women's leagues experience a similar pattern of home advantage, it was not uncovered a clear and similar change in home advantage for the women's leagues during the 2020 season. This can be related to the fact that the women's leagues normally attract a low number of spectators.

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1.0 Introduction

When the wave of Covid-19 really washed over Europe in March 2020 the fewest of us realized it would become such a marathon like the pandemic turned out to be and still is while writing this. Restrictions have led to negative financial and social consequences for individuals and industries worldwide. The sport industry is no exception; European Football leagues were postponed for many weeks in the end of 2019/2020 season and some leagues were even canceled. The Norwegian and Swedish top leagues for men and women, which normally start their seasons in March/April were forced to postpone until June/July. Some leagues have allowed two additional substitutes every match in order to compensate for a tighter schedule of matches.

After the preliminary postponements, the most evident consequence of the pandemic restrictions has been the lack of spectators. Less visible consequences for the outside world are the virus control protocols that people in the elite sport industry need to follow in order to compete. Proven infections have led to loads of quarantines and even postponements of matches.

Despite the negative effects, the pandemic has also given a unique opportunity to take advantage of and comparing how different conditions affect mechanisms that is not available for measurement when things are normal. The lack of spectators gives us the opportunity to compare how players, teams and referees act differently when the stands are empty but everything else is close to normal. More specifically, we can examine whether the referee plays a role in giving the home team an advantage as a result of pressure from spectators, for example by giving the home team fewer yellow cards. Similarly, it would be possible to indicate how spectators affect team or individual players performance.

The absence of spectators in sport is a well-known area of natural experiments in economic theory. Sport competitions are in its purest form about maximizing the opportunity to win. In other words, we can normally expect that the actors maximize their efforts in sport competitions. Professional football is played between two teams of 11 players each. National leagues are normally played in a round robin format where every team play against each other both home and away once. As the spectators in normal times are present at the stadium, it is difficult to measure the impact they have on the match outcome and events during the

match. When the spectators are forced out of the stadium it gives a unique opportunity to measure this effect, and additionally, it can provide information on how individuals cope with social pressure that might be interesting knowledge in other industries (e.g. business, education).

Based on the context we are in, it is found natural to research how the pandemic restrictions have influenced the home advantage in Scandinavian elite football for both men and women. Additionally, it gives a rarely documented insight on overall home advantage on Scandinavian elite football and especially on women's elite football.

2.0 Literature review

The scientific basis on the area of this master thesis is in general well documented. However, there has not been a lot of research in the context of neither Scandinavian men's football or women's football in general, which are gaps that this project seeks to contribute complementing.

"It is not from the benevolence of the butcher, the brewer, or the baker, that we expect our dinner, but from their regard to their own interest"
(Adam Smith 1776)

Adam Smith is commonly known as the 'father of economics' and his book "Wealth of Nations" offered among others the famous above-mentioned quote which refers to human's rationality. Rationality is a cornerstone in economic theory that assumes people act in self-interest. This widely accepted assumption enables us to draw lines between events and put them into context. It even allows us to scientifically conclude on human behavior in specific situations, and what we discover in certain situations can sometimes be transferable to and applicable in other situations.

It can admittedly be difficult to find such situations where rational behavior occurs in a way that it is measurable. Sports, however, does continually offer these situations. Sports involve loads of measurable data on performance and the participants are usually highly competitive, which means they act in the self-interest of winning. How people perform in sport in front of spectators might be transferable to other situations where people need to perform in front of spectators (e.g. lecturers, artists).

The phenomenon that professional sport teams in general performs better in familiar circumstances, as on their home ground, is referred to as home advantage, and was the subject for a literature review (Courneya and Carron, 1992) which concluded that home advantage exists in sports with the premise that the home team wins at least 50% of the matches.

There are different explanations why the phenomenon of home advantage exists. Some of the possible reasons are more accessible to be examined with big data research and economical behavior theory while other possible reasons must be researched with the base in other theories and sometimes qualitatively. Big data research involves collecting open and free accessible data that can be compiled and analyzed in regressions in order to find trustworthy explanations and connections that we observe or suspect. Some reasons can be examined continually under normal circumstances such as Goller and Krumer (2020) which examined whether European cup matches played on non-frequent days affected the home advantage. This paper concluded that there is a difference in the distribution of home matches on non-frequent days versus frequent days. This can potentially lead to unfair conditions of the tournament as the home team benefits more home advantage by crowd support when the match is played on a frequent day. The normal tournament scheduling can thus be a driver for home advantage that possibly can be reduced with awareness on this issue when scheduling.

Some other reasons to explain home advantage needs special conditions to be examined purely. Pettersson-Lidbom and Priks (2010) took advantage of such conditions in Italian elite football of the season 2006/2007, when some teams had to play the home matches in front of empty stands. The study showed a significant decrease in home advantage with an equalization of yellow cards, red cards and fouls. Maybe especially interesting was the finding that the *players* did not seem to act different when the stands were empty, but that the *referees* evidently suffered for social pressure and made more equal decisions when the stands were empty. Even though the favoring of the home team might be subconscious for the referee, the findings points on something fundamentally that is against the spirit of the game. Referees are appointed to do fair independent decisions but gives in to the social pressure that the home supporters represent.

Page and Page (2010) similarly measured the effect on crowd size compared in relation to the home advantage phenomenon. The findings suggest individual differences between

referees on how they cope with pressure, as some referees give a stable home advantage whereas others increase the home advantage with the increase in crowd size.

Dohmen and Sauermann (2016) reviewed research concerning referee bias and came to the same conclusion: referee bias exists across different countries and sports. They brought forward *social & material payoffs* as determinants for referee bias, respectively explained as the amount of pressure stakeholders put on the referee and that financial incentives contribute to decrease the referee bias and increase the awareness on fair decision-making.

Pettersson-Lidbom and Priks (2010) suggests that teams in general are professional and do not adjust their performance under pressure.

However, teams consist of individual athletes and team leaders that as individuals respond differently in different situations, this is evident in a study conducted by Harb-Wu and Krumer (2019) that suggest that the highest capable professional biathletes chokes under the pressure of a supportive audience due to high expectations. Both examples show that social pressure can have a negative impact on individual performance respectively for referees and athletes.

Several scholars have already taken advantage of the Covid-19 situation and investigated the effects of restrictions in different contexts. One of these studies is Reade, Schreyer and Singleton (2020), containing a database of in total 160 matches played behind closed doors in Italy, France and European tournaments. The data of this study included leagues that continued as usual except the absence of spectators in the end of the season 2019/20. The study found that the home advantage eroded as the away teams received an even number of yellow cards as the home team after lockdown. The conclusion is aligned with previous research concerning referee bias (Pettersson-Lidbom and Priks 2010). Home wins were also proven to be less frequent than usual when the matches were played behind closed doors. Similar results was found by Leitner and Richlan (2020), which also looked into matches behind closed doors in the 2019/2020 season. The main finding was that the home advantage almost vanished in these matches, as home teams lost significantly more and away teams won significantly more. Home teams was also booked with yellow cards significantly more than in regular matches. A paper that looked into the three top leagues of Germany (1st, 2nd and 3rd Bundesliga) by Fischer and Haucap (2020) found a significantly reduced home advantage in the top league but not in the lower leagues. The study suggests that the difference across the leagues is due to that change in spectators is more dramatical for the

top league clubs as they are used to a higher number of spectators. These findings are interesting as this project is looking into less popular leagues than the European top leagues. Cueva (2020) includes a larger number of leagues in his research, containing 34 leagues with a total of 2749 matches played during lockdown. Similarly, it found respectively an 4% percent points reduction in home wins and equally an increase in away wins in matches played when spectators were absent. Whether the change is due to referees suffering from social pressure or that the home team play more aggressively when supported by the spectators is not completely clear, but the author suggests that social pressure most likely is a crucial factor.

As this study is focusing on leagues that are relatively small, in the respect of having lower wages and attendance compared to the largest leagues, it is also interesting to investigate literature with evidence from minor leagues and possible differences. A difference can be that more popular leagues attract more attendance and put more social pressure on the referees and players. Schreyer and Ansari (2021) questions the robustness of present studies on stadium attendance research as niche sports and smaller markets have not got the same attention as the top-tier leagues in especially “American football, baseball, European football and hockey”. Therefore, we must be careful in accepting the evidence from those leagues as the answer in sports and markets where the context is different.

3.0 Method

3.1 Data

The analyses of this research are based on data from men’s and women’s football matches, in the top leagues only, of Norway and Sweden from the seasons 2019 and 2020.

These Scandinavian leagues seems suitable for analyses regarding the effects of Covid-19 on football as the 2019 seasons ended just before the pandemic restrictions were asserted and the 2020 seasons were fully affected by restrictions. This means that we have two whole seasons to compare what effects Covid-19 had on football matches.

Table 1

	Season 2019	Season 2020
Sweden Men	16 teams	16 teams
Norway Men	16 teams	16 teams
Sweden Women	12 teams	12 teams
Norway Women	12 teams	10 teams

The data consist of in total 1446 matches; 960 men's matches and 486 women's matches. The unequal number of teams in the Norwegian women's league is due to reorganizing of the league. This is considered in the analyses by excluding the matches that involves the two teams that ended last in the 2019 season (Stabak & Fart). The total of women's matches is reduced to 444 matches and the total number of matches is 1404, other exclusions to check for robustness are explained in accordance with the analyzes.

The Swedish top league for men did not allow any spectators in the 2020 season, while the Norwegian top league allowed at most 600 spectators in some regions.

3.2 Women's elite football

Women's elite football have previously received limited attention in similar research. But as we can see in Table 2, Scandinavian women's elite football does in general experience a similar home advantage in case of goals scored and points received compared to the away team. The home advantage seems to be slightly smaller than in the men's sample.

However, it gives a starting point to look into what affects home advantage in women's elite football with basis in the knowledge that is available targeting men's elite football.

Women's elite football has experienced growth later years as professional men's clubs have started women's teams which has contributed to a rise in professionalization. Wages and facilities have in general still a long way to go in order reach the top professional men's clubs and only a limited number of players in the Norwegian and Swedish top leagues are fully professional.

3.3 Sources of data collection

For the men's leagues it is Transfermarkt that is used to procure data concerning team value and to crosscheck match data such as attendance, goals, yellow and red cards that is obtained from different sources. Transfermarkt is a recognized source in this field. Peeters (2018) found that player valuations on this site is a reliable forecast for results.

Match data for Norwegian matches are obtained from NIFS.no that is powered by The Norwegian News Agency (NTB).

Swedish match data are respectively obtained from Allsvenskan.se (men), the official league website, and Sofascore.com (women).

Women's match data are crosschecked against respectively Fotball.no (Norway) and Scoreboard.com (Sweden).

3.4 Variables

Some considerations regarding how to register data into the database have been done. Cases of considerations are mentioned in the next sections.

3.4.1 Ability

Several measurements to adjust for ability have been collected. Adjusting for ability let us eliminate the possibility that the difference in ability between teams influence the outcome variable.

Variables: "Oddshomeunited"/"Oddsawayunited"

Pre-set betting odds provides an updated indication of the teams' ability compared with the opponent and are available for most matches in the database. Pre-set betting odds from 'Norsk Tipping' for all leagues were available through NIFS.no. As some matches were not covered, another column with pre-set betting odds from BetWay obtained through Sofascore.com was added. The BetWay-value is used if both services offered odds. If not, the value from 'Norsk Tipping' was used. The "-united" in the end of the variable name used in regressions refers to this fixed column of data.

Variables: “valuehome”/”valueaway”

For the men’s leagues it is also collected a team value obtained from Transfermarkt.com. The last available team value before the first match of each season have been used in the database. The team value adds up as a summation of each player’s value within the team. The values are given in Million EUR (€).

This measure was not available for the women’s league through Transfermarkt.com.

3.4.2 Sanctions

Variables:

“Homeyellow” – Yellow cards given to the home team

“Awayyellow” – Yellow cards given to the away team

“Homered” – Red cards given to the home team

“Awayred” – Red cards given to the away team

Special considerations have been taken into account when registering yellow and red cards. If a player has received a yellow card it is registered as “1” even though the player received a second yellow card later in the game. The second yellow card is not registered as another yellow card but “1” red card. In order to control for these occasions, it is also a column that registers “1” second yellow card. A straight red card is registered as “1” red card. This way of registering makes it possible to differentiate each card given as separate acts during a game but does not consider the severity of a challenge. A straight red card that could be seen as a stronger challenge than two yellow cards are registered as only “1” red card whereas the latter challenge ends up with “1” yellow card and “1” red card. Examining the number of actions seems to be the best approach to meet the purpose of this study.

3.4.3 Fatigue

Variables:

“Lastgamehome” – days since last match played for the home team

“Lastgameaway” – days since last match played for the away team

In order to account for the possibility that fatigue influenced the results a column was added for this. The column consists of the number of days since last match played for respectively the home and away team. To make sure that the data is valid, first round matches and when at least one of the teams had a break for more than 12 days (summer break, international

break etc.) have been excluded. The workload for the players can be different as some teams have many players on international games, while other teams play friendly games. Matches that is not excluded are considered to follow a kind of routine in-between.

The season started later in 2020, which resulted in a tighter schedule. The leagues in the dataset usually have a longer summer break, and this was shortened down in 2020.

3.4.4 Other variables

“Homegoals” – Goals scored by the home team

“Awaygoals” – Goals scored by the visiting team

“Homepoints” – Points for the home team. Win = 3 points, Draw = 1 point, Loss = 0 point

“Awaypoints” – Points for the visiting team. Win = 3 points, Draw = 1 point, Loss = 0 point

“Homeshots” – Shots on goal for the home team

“Awayshots” – Shots on goal for the visiting team

“Homepossession” – The percentage of time the home team had possession on the ball

“Attendance” – The number of spectators

“Totalyellow” = “Homeyellow” + “Awayyellow”

“Diffyellow” = “Awayyellow” – “Homeyellow”

“Totalred” = “Homered” + “Awayred”

“Diffred” = “Awayred” – “Homered”

“Diffpoints” = “Homepoints” – “Awaypoints”

“2020.season” – The change compared with the 2019 season

4.0 Results/Analyses

In order to get an overview of the data and differences between the seasons, a summary of T-test on different variables have been summarized in Table 2 and Table 3. Table 2 contains the total results and Table 3 contains results for the specific leagues. On total level it shows a statistically significant increase in yellow cards for both home and away teams for men. However, the increase is only significant for the home team in Sweden and for the away team in Norway. Only the away team received a statistically significant increase in yellow cards in the women's leagues. Moreover, we can see that goals for the away team increase which naturally contributes to changes in points in the men's league. The home advantage decreased as men's away team gathered a closer number of points in 2020 compared with 2019. This effect seems equivalent in both Norway and Sweden. It was not discovered a significant change in this matter for the women's leagues. Variables connected to the teams in-game performance (possession & shots on goal) did not change significantly in the men's leagues. It was not found any reliable sources to gather these statistics for the women's leagues.

Table 2

	Men				Women				
	Mean		Diff	P-value	Mean		Diff	P-value	
	2019	2020			2019	2020			
Homeyellow	1,515	1,675	0,160	0,042**	0,811	0,865	0,054	0,52	
Awayyellow	1,671	1,815	0,144	0,067*	0,689	1,032	0,342	0,0001***	
Homered	0,056	0,052	-0,004	0,776	0,018	0,027	0,009	0,523	
Awayred	0,054	0,063	0,008	0,589	0,036	0,036	0,000	1,000	
Homegoals	1,658	1,642	-0,017	0,8502	1,631	1,577	-0,054	0,688	
Awaygoals	1,152	1,342	0,190	0,01***	1,288	1,275	-0,014	0,914	
Homepoints	1,67	1,51	-0,158	0,059*	1,58	1,56	-0,018	0,889	
Awaypoints	1,05	1,21	0,154	0,056*	1,18	1,26	0,077	0,544	
Homepossession	51,00	51,38	0,38	0,429	No data				
Homeshots	5,10	5,05	-0,05	0,776	No data				
Awayshots	3,87	4,08	0,21	0,148	No data				
N = 960		T-test		N = 444 (Stabak & Fart excluded, see 3.1)				T-test	

Table 3

	Men Sweden				Men Norway				
	Mean		Diff	P-value	Mean		Diff	P-value	
	2019	2020			2019	2020			
Homeyellow	1,621	1,867	0,246	0,031**	1,408	1,483	0,075	0,489	
Awayyellow	1,792	1,875	0,083	0,462	1,550	1,754	0,204	0,059*	
Homered	0,071	0,054	-0,017	0,452	0,042	0,050	0,008	0,663	
Awayred	0,067	0,075	0,008	0,731	0,417	0,050	-0,367	0,663	
Homegoals	1,583	1,483	-0,100	0,395	1,733	1,800	0,067	0,611	
Awaygoals	1,125	1,325	0,200	0,053*	1,179	1,358	0,179	0,089*	
Homepoints	1,63	1,43	-0,200	0,106	1,72	1,59	-0,13	0,292	
Awaypoints	1,13	1,25	0,125	0,293	0,98	1,17	0,19	0,096*	
Homepossession	50,44	51,33	0,89	0,195	51,56	51,42	-0,14	0,835	
Homeshots	5,08	5,09	0,01	0,947	5,12	5	-0,12	0,62	
Awayshots	4,10	4,29	0,19	0,417	3,63	3,88	0,25	0,197	
Attendance	9165	0	-9165	0,000***	5781	295	-5486	0,000***	
<i>N = 480</i>				<i>T-test</i>	<i>N = 480</i>				<i>T-test</i>
	Women Sweden				Women Norway				
	Mean		Diff	P-value	Mean		Diff	P-value	
	2019	2020			2019	2020			
Homeyellow	0,788	0,765	-0,023	0,82	0,844	1,011	0,167	0,255	
Awayyellow	0,712	1,015	0,303	0,0051***	0,656	1,056	0,400	0,0048***	
Homered	0,023	0,030	0,007	0,703	0,011	0,022	0,011	0,563	
Awayred	0,023	0,038	0,015	0,475	0,056	0,033	-0,023	0,472	
Homegoals	1,644	1,561	-0,083	0,643	1,611	1,600	-0,011	0,957	
Awaygoals	1,189	1,341	0,152	0,371	1,433	1,178	-0,255	0,160	
Homepoints	1,70	1,53	-0,170	0,299	1,39	1,60	0,211	0,293	
Awaypoints	1,07	1,30	0,230	0,151	1,36	1,20	-0,160	0,432	
Homepossession	No data				No data				
Homeshots	No data				No data				
Awayshots	No data				No data				
Attendance	858	31	-827	0,000***	311	156	-155	0,000***	
<i>N = 264</i>				<i>T-test</i>	<i>N = 180 (Stabak & Fart excluded)</i>				<i>T-test</i>

4.1 Yellow cards

Men:

It was found an overall significant increase in total yellow cards following the restrictions. The increase in yellow cards is still significant when adjusting for fatigue (Lastgamehome, Lastgameaway), attendance and ability (valuehome, valueaway).

Table 4

VARIABLES	(1) totalyellow	(2) totalyellow	(3) totalyellow	(4) totalyellow
2020.season	0.304*** (0.115)	0.407*** (0.116)	0.320** (0.129)	0.492*** (0.169)
valuehome		0.042*** (0.015)	0.041** (0.017)	0.026 (0.020)
valueaway		0.049*** (0.017)	0.039** (0.018)	0.035* (0.018)
Lastgamehome			0.001 (0.042)	0.004 (0.042)
Lastgameaway			-0.029 (0.042)	-0.033 (0.042)
attendance				0.000 (0.000)
Constant	3.185*** (0.082)	2.393*** (0.211)	2.692*** (0.353)	2.667*** (0.349)
Observations	960	960	835	835
R-squared	0.007	0.022	0.018	0.021

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

When comparing the seasons against each other in a T-test (Table 5) it is not found significant evidence ($H_a > 0.1$) that neither the home or away team received relatively to the opponent more or less yellow cards in 2020 compared with the season of 2019.

Table 5

```
. gen diffyellow = awayyellow - homeyellow
```

```
. ttest diffyellow, by (season)
```

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
2019	480	.15625	.0722224	1.582314	.014338	.298162
2020	480	.1395833	.0789096	1.728822	-.0154684	.294635
combined	960	.1479167	.0534583	1.656345	.0430079	.2528254
diff		.0166667	.106971		-.1932579	.2265913

diff = mean(2019) - mean(2020) t = 0.1558
Ho: diff = 0 degrees of freedom = 958

Ha: diff < 0 Pr(T < t) = 0.5619
Ha: diff != 0 Pr(|T| > |t|) = 0.8762
Ha: diff > 0 Pr(T > t) = 0.4381

Women:

In regards of total yellow cards, the same tendency was found in the women's leagues. The increase in yellow cards is still significant when adjusting for fatigue (Lastgamehome, Lastgameaway), attendance and ability (Oddshomeunited, Oddsawayunited).

Table 6

VARIABLES	(1) totalyellow	(2) totalyellow	(3) totalyellow	(4) totalyellow
2020.season	0.396*** (0.124)	0.383*** (0.125)	0.403*** (0.143)	0.441** (0.191)
Oddshomeunited		-0.007 (0.014)	0.000 (0.014)	0.001 (0.014)
Oddsawayunited		-0.015 (0.015)	-0.007 (0.017)	-0.006 (0.017)
Lastgamehome			0.048 (0.059)	0.043 (0.060)
Lastgameaway			-0.055 (0.061)	-0.050 (0.062)
attendance				0.000 (0.000)
Constant	1.500*** (0.081)	1.599*** (0.125)	1.589*** (0.268)	1.548*** (0.302)
Observations	444	436	358	354
R-squared	0.023	0.023	0.027	0.029

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The relative difference between the home team and the away team in the matter of received yellow cards increased significantly for the women's leagues. The table shows that the difference is significant even after accounting for the same factors as above.

Table 7

diffyellow	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
season 2020	.3497111	.1665115	2.10	0.036	.0222123	.6772098
Lastgamehome	.0171222	.0513926	0.33	0.739	-.083958	.1182023
Lastgameaway	.001111	.0560115	0.02	0.984	-.1090537	.1112758
attendance	-.0000565	.0001554	-0.36	0.717	-.0003622	.0002492
Oddshomeunited	-.0262576	.0129166	-2.03	0.043	-.0516623	-.0008529
Oddsawayunited	.0662377	.0169126	3.92	0.000	.0329735	.0995019
_cons	-.4624904	.2747584	-1.68	0.093	-1.002892	.077911

4.2 Red cards

No significant increase in red cards for neither of the leagues were found (P-value > 0.1).

Table 8

VARIABLES	(1) totalred	(2) totalred	(3) totalred	(4) totalred
2020.season	-0.008 (0.033)	0.017 (0.026)	0.023 (0.029)	-0.011 (0.036)
Constant	0.137*** (0.022)	0.083*** (0.018)	0.045** (0.018)	0.067** (0.026)
Observations	480	480	264	180
R-squared	0.000	0.001	0.002	0.001

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

(1) Sweden Men

(2) Norway Men

(3) Sweden Women

(4) Norway Women

4.3 Goals

Table 9

Men VARIABLES	(1) totalgoals	(2) diffgoals	(3) Homegoals	(4) Awaygoals
2020.season	0.173 (0.111)	-0.206* (0.119)	-0.017 (0.088)	0.190** (0.073)
Constant	2.810*** (0.079)	0.506*** (0.083)	1.658*** (0.062)	1.152*** (0.052)
Observations	960	960	960	960
R-squared	0.003	0.003	0.000	0.007

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

(1) Homegoals + Awaygoals

(2) Homegoals - Awaygoals

Men:

It was found a significant increase in away goals for men's leagues between the seasons. Analyzes (Table 10) suggests that away goals increase with decreasing attendance. The table show consistency in this matter when adjusting for ability and fatigue. The same tendency is found when controlling only the 2019 season (4) when the normal number of spectators were present at the stadium throughout the season.

The attendance coefficient is small as it measures the change in one spectator. The coefficient varies between -.0000282 and -.000019 which means that a decrease of 1000 spectators increased the expected away goals with between 0,028 and 0,002.

Table 10

Men VARIABLES	(1) Awaygoals	(2) Awaygoals	(3) Awaygoals	(4) Awaygoals
attendance	-0.000*** (0.000)	-0.000*** (0.000)	-0.000** (0.000)	-0.000** (0.000)
valuehome		-0.055*** (0.010)	-0.051*** (0.011)	-0.037** (0.016)
valueaway		0.048*** (0.012)	0.047*** (0.013)	0.037** (0.017)
Lastgamehome			-0.008 (0.026)	-0.013 (0.033)
Lastgameaway			-0.008 (0.026)	-0.014 (0.035)
Constant	1.354*** (0.044)	1.376*** (0.128)	1.424*** (0.198)	1.500*** (0.300)
Observations	960	960	835	415
R-squared	0.018	0.061	0.057	0.056

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

(1)-(3) Effect with new variables added both seasons included

(4) 2019 season

Women:

There was not found any statistically significant difference in goals scored for the women's leagues between the seasons (P-value > 0.1).

4.4 Points

Men:

As points is the product of the difference of goals scored for respectively the home team and the away team it was expected a decrease in the difference of points between the teams (home points – away points) in 2020 following the increase of away goals in the men's leagues in 2020 (see chapter 4.3). The tendency in the dataset is as expected but only significant on the weakest level and not significant when adjusting for fatigue (3) which makes the number of observations smaller (see chapter 3.4).

Table 11

VARIABLES	(1) diffpoints	(2) diffpoints	(3) diffpoints
2020.season	-0.313* (0.162)	-0.298* (0.160)	-0.224 (0.180)
valuehome		0.151*** (0.020)	0.143*** (0.023)
valueaway		-0.138*** (0.023)	-0.141*** (0.025)
Lastgamehome			-0.024 (0.058)
Lastgameaway			0.011 (0.059)
Constant	0.619*** (0.113)	0.508* (0.291)	0.644 (0.475)
Observations	960	960	835
R-squared	0.004	0.077	0.078

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Women:

There was no statistically significant difference in points between the home and away team in the women's leagues between the seasons (P-value > 0.1).

5.0 Discussion

As there is limited similar research on women's football in this field, it is found convenient to compare the result with men's data. However, firstly the data on men's football is discussed upon previous research.

The ultimate measure of home advantage in a football match is the win/lose frequency of the home team. Events during a match such as yellow cards can be a crucial factor for what adds up to the home advantage in the single match.

Yellow cards:

The increase in total yellow cards contradicts the expectation that yellow cards decreases when the stands are empty. Reade, Schreyer and Singleton (2020) found on overall level that the difference of yellow cards between the home and away team was eliminated when the stands were empty. Yellow cards to the home team did not change which means that the total yellow cards were reduced. The mentioned paper was conducted using data from the Italian leagues, France and European tournaments.

On the other hand, an increase of total yellow cards is aligned with similar research done following the Covid-19 outbreak by Cueva (2020). It was found an increase in yellow cards for the home team that eliminated the home advantage that existed prior to Covid-19. The rule of allowing two additional substitutions, from three to five¹, came into force in the Norwegian and Swedish leagues from the 2020 season, and Cueva suggests that this change of rule gives the teams manager an extended opportunity to substitute players that already are booked with a yellow card and change him/her with another player that is not afraid of being booked with a first yellow card. Moreover, substitutions speak for a higher intensity throughout the game as tired legs are replaced with fresh, evident in a study by Padrón-Cabo et al. (2018) which found that "*substitutes covered by 9% and 24% more distance*".

The effect of referee bias on home advantage is well documented on bigger leagues with high attendance. Most games played in Swedish and Norwegian leagues are normally played with less than 10 000 spectators. It is not found any statistical evidence that the difference in yellow cards changed significantly in the 2020 season when the spectators disappeared. This suggests that the spectators in Swedish and Norwegian leagues does not have the same level of influence on referee decisions as in leagues where the crowds are bigger. The

¹ <https://soccer.nbcsports.com/2020/07/15/five-substitute-rule-extended-to-2021-by-fifa/> (accessed 24.5.21)

literature review by Dohmen and Sauermann (2016) which concluded with the existence of a referee bias, did in general include papers that assessed bigger leagues, in the case of attendance, than the Norwegian & Swedish ones.

Points and goals:

Aligned with recent studies in men's football (Reade, Schreyer and Singleton 2020) (Cueva 2020) it is found a decreased home advantage in this study as the difference in goals between the home and away team decreased, due to an increase in away goals. The home and away team did also gather a more similar number of points in the Covid-19 season aligned with the mentioned research, which is as expected following the mentioned studies.

Women:

The T-test in Table 3 revealed a significant increase of yellow cards for the away teams in both countries. The away teams received a lower number of yellow cards than the away teams in 2019 which contradicts the present literature on home advantage. The results compared with results for the men's leagues indicate that the yellow cards for the away team in 2019 was lower than expected and was adjusted to a normal level in 2020. A timely question is to look into what happened in the women's leagues in 2019. But this question is not considered in this study as the database would have to be extended with previous seasons. A suggestion is that an ever increasingly professionalization of the women's leagues can explain that the leagues approaching the numbers we see in men's leagues.

Consequently, Covid-19 did not seem to have any effect on the variables measured for the women's leagues. The difference in circumstances in the case of attendance pre and during Covid-19 did not change that much for the women's leagues as the allowed attendance was close to normal in the measured Scandinavian women's leagues.

6.0 Conclusion

Men:

The results suggest that Covid-19 restrictions and regulations have influenced home advantage, as the home team evidently received a closer number of points to the opponent and the away team scored more goals.

In the case of increase in total yellow card (both teams received more yellow cards) it cannot be said with certainty what caused this, but the increase in available substitutions is a plausible explanation put forward by Cueva (2020).

The non-significant change in difference of yellow cards between the seasons suggests that referee bias in minor leagues such as the Norwegian and Swedish leagues are different from larger leagues but this needs attention in future research.

Women:

It is found that women's football experience the same mechanism of home advantage independently from the Covid-19 situation as it is discovered that the home team in general scored more goals and gathered more points than the opponent. It was not found consistency upon previous research in regard to differences between the teams of received yellow cards.

Differently from the men's leagues, it was not found that the Covid-19 restrictions influenced the women's leagues. Reasons for this is discussed and may be related to the fact that women's leagues did not suffer that much from attendance restrictions as the normal attendance is low. However, physical and psychological gender differences cannot be overlooked as other possible explanations.

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