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The effect of Saturday matches on stadium attendance in Norwegian Eliteserien

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Abstract

Research question. The paper studies the effect of matches scheduled on Saturdays on stadium attendance in the Norwegian Eliteserien division.

Research method. We estimate how scheduling the match on Saturday influences the stadium attendance using data on every match in the seasons from 2009 to 2019 of the Norwegian Eliteserien. We estimate various specifications using the OLS method with robust residuals.

Results and findings. There is a significant positive effect of Saturday matches on stadium attendance of Eliteserien teams.

Implications. The results of this study suggest that it is possible to achieve financial improvements if more football matches were scheduled on Saturday.

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Chapter 1. Introduction

In 2017, Eliteserien signed an agreement with Discovery for TV broadcasting. It seems that some major changes have been done to the scheduling in favor of the new TV broadcaster. The number of matches played on Saturdays dropped from 43-50 in the seasons 2013-2016 to 27-37 in 2017-2019 seasons. The league is probably expecting to increase its TV broadcasting revenue and compensate for the recent decline in gate receipts.[1]

Since the early 1990s, the European football has gone through extreme changes, largely due to the fast development of the global sports broadcasting. The top European leagues went out of their local markets to compete for the international TV audience. The last decade was highly successful for the European football when the revenue of all the European leagues combined increased by 80%. However, as their revenue continued to grow, so too did the inequality between the large and small leagues. By the end of 2018, the largest portion of the global TV market belonged to the top 5 European leagues (England, Spain, Germany, Italy and France). According to the UEFA club licensing benchmarking report (2018), they earned 88,4% of the total €7,9bn of the TV broadcasting revenue and 75% of the total revenue.

Many European leagues were able to improve their financial situation in this period by making it a priority to maximize the TV broadcasting revenues. According to the same UEFA report, the income sources are generally allocated as follows: TV broadcasting (37%), gate receipts (15%), UEFA revenue (10%), sponsorship (22%), commercial (8%) and other (7%).

The Norwegian Eliteserien was among the leagues with less share of the TV broadcasting revenue. According to UEFA (2018), its revenue is allocated as follows: TV broadcasting (17%), gate receipts (15%), UEFA revenue (12%), sponsorship and commercial (41%), and other sources (15%). The Norwegian top-tier division is a small league. It has ranked 22nd in the recent UEFA ranking published in 2019.[2] The league has also been outside the top 20 for the last ten seasons, so its position is weaker than that of many other leagues on the continent. Evidently, as a small league, Eliteserien has limited possibilities of growing the revenue from the TV contracts. It still heavily relies on the gate receipt, which has traditionally been a major source of its income. The situation puts an extra pressure on the Norwegian clubs that struggle to keep their fans at the stadium. It seems important that the league should focus on keeping the average stadium

[1] In 2016 the combined gate receipt revenue of Eliteserien clubs went down by 16% registering the greatest decline among the top 20 leagues (UEFA, 2016).

[2] https://www.uefa.com/memberassociations/uefarankings/country/#/yr/2020

attendance as high as possible. But over the last decade it has dropped by 35%. When taking into account the size of the stadium, the attendance as share of the stadium capacity has dropped by about 12 percentage points.

One of the cornerstones of the stadium attendance is the scheduling of matches. There are many stakeholders whose interests affect the scheduling. But the fans seem to have the least power to have a say in scheduling procedure. However, if the fans prefer certain days of the week (Wang, Goossens & Vandebroek, 2018) or a specific kick-off time of the game (Krumer, 2020), it's important to consider these preferences when planning the schedule because they are ultimately the ones who choose to come or not to come to the match.

According to the Norwegian Football Federation, the scheduling process in Eliteserien includes two stages. First, the clubs and the TV broadcaster send their suggestions on the best day and time of the match. This information along with other scheduling constraints (number of breaks etc.) enter the mathematical program that calculates the best schedule. Nevertheless, the kick-off time and date are eventually decided by the clubs and TV broadcasters, but those two have different rationale. Moreover, clubs don't always know their fans and what's important to them. The TV broadcaster might prefer weekend evenings, so that more people can watch football, but the stadium fans might refuse to come to matches that end too late because they won't be able to travel back home from the stadium. One possible solution to the problem could be the optimization of the tournament schedule that maximizes the stadium attendance. Along with the increased revenues, higher stadium attendance could bring more sponsorship and lead to better TV broadcast contracts in the future.

Over the last two decades, a substantial scientific effort has been dedicated to analyzing how scheduling operates in sports in general and football particularly. Most research has been concentrated on the top European soccer leagues, such as Italian top division (Della Croce & Oliveri, 2006), English top four divisions (Kendall, 2008), Belgian top division (Goossens & Spieksma, 2009; Wang, Goossens & Vandebroek, 2018), German Bundesliga (Krumer and Lechner, 2018), and various top European leagues (Goller, Krumer, 2020; Yi, Goossens & Nobibon, 2020). Some works have covered leagues from non-European countries, such as the Brazil (Ribeiro & Urrutia, 2007). However, there seems to be no research investigating the minor European leagues and how scheduling optimization could benefit the leagues where stadiums struggle to sell tickets even for the biggest matches. The only exception is Goossens and Spieksma (2012) who examined 25 European leagues in the 2008-2009 season (the 2008 season in case of

Norway) and found that nearly half were still using the so-called "canonical schedule", a scheduling method developed at least a century ago (Mendelsohn & Rosa, 1985). Norway was among the leagues who had abandoned that method, perhaps, due to the developed mathematical programming. A detailed discussion about the scheduling in Norway could also be found in Flatberg (2009).

While historically most matches in Eliteserien have been scheduled on Sundays, we've noticed that most derbies and high-status matches have been held on Saturdays. Could it be that matches on Saturdays have the potential of attracting more audience to the stadiums? As a comparison, the English Premier League, French Ligue 1 and German Bundesliga has the most football matches on Saturdays (Goller & Krumer, 2020).

The purpose of this study is to demonstrate the potential of scheduling more matches on Saturdays. Currently, most matches in the Norwegian Eliteserien take place on Sundays with a kick-off time at 18:00 or later. It seems that such a schedule structure may not be convenient for many fans who start their workweeks on Monday morning or have families with kids. Additionally, evenings are usually colder, which may also be a reason why some people decide to stay home rather than attend a football match. These factors might partly explain the decreasing stadium attendance in Norway, which has dropped by 35% over the last ten years.

Chapter 2. Description of the Norwegian football

Norwegian football market

Buraimo, Tena and de la Piedra (2018) assume that to better understand a football market and the demand for attendances, it's important to characterize whether it can be described as a well-established market or emerging market and whether the economy it operates in is developing or developed. According to the OECD's classification, Norway is a developed country and belongs to the category of I Repayment.[3] The United Nations Human Development Index has ranked Norway number one for six consecutive years, including in 2019.

The framework of football market classification is not very well established, so allocating the Norwegian football market to a certain category is not that easy. According to Buraimo, Tena and de la Piedra (2018), developed football markets are well-established, have a rich history and generate significant non-domestic revenue. Such markets have limited potential to increase their

[3] https://www.oecd.org/trade/topics/export-credits/documents/oecd-export-credits-prevailing-list-of-countries-repayment-terms-and-aid-eligibility.pdf

stadium attendance. The main purport of the federations of such markets is to facilitate the competition with other leagues on the global market. As for the developing or emerging markets, although they may have been established many decades ago, they are not that evolved as a professional sport. Such leagues may face intense competition with developed football markets from developed economies, and they often lose their best players to more established football leagues. The attendance in such leagues may be less affected by income and economic security (unemployment) than by product quality and fans preferences.

Eliteserien was founded in 1937 and was initially called Norgesserien. Since then, it had had a few major structural changes until it finally became a professional football league in 1991. Following the Fossoy, Moe and Fretland (2017) we will briefly discuss the history of the top Norwegian division from 1960s (when many developed European leagues became professional) to 1990s to better understand and classify today's football market in Norway.

On August 20, 1960 the state-owned monopoly NRK started broadcasting Norwegian football matches pushing out all the other TV channels in the period from 1960 to 1981. The NRK monopoly continued for more than 20 years and was probably one of the reasons why the Norwegian football had waited so long to become professional. The clubs could not earn money on broadcasting and had no power to influence the state policies. In the 1970s, the Norwegian Football Federation (NFF) started selling NRK broadcasting rights for the top league matches. Thanks to live broadcasts of English matches, football gained popularity on TV. Over the following decade the business took interest in advertising through football, but the state-owned NRK was a commercial-free channel. At the time, all Norwegian athletes, including football players, were mostly amateurs. Throughout the 1970s there was an ongoing debate on professionalism and amateurism in sports, and by the end of the decade the special committee (Idrettstinget) decided there was no grounds to oppose the professionalization of football by the internationally established rules. By 1991, the top Norwegian football league was ready to become professional.

Nevertheless, Norway professionalized football 24 years later than Sweden (1967), 13 years later than Portugal (1978), 28 years later than Germany (1963), 37 years later than Netherlands (1954) and 103 years later than England (1888).[4] The 20 years of the NRK monopoly and ban on advertisement, as well as amateurism in sport made it very hard for the Norwegian

[4] For additional information see Billing, Franzén and Peterson (2004), https://www.ligaportugal.pt/pt/40anos/ , https://web.archive.org/web/20110423074449/http://www.bundesliga.com/en/liga/news/2008/index.php?f=127776.php , https://www.knvb.com/about-the-knvb/history , https://www.efl.com/-more/all-about-the-efl/

football market to catch up with the leading European leagues. Therefore, it can be assumed that the Norwegian football is still in its early stage and this market can be considered emerging (see *Table 1*).

Table 1. Classification of football markets

		Country by economic level	
		Developed	*Developing*
Football market	*Well-established*	Big 5*, Portugal, Netherlands	Brazil, Argentina
	Emerging	**Norway,** USA, Japan, Australia	China, India, Peru

* All inputs except Norway are taken from Buraimo, Tena, de la Piedra (2018).

The 2016 UEFA club licensing benchmarking report showed that the TV broadcasts generated 16% of the total revenue of €146m for the Norwegian Eliteserien clubs with an aggregate revenue of €23m and growth of 11%, whereas the gate receipts reached 18% and €26m in total. However, the latter dropped by 16% in 2016 scoring the greatest decline among the top 20 leagues in the gate receipt. The average gate receipt for Eliteserien reached €1.6m per club in 2016, which was the 16th result among Europe's top division leagues. The average yield or the price of attending the football match per spectator amounted €14.9 putting the league on the 14th place among the European top division leagues – less than in Sweden by €1.6, and less than in Denmark by €6.4.[5]

The following year, the total revenue of Eliteserien clubs increased by €6m and reached €152m. However, the gate receipt remained the same composing 17% of the total revenue (UEFA, 2017). According to the 2018 UEFA club licensing benchmarking report, Norway was among 17 countries (out of 55) who had reduced their aggregate revenue by about 5%, dropping to the level of 2016 (€146m). The structure of the total revenue slightly changed compared to 2016: the TV broadcasts generated 17% of the total revenue, while the gate receipts brought only 15%, equaling €21m euro in 2018 was less than in 2017 by 15% and less than in 2016 by 19%. For example, in Sweden the gate receipts generated 23% of the total revenue of 154m euro in 2018. Although, Norway marked the highest decline among the top 20 European leagues, the average yield per spectator increased by almost 80% and reached €26.6 in 2018 – the fifth result among the European leagues, only €5 less than in Sweden and €20,4 more than in Denmark.

[5] The average yield is calculated by dividing gate receipt revenues by the number of attendees at league and UEFA competition matches. The actual "true" yield covering all competitions and friendly matches can be expected to be slightly lower (UEFA, 2018).

The recent decline in the gate receipts was compensated by the increased revenue of the TV broadcast after Eliteserien had signed a new deal with Discovery in 2017. However, in the future, the TV revenue might not be increasing fast enough to compensate for the decline in the gate receipt revenue. Therefore, the Norwegian clubs still heavily depend on the match-day revenue, and if they continue to lose spectators, they might face grave financial challenges, which will lower their chances to perform well internationally and worsen the already weak financial situation. Considering the growing competition with the top European leagues, the future of the Norwegian football does not look too bright.

Description of Eliteserien

Our focus is the top Norwegian football league, or Eliteserien, as it was called starting from the 2017 season. To avoid confusion, we will use this name regardless of the time period, though our analysis will cover 11 seasons from 2009 till 2019 when the latest season prior to this research was completed. One of the reasons to limit the dataset to the last 11 seasons was the fact that in 2009 Eliteserien tournament was expanded by two additional teams and since then it consisted of 16 teams in total. If we include the 2008 season, the different tournament structure might affect the consistency of the results, so we will analyze the period while the league structure stayed the same.

The tournament has a round-robin structure when each of the 16 teams plays with all the other 15 clubs twice – once at home and once away. In total, each team plays 30 matches in one season – 15 at home and 15 away. Thus, the regular tournament consists of 30 rounds of 8 matches usually played during a single week, though there were cases when matches of some rounds were played much later than the rest of the round.

Clubs get three points for a win, one point for a draw, and no points for a loss. Those who finish 15th and 16th by the end of the season relegate to the second-tier league, while the 14th team enters the promotion/relegation play-off. The champion of the season enters the UEFA Champions League for the next season. For example, the champion of the 2018 season, Rosenborg BK, entered the first qualifying round of the 2019/2020 UEFA Champions League with three rounds of qualification in total. The last time a Norwegian club participated in the group stage of the UEFA Champions League was Rosenborg BK in the 2007/08 season.

Table 2. Eliteserien tournament structure

Season	First match	Last match	Difference in weeks	Last round		Summer break, week number	
	Week number			Day	KOT	Start	End
2019	13	48	35	Sunday	18:00	29	31
2018	10	47	37	Saturday	18:00	27	31
2017	14	48	34	Sunday	18:00	30	32
2016	11	45	34	Sunday	18:00	No break	
2015	15	45	30	Sunday	18:00	28	30
2014	13	45	32	Sunday	18:00	No break	
2013	11	45	34	Sunday	18:00	No break	
2012	13	47	34	Sunday	18:00	No break	
2011	12	48	36	Sunday	18:00	27	29
2010	11	45	34	Sunday	18:00	32	34
2009	11	44	33	Sunday	18:00	28 31	30 33

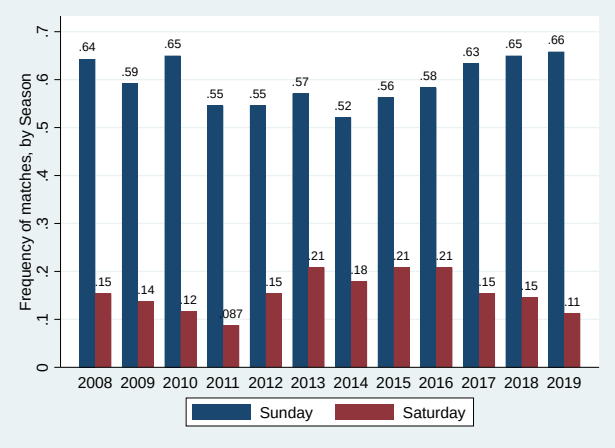
Eliteserien season's starting and ending dates had been changing between seasons with no clear pattern (*see Table 2).* Seasons usually start between week 10 and week 15 (in the annual calendar) and end between week 45 and week 48. It usually takes between 30 to 37 weeks to run all 30 rounds, with most seasons lasting 34 weeks. Seven out of eleven Eliteserien seasons had at least a two-week summer break, usually in July. Moreover, the actual interval between the last match before the summer break and the first match after the break varies between the clubs.

It is also interesting that in every season all matches in each of the last two rounds were played at the same time. The kick-off time (KOT) of these matches was set at 18:00, usually on Sundays except for the 2018 season. There was always a one-week interval between the 29th and 30th rounds, except for the 2018 season when the interval between the last two rounds lasted 13 days.

Eliteserien schedule

In Eliteserien, most matches are scheduled in the weekend, with more than 50% of the total matches played on Sundays and about 10-20% of matches played on Saturdays (see *Figure 1a*). In the recent six seasons the share of Sunday matches was gradually increasing from 52% to 66%, and the share of Saturday matches decreased from 21% to 11% between 2013 and 2019 seasons. In 2019, the share of Sunday matches in Eliteserien was 55 percentage points higher than the share of Saturday matches, which is the highest difference in the observed seasons. More than 80% of the Sunday matches in Eliteserien (more than 95% in 7 out of 12 seasons, see

Figure 1b) had a kick-off time at 18:00 or later. Moreover, in the last three seasons almost 100% of Sunday matches kicked off at 18:00 or later.



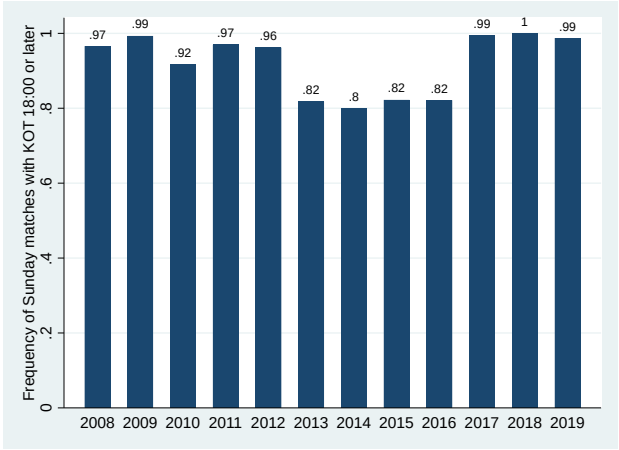


Figure 1a. Frequency of Sunday and Saturday matches from total matches in Eliteserien
Figure 1b. Frequency of Sunday matches with KOT 18:00 or later from total Sunday matches in Eliteserien

Eliteserien scheduled summer matches with different proportion of weekend matches as in the rest of the season. During the summer months the share of Saturday matches was usually higher than the rest of the season, although there is no observable solid pattern (see *Figure 2*). The highest proportion of Saturday matches during the summer months was 32% in the 2013 season. The share of Sunday matches in Eliteserien in summer was similar to the rest of the season.

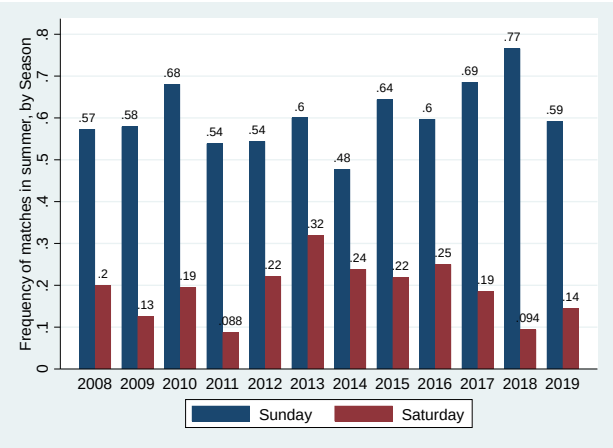
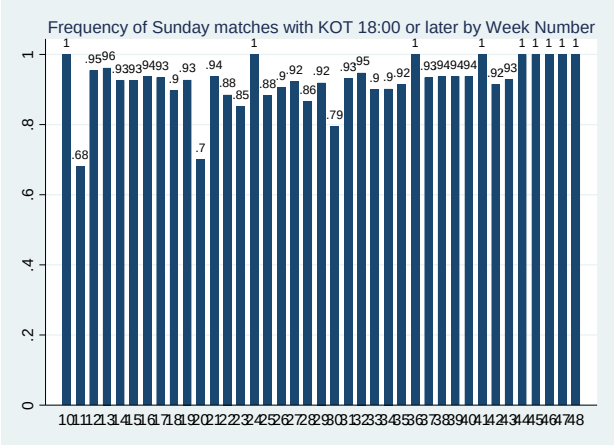


Figure 2. Frequency of Sunday and Saturday matches from total matches in summer in Eliteserien

To demonstrate the full picture of Eliteserien weekend match scheduling, we checked the frequencies of late Saturday and Sunday matches by calendar weeks. Except for some weeks in

summer, the share of late-Sunday matches was higher than 90% for the entire season (see *Figure 3a*). The share of late Saturday matches was higher in summer (see *Figure 3b*), but no clear pattern that can be traced.



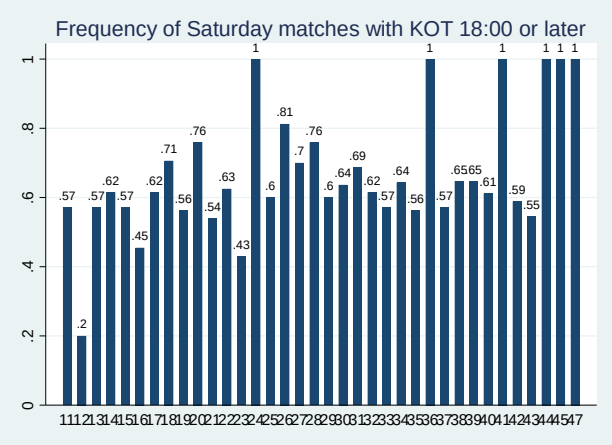


Figure 3a. Frequency of Sunday matches with KOT 18:00 or later from total Sunday matches, by week number in Eliteserien
Figure 3b. Frequency of Saturday matches with KOT 18:00 or later from total Saturday matches, by week number in Eliteserien

The typical weekend in Eliteserien consisted of 4-6 matches on Sunday, usually with kick-off time at 18:00, 1-2 matches on Saturday, and a match on Monday or Friday. In rare cases, matches were played on other weekdays (*see Table 3*). During the first half of the season some of the rounds (3-7 rounds in different seasons) didn't have any matches on Sunday. Most of these matches were played on a different day of the week, be it on Saturday, Monday, Thursday or Friday. The reason of these changes is that the schedule must consider international breaks of national teams' matches, which often take place in May and the beginning of June.

Table 3. The distribution of matches by days of the week, number of matches

Weekday	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
Monday	**34**	**38**	**39**	**32**	**17**	24	14	14	**29**	**36**	**26**	**303**
Tuesday	3	1	0	2	4	8	4	0	8	0	2	32
Wednesday	15	13	8	14	3	2	9	8	5	12	6	95
Thursday	12	4	21	3	14	14	6	9	5	0	9	97
Friday	1	0	20	21	15	24	**22**	**19**	4	1	12	139
Saturday	**33**	**28**	21	**37**	**50**	**43**	**50**	**50**	**37**	**35**	**27**	**411**
Sunday	**142**	**156**	**131**	**131**	**137**	**125**	**135**	**140**	**152**	**156**	**158**	**1563**
Total	240	240	240	240	240	240	240	240	240	240	240	2640

The distribution of matches by weekdays and kick-off time largely depended on the TV deal that Eliteserien had signed. Over the 11 seasons, Eliteserien had three different TV partnerships. The first TV deal lasted from 2009 to 2012: Lyse Energi purchased rights for five

Sunday matches, NRK owned the rights for one Saturday match, while TV2 got evening matches on Sundays and Monday matches. However, in the 2011-2012 seasons NRK was replaced by MAX, which broadcast matches on Saturdays, Fridays or Thursdays. Therefore, during these seasons about three matches of each round – all on different days of the week – were broadcast on the public TV and were available for most Norwegians. During this period most matches had the kick-off time at 18:00 or later with only 5-10% starting earlier (see *Table 4*).

Table 4. The distribution of matches by kick-off time, number of matches

Hour	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
14	0	0	1	0	0	0	0	0	0	0	0	1
15	0	7	0	0	53	52	45	50	6	5	4	222
16	21	12	13	11	0	0	0	0	1	0	2	60
17	0	18	0	0	1	1	0	0	0	1	0	21
18	**148**	**141**	**140**	**145**	**133**	**126**	**139**	**123**	**169**	**187**	**164**	**1615**
19	38	35	58	62	51	50	29	41	34	20	36	454
20	30	27	27	21	2	11	27	26	30	27	32	260
21	3	0	1	1	0	0	0	0	0	0	2	7
Total	240	240	240	240	240	240	240	240	240	240	240	2640

The next TV deal included four seasons from 2013 to 2016. About 20% of the matches in this period had kick-of time at 15:00, and only two matches of each round were broadcast on the public TV by TV 2 or TV 2 Zebra with the total of 240 matches in four years. Out of these matches only 11 were played on Saturdays, and 109 took place on Sundays.

From the 2017 season, the Eliteserien TV rights have been bought by Discovery, and the number of matches starting at 18:00 increased to 68-78%, with almost 100% matches starting at 18:00 or later. The number of matches broadcast on the public TV (Max or TV Norge) decreased to 48 in 2017, and 45 in 2018-2019. Almost half of the 138 matches on the public TV were played on Mondays (63), 38 were played on Sundays, and only 16 on Saturdays.

Chapter 3. Data

Theoretical framework

This section will discuss what data should be included in our analysis and how to obtain these data from the open sources. One of the important procedures when measuring the effect of Saturday matches on attendance is to separate the effects of other factors that are correlated both with the probability of allocating matches on Saturdays and the stadium attendance. Thus, to select these factors and include them in our analysis, we will follow the scientific work on the determinants of stadium attendance demand.

One of the first studies on the football attendance was published by Bird (1982). Since then, the body of literature on the subject has grown substantially, and the context has become broader covering such topics as the analysis of broadcasting, market size and scheduling and other determinants of stadium attendance. A number of studies are concerned with developed economies and established football markets (Buraimo & Simmons, 2008; Buraimo & Simmons, 2009; Domizio & Caruso, 2015; Besters, van Ours & van Tuijl, 2018 and others) or developed markets in the developing economies (Buraimo, Tena & de la Piedra, 2018).

Fewer studies concentrate on such leagues as Eliteserien or Allsvenskan that operate in the developed economies but fall below the top 20 European leagues of the UEFA ranking.[6] Two papers focus on Norway: Solberg & Mehus (2014) and Kringstad, Solberg & Jacobsen (2018). Both discuss the impact of the TV broadcasting on stadium attendance in Eliteserien and conclude that the public TV is an important determinant of stadium attendance.

Overall, we selected about 30 different variables from the literature on the stadium attendance demand, which can be roughly grouped into seven categories (see *Figure 4*):

- Economics/demographics
- Geographic
- Teams related
- Match specific
- TV broadcast
- Scheduling
- Season

Some of the factors presented in the *Figure 4* have not been included in the final regression, mainly because of the lack of information on these variables. Others have not been included to avoid the multicollinearity problem. But generally, we have considered all the factors to be important and haven't utilized any selection mechanism to eliminate any of them.

[6] https://www.uefa.com/memberassociations/uefarankings/country/#/yr/2020

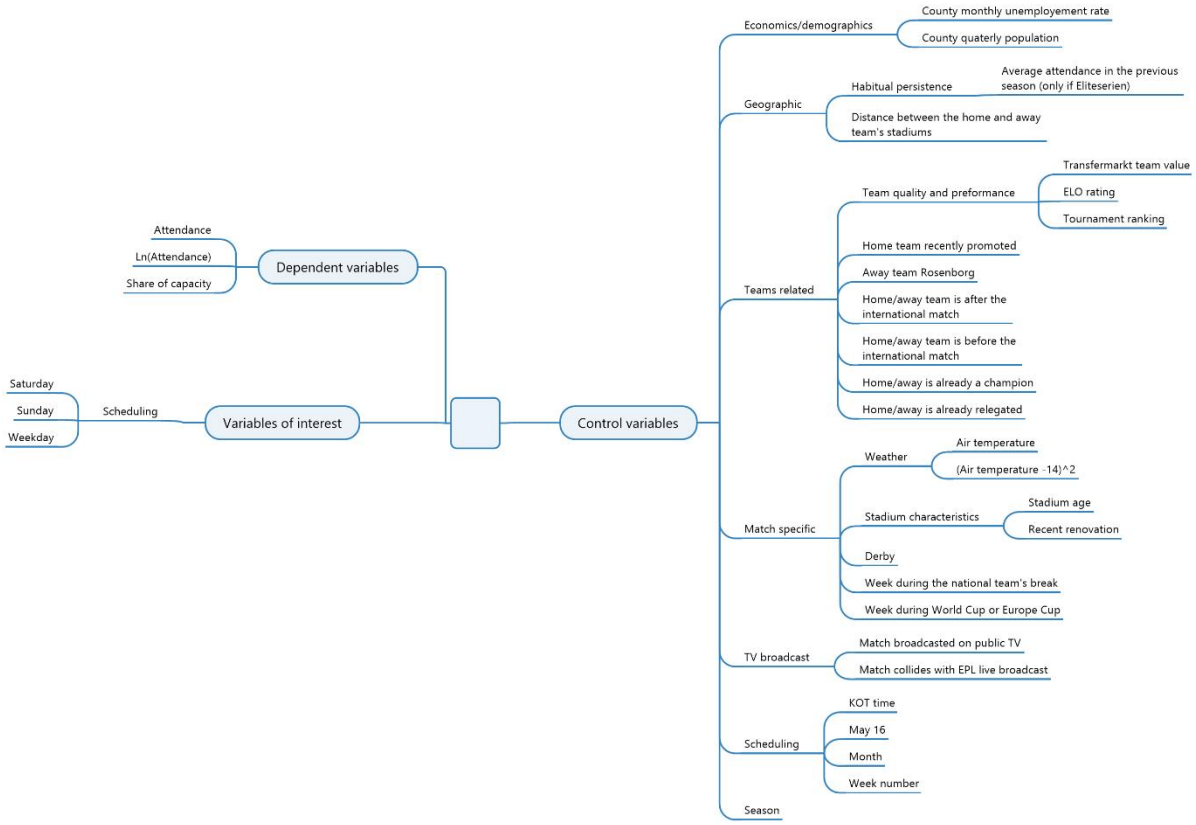


Figure 4. Variables scheme

Eliteserien average attendance

Data on all Eliteserien matches from 2008 to 2019 have been collected from various sources. The main sources for football-related data were Transfermarkt[7] and the Norwegian Football Association.[8]

To estimate on the relationship between Saturday matches and attendance, we have introduced a set of outcome variables on the level of a single match between a home and away team. The first represents the total number of fans attending the stadium during the match. Metrics of the stadium attendance have been mainly collected from Transfermarkt except for several matches with missing or corrupted information, for which the data have been taken from the Norwegian Football Association. Most clubs reported total attendance as a sum of seasonal tickets plus single-match tickets sold. However, some clubs reported the actual number of spectators at the stadium. To control for possible non-linearity in the effects on the dependent

[7] https://www.transfermarkt.com/tippeligaen/startseite/wettbewerb/NO1
[8] fotball.no

variable, we build a natural logarithm of attendance as one of the main outcome variables (Buraimo & Simmons, 2015; Buraimo, Tena & de la Piedra, 2018).

We then define the share of capacity by dividing the total attendance of each match by the stadium capacity of the venue where the match took place. To collect the stadium capacity and the stadium age, we have gone through each stadium individually tracking the historical data on how the stadium capacity had changed over the last 11 years. Most stadiums had a detailed description on their clubs' websites, but in some cases the information was collected from Wikipedia or Nordic Stadiums website. [9]

The seasonal average stadium attendance in Eliteserien has been steadily decreasing since 2009 dropping by 35,5% over the 11 years (see *Table 5*). All the 11 seasons have been showing a decrease in average attendance, except in 2014 and 2016, with the highest drop of 12,5% in 2018. As a comparison, the Swedish Allsvenskan increased its average attendance by 7,6% during the same period, though with more fluctuation, with five seasons registering the drop in average attendance (max. 16,8%) and five other recording the increase in average attendance (max. 39%).

To eliminate the abnormal effect of almost 40% increase in the Allsvenskan attendance in 2015, we will split all nine seasons into two periods: from 2009 to 2015 and from 2015 to 2019. During the first period the Eliteserien average attendance decreased by 22,3%, while the Allsvenskan average attendance decreased by 11,7%. During the second period the Eliteserien average attendance decreased by 13,8% and the Allsvenskan average decreased by 12,1%. Therefore, both leagues show similar trends of negative attendance.

Table 5. Average attendance in Eliteserien and Allsvenskan

Eliteserien	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	Average
Av attendance	8960	8107	7994	7019	6823	6952	6710	6971	6698	5864	5782	7080
Av share of capacity	68,5%	65,0%	62,0%	64,2%	59,6%	60,9%	61,0%	60,2%	62,3%	60,4%	60,6%	62,3%
Attendance change		- 10%	- 1%	- 12%	- 3%	2%	- 3%	4%	- 4%	- 12%	- 1%	
Share of capacity change		-3,5pp	-3pp	2,2pp	-4,6pp	1,3pp	0,1pp	-0,8pp	2,1pp	-1,9pp	0,2pp	
Allsvenskan												
Av attendance	8514	7086	7589	8101	7672	7527	10426	9671	9829	8761	9164	8577
Av share of capacity	58,0%	53,1%	53,5%	56,6%	51,4%	50,2%	62,0%	61,0%	63,6%	51,7%	55,0%	56,0%
Attendance change		- 17%	7%	7%	- 5%	- 2%	39%	- 7%	2%	- 11%	5%	
Share of capacity change		-4,9pp	0,4pp	3,1pp	-5,2pp	-0,8pp	11,8pp	-1.0pp	2,6pp	-11,9pp	3,3pp	

[9] http://www.nordicstadiums.com/

From 2009 to 2014 the average share of stadium capacity in Eliteserien dropped from 68,5% to 60,9%. During the same period, it was 8-12 percentage points higher than in Allsvenskan. During the 2015 season the average share of capacity in Allsvenskan increased by more than 10 percentage points and became higher than in Eliteserien, though dropping back in 2018-2019 seasons. Overall, in all the seasons except 2014 the average share of capacity in Eliteserien was higher than 60% (see *Figure 5*).

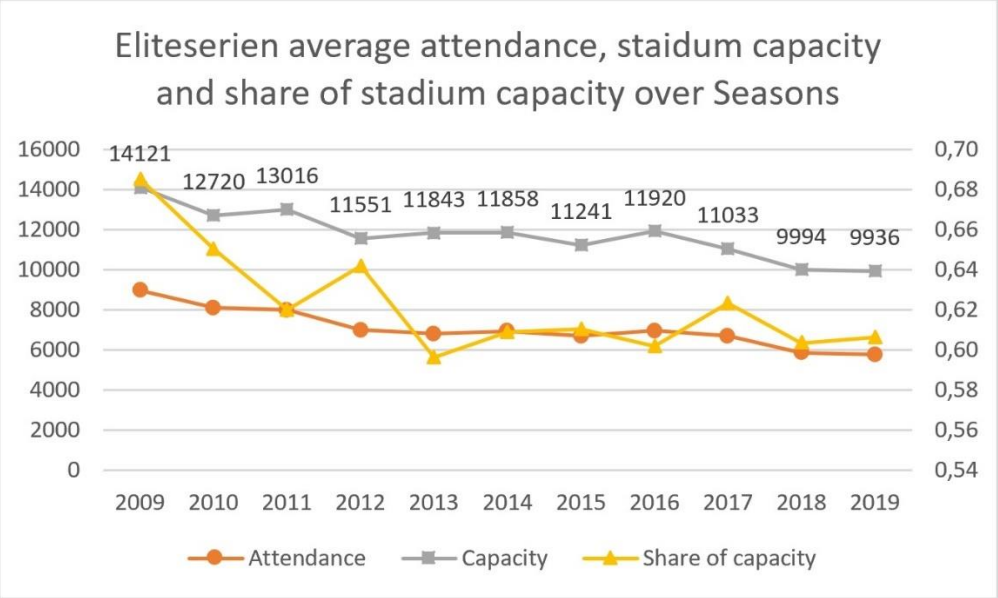


Figure 5. Eliteserien average attendance, stadium capacity and share of stadium capacity

The average stadium capacity of the Eliteserien teams decreased by 29.6% from 14 121 in 2009 to 9936 in 2019 (*see Figure 5*). The decrease in average stadium capacity can be perhaps explained by the fact that new clubs in the tournament had smaller stadiums than the clubs they had replaced. For example, by end of 2012, Fredrikstad with the average capacity of 12 169 people was relegated to the second-tier league and replaced by Sarpsborg 08 with the average capacity of 8022. By end of 2017 Aalesund with the average capacity of 10 778 was relegated and replaced by Ranheim (average stadium capacity: 3000). Moreover, the average stadium capacity might have declined because the clubs reduced their stadium capacities during renovation to make the stadiums more comfortable for the audience or adapt them to the declining interest of fans. In any case, since 2013 the average share of stadium capacity has been relatively stable – between 60% and 62%.

Eliteserien attendance

In the 11 seasons between 2009 and 2019, the total of 25 clubs participated in Eliteserien: 11 clubs participated in 10 or 11 seasons, and eight clubs participated in less than five seasons

(see Table 6). Out of all the 25 clubs, 13 marked the average attendance of less than 5000 for all the seasons of Eliteserien during the observation period. Out of 14 clubs with eight and more seasons in Eliteserien only two had an average share of capacity lower than 50%. Only Kristiansund BK had an average capacity higher than 80%, and it also marked the biggest share of sold-out matches (17,8%).[10] The overall share of the sold-out matches is very low with most clubs having less than 10% of their matches sold out.

Table 6. Average attendance per club in Eliteserien

Team	Seasons	Average attendance	Average share of capacity	Sold out matches	
				Total	Share
Rosenborg BK	11	15770	73,6%	19	11,5%
Vålerenga	11	10377	42,8%	1	0,6%
Molde FK	11	8439	75,0%	17	10,3%
Odds BK	11	6487	53,1%	0	0%
Strømsgodset	11	6147	68,8%	1	0,6%
Lillestrøm SK	11	5975	52,0%	2	1,2%
SK Brann	10	12402	73,9%	18	12,0%
Viking FK	10	10044	61,4%	1	0,7%
Stabæk	10	5161	69,9%	9	6,0%
Haugesund	10	4793	53,4%	1	0,7%
Tromsø	10	4159	62,2%	5	3,3%
Aalesund	9	8226	76,3%	16	11,9%
Start	8	6401	44,3%	0	0%
Sarpsborg 08	8	4300	53,6%	0	0%
Bodø/Glimt	6	3477	62,7%	5	5,6%
Sogndal	6	3331	59,3%	3	3,3%
Sandefjord	5	4293	65,2%	5	6.7%
Fredrikstad	3	8838	70,1%	3	6.7%
Kristiansund BK	3	3986	89,7%	8	17.8%
Sandnes Ulf	3	3377	68,0%	5	11.1%
Hönefoss	3	2977	72,3%	4	8,9%
Mjøndalen	2	2475	58,9%	1	3,3%
Ranheim IL	2	1950	65%	2	6,7%
FK Lyn	1	4219	15,5%	0	0%
Kongsvinger	1	2774	41,4%	0	0%

The clubs that participated in Eliteserien both in the 2009 and 2019 seasons saw a drop in the season's average attendance between 10,2% to 61,5%, except for the Strømsgodset that lost only 0,4% (see *Table 7*) of the average attendance.[11] Strømsgodset was able to increase its average attendance by 28,4% from 2009 to 2016 while also raising its average share of capacity

[10] Matches with share of stadium capacity more than 95%

[11] Note that instead of 2009 we took 2010 as a reference season for Haugesund

by 16,9 percentage points from 59,5% to 76,4% (see *Table 8*). In the following three seasons its average attendance and share of capacity dropped back to the level of the 2009 season.

Apart from Strømsgodset only Molde FK (+5%), BK Odds (+9,2%), Haugesund (+11,8%) were able to increase their average attendance in the period from 2009 to 2016.

Note that there are two clubs that drastically decreased their stadium capacities by moving to another stadium. Stabæk moved from Telenor arena (15000) to Nadderud arena (7000) at the beginning of 2012 season, which decreased its stadium capacity by more than a half. It has also decreased its average attendance between 2011 and 2012 by 47,5% and between 2009 and 2016 by 60%. The change in the stadium helped Stabæk immediately increase their share of capacity by almost 30 percentage points and maintain it 74% since then.

Vålerenga changed their stadium during the 2017 season and moved from Ullevaal stadium (27200) to Intility arena (17333). By the end of the 2017 season Vålerenga recorded an increase in average attendance compared to 2016 season, in the next two seasons it dropped below the average attendance of 2009-2016 seasons. Although the share of capacity increased in 2017-2019 compared to previous seasons, it remained below 50% in 2019. Thus, that made Vålerenga the only club who played more than eight seasons in Eliteserien between 2009-2019 with the average share of capacity below 50%.

Most improvements in the stadium attendance in the period between 2009 and 2016 seasons were offset in 2017-2019 - only Sarpsborg 08 (+42,6%) and FK Viking (+1,4%) registered an increased average attendance during these three seasons compared to the 2016 season. The rest of the teams with available data saw a decline in the average attendance with the highest decline in BK Odds (-30%). The total average attendance decreased by 22,2% between seasons 2009 and 2016 and went down by another 17% between 2016 and 2019.

Table 7. Eliteserien club's average seasonal attendance

Team	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average	2009-2016	2016-2019	2009-2019
Aalesund	10218	10146	9566	9183	8192	7601	6695	6369	6062			8226	-37,67		
Bodø/Glimt	4233					3218	3184	3668		3218	3339	3477	-13,35	-8,97	-21,12
FK Lyn	4219											4219			
Fredrikstad	10293		9072	7149								8838			
Haugesund		4660	4541	4514	5078	5579	5386	5212	4455	4316	4185	4793	11,85*	-19,70	-10,19*
Hönefoss		3313		2900	2717							2977			
Kongsvinger		2774										2774			
Kristiansund BK									3824	4041	4091	3986			
Lillestrøm SK	7602	6676	6010	5692	5481	5899	5527	5855	5628	5559	5791	5975	-22,98	-1,09	-23,82
Mjøndalen							2608				2343	2475			
Molde FK	7995	8395	9818	9362	8822	9241	8951	8392	7785	7110	6956	8439	4,97	-17,11	-13,00
Odds BK	7362	6585	5713	5177	5298	7157	7911	8038	7106	5383	5627	6487	9,18	-30,00	-23,57
Ranheim IL										2018	1883	1950			
Rosenborg BK	17652	16844	14514	13394	14805	13915	18039	17585	17592	16423	12703	15770	-0,38	-27,76	-28,04
SK Brann	15929	13744	13012	12339	11305	11985		12380	11858	10431	11042	12402	-22,28	-10,81	-30,68
Sandefjord	5805	4390					4125		4011	3136		4293			
Sandnes Ulf				3921	3138	3071						3377			
Sarpsborg 08			3818		3689	3946	3869	3875	4689	4987	5526	4300		42,61	
Sogndal			3210	3658	3380	3349		3143	3246			3331			
Stabæk	9477	8014	7431	3903		3834	3880	3808	3960	3655	3652	5161	-59,82	-4,10	-61,46
Start	8231	8388	7055		6183	5962	6155	4465		4771		6401	-45,75		
Strømsgodset	5316	5903	5707	6100	6525	6708	7030	6826	6271	5939	5297	6147	28,40	-22,40	-0,36
Tromsø	5175	4696	4842	4209	4445		3635	4031	3596	3655	3312	4159	-22,11	-17,84	-36,00
Viking FK	13070	11530	10255	9893	10284	10014	10272	8813	7380		8933	10044	-32,57	1,36	-31,65
Vålerenga	10788	13650	13336	10908	9819	9755	10099	9073	9702	9180	7834	10377	-15,90	-13,66	-27,38
Average attendance	8960	8107	7994	7019	6823	6952	6710	6971	6698	5864	5782	7080	-22,20	-17,06	-35,47
Total attendance,m	2,15	1,95	1,92	1,68	1,64	1,67	1,61	1,67	1,61	1,41	1,39	18,69			

* Haugesund from 2010 to 2016 and from 2010 to 2019.

Table 8. Eliteserien club's average seasonal share of capacity

Team	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average	2009-2016	2016-2019	2009-2019
Aalesund	94,8%	94,1%	88,8%	85,2%	76,0%	70,5%	62,1%	59,1%	56,2%			76,3%	-35,71		
Bodø/Glimt	69,2%					52,6%	52,1%	60,0%		69,7%	72,4%	62,7%	-9,25	12,36	3,11
FK Lyn	15,5%											15,5%			
Fredrikstad	81,1%		72,2%	56,9%								70,1%			
Haugesund		51,9%	50,6%	50,3%	56,5%	62,1%	60,0%	58,0%	49,6%	48,1%	46,6%	53,4%	6,14*	-11,42	-5,29*
Hönefoss		80,4%		70,4%	66,0%							72,3%			
Kongsvinger		41,4%										41,4%			
Kristiansund BK									86,1%	91,0%	92,1%	89,7%			
Lillestrøm SK	66,1%	58,1%	52,3%	49,5%	47,7%	51,3%	48,1%	50,9%	48,9%	48,3%	50,4%	52,0%	-15,19	-0,56	-15,75
Mjøndalen							62,1%				55,8%	58,9%			
Molde FK	71,1%	74,6%	87,3%	83,2%	78,4%	82,2%	79,6%	74,6%	69,2%	63,2%	61,8%	75,0%	3,53	-12,77	-9,24
Odds BK	58,9%	52,7%	45,7%	41,4%	42,4%	57,3%	63,3%	68,3%	60,4%	45,7%	47,8%	53,1%	9,42	-20,49	-11,07
Ranheim IL										67,3%	62,8%	65,0%			
Rosenborg BK	82,4%	78,6%	67,8%	62,5%	69,1%	65,0%	84,2%	82,1%	82,1%	76,7%	59,3%	73,6%	-0,31	-22,79	-23,10
SK Brann	93,7%	82,1%	77,7%	73,7%	67,5%	71,6%		73,9%	70,8%	62,3%	65,9%	73,9%	-19,79	-7,99	-27,78
Sandefjord	88,2%	66,7%					62,7%		60,9%	47,6%		65,2%			
Sandnes Ulf				78,9%	63,2%	61,8%						68,0%			
Sarpsborg 08			47,6%		46,0%	49,2%	48,2%	48,3%	58,5%	62,2%	68,9%	53,6%		20,57	
Sogndal			57,1%	65,1%	60,1%	59,6%		55,9%	57,7%			59,3%			
Stabæk	63,2%	46,0%	49,5%	79,0%		77,7%	78,6%	77,1%	80,2%	74,0%	74,0%	69,9%	13,95	-3,16	10,79
Start	57,0%	58,1%	48,8%		42,8%	41,3%	42,6%	30,9%		33,0%		44,3%	-26,06		
Strømsgodset	59,5%	66,1%	63,9%	68,3%	73,0%	75,1%	78,7%	76,4%	70,2%	66,5%	59,3%	68,8%	16,90	-17,11	-0,21
Tromsø	77,4%	70,2%	72,4%	63,0%	66,5%		54,4%	60,3%	53,8%	54,7%	49,5%	62,2%	-17,11	-10,75	-27,86
Viking FK	78,7%	69,5%	61,8%	59,6%	63,1%	61,4%	63,0%	54,1%	46,4%		56,2%	61,4%	-24,67	2,12	-22,55
Vålerenga	39,7%	50,2%	49,0%	40,1%	36,1%	35,9%	37,1%	33,4%	46,2%	55,4%	47,3%	42,8%	-6,30	13,96	7,66
Average share of capacity	68,5%	65,0%	62,0%	64,2%	59,6%	60,9%	61,0%	60,2%	62,3%	60,4%	60,6%	62,3%	-8,32	0,42	-7,91

* Haugesund from 2010 to 2016 and from 2010 to 2019.

Descriptive analysis

Figure 5 shows the development of attendance-related variables. The results of the descriptive analysis of these variables are presented in *Table 9*. To control for the quality of the teams that may play a role in the attendance demand, we use ELO ratings that take into account the previous results of the teams (Hvattum & Arntzen, 2010). ELOfootball contains information on the ELO rating of all the Eliteserien teams in the 2009-2019 seasons.[12] We control for the ELO rating of home and away teams: the higher the ELO rating, the higher the quality of the team. We also include the team's positions in the tournament table before the match – the *home position* and the *away position*.[13]

In order to consider the weather conditions during the matches, we have included the *air temperature* and *(air temperature – 14)^2* variables. The latter variable tries to capture the non-linear effect of the air temperature that is different from 14 degree of Celsius, as suggested by Hoffmann, Ging and Ramasamy (2002). We also use the *distance between the home and away teams' stadiums* measured in kilometers since the closer the teams are to each other, the easier it is for the away fans to travel to the match venue. We take the distance of the shortest possible route between the stadiums according to Google maps. In addition, we use the stadium age and its squared term to account for the possible attractiveness of the stadium's facilities.

From *Table 9* we see that the average stadium attendance of the matches played on Saturdays (7769) is higher than of matches played on Sundays (6754) or midweek (7422). The average capacity of stadiums on which the Saturday matches are played (12210) is also higher than on Sundays (11329), but lower than on midweek (12448). However, the average share of capacity of Saturday matches is the highest (66%) compared to Sundays (61%) and midweek (62%). Evidently, the teams with higher *ELO home* and *away* rating meet each other more often on Saturdays than on other days. Similarly, the teams' competition rankings are the lowest on Saturdays, suggesting that Saturdays' games are associated with higher ability teams.

[12] http://www.elofootball.com/

[13] The first round of the season uses the final position of the previous season. The newly promoted teams have the positions 14, 15 or 16 depending on how they have finished in the OBOS-ligaen and how many teams have been relegated from Eliteserien the previous season.

Table 9. Descriptive statistics	Saturday					Sunday					Midweek				
Variable	**Obs**	**Mean**	**St.D**	**Min**	**Max**	**Obs**	**Mean**	**St.D**	**Min**	**Max**	**Obs**	**Mean**	**St. D**	**Min**	**Max**
Stadium attendance	411	7769	4149	1949	21597	1563	6754	3789	1142	21474	666	7422	3883	1884	21130
Total stadium capacity	411	12210	6052	3000	27200	1563	11329	5752	3000	27200	666	12448	6265	3000	27200
ln (Attendance)	411	8,82	0,52	7,58	9,98	1563	8,67	0,53	7,04	9,97	666	8,78	0,51	7,54	9,96
ln (Stadium capacity)	411	9,29	0,50	8,01	10,21	1563	9,21	0,51	8,01	10,21	666	9,30	0,51	8,01	10,21
Share of capacity	411	0,66	0,18	0,25	1,19	1563	0,61	0,17	0,08	1,24	666	0,62	0,19	0,10	1,16
Tournament position of home team before the match	411	8,02	4,71	1	16	1563	8,82	4,61	1,00	16,00	666	8,80	4,57	1	16
Tournament position of away team before the match	411	7,93	4,39	1	16	1563	8,47	4,64	1,00	16,00	666	8,17	4,60	1	16
ELO rating of home team	411	1619	93	1386	1849	1563	1602	91,21	1374	1869	666	1601	82,68	1390	1858
ELO rating of away team	411	1617	89	1389	1864	1563	1600	91,42	1375	1860	666	1607	84,67	1379	1853
Air temperature	411	12,89	5,99	-3,90	27,70	1557	11,28	6,34	-7,60	28,50	665	11,68	6,08	-5,2	28,9
(Air temperature – 14)^2	411	37,05	52,01	0,00	320,4	1557	47,56	66,06	0,00	466,6	665	42,30	51,70	0,01	368,6
Distances between the home and away team's stadiums, km	411	464,9	449,3	8,60	2056	1563	623,1	502,8	0,00	2183	665	563,0	470,9	8,6	2183
Stadium age	411	12,32	11,88	0	58	1563	12,24	12,25	0	58	666	12,12	11,89	0	58
Stadium age ^2															
Match on the public TV (Yes = 1, No=0)	411	0,24	0,43	0	1	1563	0,17	0,37	0	1	666	0,56	0,50	0	1
Match collides with EPL live broadcast on Norwegian TV (Yes = 1, No = 0)	411	0,64	0,48	0	1	1563	0,72	0,45	0	1	666	0,25	0,43	0	1
Home team promoted to Eliteserien this season (Yes = 1, No = 0)	411	0,14	0,35	0	1	1563	0,15	0,36	0	1	666	0,16	0,36	0	1
Away team promoted to Eliteserien this season (Yes = 1, No = 0)															
Rosenborg is away team (Yes = 1, No = 0)	411	0,07	0,26	0	1	1563	0,06	0,24	0	1	666	0,06	0,24	0	1
Derby (Yes = 1, No = 0)	411	0,12	0,32	0	1	1563	0,06	0,23	0	1	666	0,06	0,23	0	1
Match takes place during the week when national teams play (Yes = 1, No = 0)	411	0,12	0,33	0	1	1563	0,13	0,34	0	1	666	0,06	0,23	0	1
Match takes place during the World Cup or UEFA Euro (Yes = 1, No = 0)	411	0,09	0,28	0	1	1563	0,03	0,18	0	1	666	0,05	0,21	0	1

Home team plays before the European cup match (Yes = 1, No = 0)	411	0,07	0,25	0	1	1563	0,05	0,23	0	1	666	0,01	0,09	0	1
Away team plays before the European cup match (Yes = 1, No = 0)	411	0,07	0,25	0	1	1563	0,05	0,22	0	1	666	0,01	0,11	0	1
Home team plays after the European cup match (Yes = 1, No = 0)	411	0,03	0,16	0	1	1563	0,06	0,24	0	1	666	0,00	0,04	0	1
Away team plays after the European cup match (Yes = 1, No = 0)	411	0,04	0,19	0	1	1563	0,06	0,24	0	1	666	0,00	0,07	0	1
Home team is already a champion (Yes = 1, No = 0)	411	0,005	0,07	0	1	1563	0,007	0,08	0	1	666	0	0	0	0
Away team is already a champion (Yes = 1, No = 0)	411	0,002	0,05	0	1	1563	0,007	0,08	0	1	666	0	0	0	0
Home team is already relegated (Yes = 1, No = 0)	411	0,002	0,05	0	1	1563	0,01	0,10	0	1	666	0	0	0	0
Away team is already relegated (Yes = 1, No = 0)	411	0	0	0	0	1563	0,01	0,10	0	1	666	0	0	0	0
Total population in the county of the team (before the 2014 counties), thous.	411	365,2	165,8	108,0	690,3	1563	343,6	162,8	107,9	690,3	666	360,8	163,7	107,9	690,3
Match is played on May 16 (Yes = 1, No = 0)	411	0,04	0,19	0	1	1563	0,01	0,07	0	1	666	0,09	0,29	0	1
KOT between 14 and 15 (Yes = 1, No = 0)	411	0,00	0,00	0	0	1563	0,00	0,03	0	1	666	0,00	0,00	0	0
KOT between 15 and 16 (Yes = 1, No = 0)	411	0,25	0,43	0	1	1563	0,07	0,25	0	1	666	0,02	0,15	0	1
KOT between 16 and 17 (Yes = 1, No = 0)	411	0,08	0,28	0	1	1563	0,01	0,10	0	1	666	0,01	0,12	0	1
KOT between 17 and 18 (Yes = 1, No = 0)	411	0,05	0,21	0	1	1563	0,00	0,04	0	1	666	0,00	0,00	0	0
KOT between 18 and 19 (Yes = 1, No = 0)	411	0,55	0,50	0	1	1563	0,76	0,43	0	1	666	0,30	0,46	0	1
KOT between 19 and 20 (Yes = 1, No = 0)	411	0,02	0,15	0	1	1563	0,03	0,17	0	1	666	0,59	0,49	0	1
KOT after 20 (Yes = 1, No = 0)	411	0,05	0,22	0	1	1563	0,13	0,33	0	1	666	0,07	0,25	0	1

The descriptive statistics also show that the average distance between the stadiums is higher on Sundays (623 km) than on Saturdays (465 km) and midweek (563 km) by 35% (160 km) and by 11% (60 km), respectively. In addition, more than half of the 666 matches played on midweek were broadcast on the public TV (56%). This number is a lot lower for Saturdays (24%) and Sundays (17%). On the contrary, almost 72% of the Sunday matches and 64% of Saturday matches were played at the same time with the games of the English Premier League (EPL) streamed live on the Norwegian TV. The share of the matches that coincided with the EPL games during the midweek is only 25%.

In addition, we have used the list of rivalry matches from Wikipedia to define a derby in our dataset.[14] In sum, 13 different derby types composed 176 matches in 11 seasons (for the full list, see *Appendix A*). We have found that the share of derby matches is two times bigger on Saturdays than on any other day of the week.

Table 10. The distribution of May 16 matches by teams

Team	Number of seasons in Eliteserien	Number of home matches on May 16*	Number of away matches on May 16	Share of home matches on May 16
Rosenborg BK	**11**	**11**	0	**100%**
SK Brann	**10**	**10**	0	**100%**
Viking FK	**10**	**9**	1	**90%**
Vålerenga	**11**	**8**	2	**73%**
Odds BK	**11**	**7**	4	**64%**
Strømsgodset	**11**	**7**	4	**64%**
Molde FK	**11**	**6**	5	**55%**
Lillestrøm SK	11	5	6	45%
Tromsø	10	4	6	40%
Aalesund	9	4	5	44%
Haugesund	10	3	7	30%
Stabæk	10	2	7	20%
Sarpsborg 08	8	2	6	25%
Start	8	2	6	25%
Bodø/Glimt	6	2	4	33%
Kristiansund BK	**3**	**2**	1	**67%**
Sandefjord	5	1	4	20%
Fredrikstad	3	1	2	33%
Mjøndalen	2	1	1	50%
Sogndal	6	0	6	0%
Hönefoss	3	0	3	0%
Sandnes Ulf	3	0	3	0%
Ranheim IL	2	0	2	0%
FK Lyn	1	0	1	0%
Kongsvinger	1	0	1	0%

*Note that in season 2012 only seven matches were played on May 16, as Vålerenga and Stabæk had their match on a different day.

[14] https://en.wikipedia.org/wiki/List_of_association_football_club_rivalries_in_Europe#Norway

Finally, it is important to note that the matches played on May 16 (public holiday) have traditionally attracted bigger crowds to the stadiums. The average attendance of May 16 matches during the 11 seasons in our sample is 10 966 when the average attendance of all other matches in the sample is 6948. The scheduling can't control which day of the week will be May 16; in our sample this day fell once on Sunday, twice on Saturday and eight times on midweek. What the scheduling can control is which teams will be playing home on this day. According to the data *(*see *Table 10)* the allocation of May 16 matches is hardly fair because only 8 out of 25 teams played more than half of their May 16 matches at home, and 6 teams never played at home on May 16. Both Rosenborg BK (11) and SK Brann (10) played all their May 16 matches at home. Haugesund and Stabæk played most May 16 matches away (7).

Chapter 4. Estimation strategy

We will estimate the effect of playing on Saturday on stadium attendance. First, we need to consider that scheduling matches on different days of the week is not generally done randomly but rather depends on many factors, such as weather, the timetable of the European Cups, National team tournaments, etc.. Moreover, the descriptive analysis demonstrated that matches played on different weekdays vary in the quality of the participating teams and kick-off times. These factors are likely to correlate both with match allocation and stadium attendance. This means that a simple comparison of average attendances on different weekdays would potentially lead to biased and inconsistent estimations. In other words, we need to separate the effect of Saturday on stadium attendance from the other effects and measure the causal relationship between them.

Our strategy is to control for all possible factors that are correlated both with weekday match allocation and stadium attendance. We will calculate the OLS estimates of the following linear regressions in various specifications:

$$(1)\ ln(Att_i) = \alpha + \beta_1 Saturday_i + \beta_2 \ln(Capacity)_i + \phi X_i + \mu SeasonDummies_i + \varphi WeeknumberDummies_i + \varepsilon_i$$

$$(2) ShareCapacity_i = \alpha + \beta_1 Saturday_i + \beta_2 \ln(Capacity)_i + \phi X_i + \mu SeasonDummies_i + \varphi WeeknumberDummies_i + \varepsilon_i$$

Our main goal is to estimate β_1 coefficient in both regressions while controlling for *stadium capacity* and other potential confounding factors *X* discussed in the description analysis, as well, as *season* and *calendar weeks*. We will also estimate other coefficients checking if the results are plausible and meet our expectations. In addition, there might be a mistake in the calculation of standard errors. If such a problem occurs, it might create confusion whether our results are statistically significant. We might conclude that there is enough evidence that the estimated effect of Saturday match on stadium attendance is statistically significant with a good level of confidence, when in fact the level of confidence is lower. According to the

Gauss-Markov theorem the OLS estimators will be BLUE (best linear unbiased estimator) if certain conditions are met.

Out of all the conditions of the Gauss-Markov theorem, one is of a particular importance to our analysis. The potential problem with OLS estimation of regressions (1) and (2) is the *heteroskedasticity*, or non-constant variance of errors in the regression. The effect of Saturday on attendance may vary for big clubs and small clubs or it may vary by different stage of the tournament. In fact, it is possible that smaller clubs, or clubs that play home matches on the stadiums with lower capacity will have less variance in home match attendance than bigger clubs *(see Figure 6).* The existence of heteroskedasticity does not affect the coefficient estimators and does not cause them to be biased or inconsistent. However, it may lead to underestimation of coefficient estimators' standard error. As a result, the analysis will show lower p-values of these coefficients. That may lead to the wrong conclusion about the statistical significance of coefficient estimators.

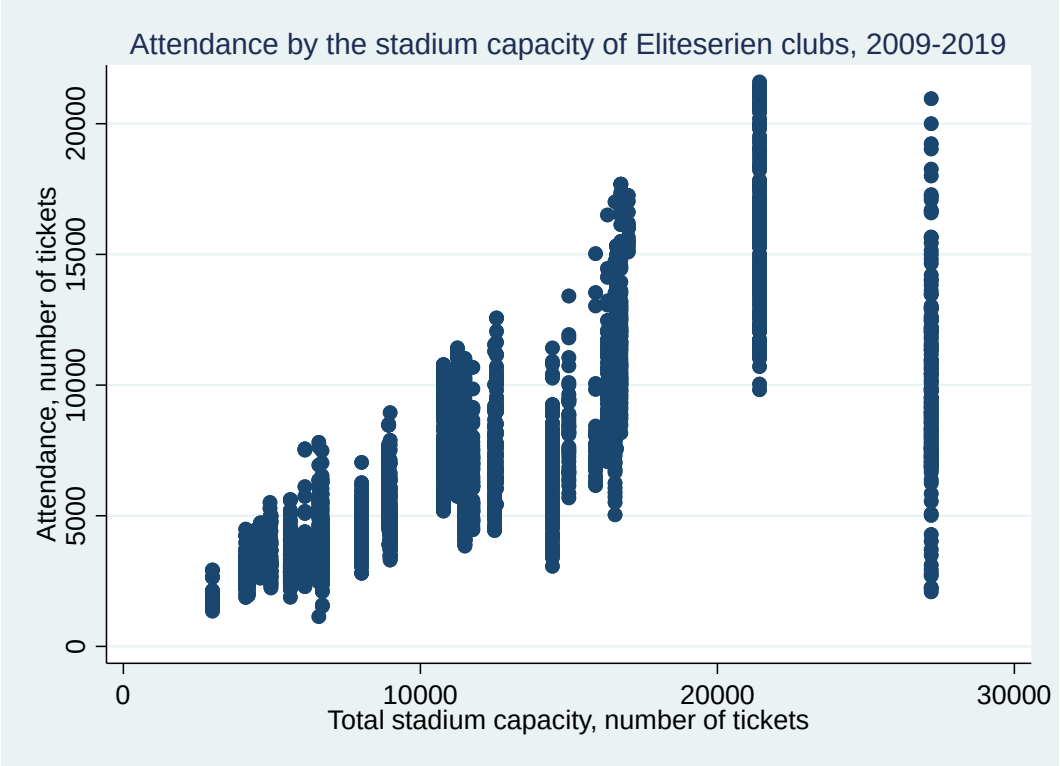


Figure 6. Attendance by the stadium capacity of Eliteserien clubs, 2009-2019

In our estimations we will use standard errors that are robust to the heteroskedasticity or White-Huber standard errors to obtain efficient estimates of our coefficients. This technique is used to recalculate the standard errors of OLS estimators by using the variance-covariance matrix of the errors in the original linear regression itself. This technique does not need us to impose any assumptions on the structure of heteroskedasticity to obtain efficient estimators. It is helpful because although we have our suspicions on

the nature of the heteroskedasticity source, the exact factors and their form that are causing heteroskedasticity are likely to be unknown as big and small clubs in our dataset differ in many factors.

Chapter 5. Estimation results

Table 11 demonstrates our estimation results for regressions with a logarithm of stadium attendance and a share of stadium capacity as dependent variables.

We find a significantly higher attendance in games that take place on *Saturdays* compared to other days. After controlling for a variety of potential confounding variables that include, among others, the teams' strengths, local derbies, TV broadcast and others, the Saturday games attract, on average, 4.4% more audience compared to other days (*column 1 Table 11*). The average attendance in the sample is 7 080, which means that Saturday matches attract about 310 more fans on average. This calculation will vary for different clubs considering the diversity of the average stadium capacities and attendances among the Eliteserien clubs.

The positive effect of the *Saturday* matches on the *share of capacity* is statistically significant at 1% (*column 2 Table 11*). The interpretation of the estimated results is different from the one we discussed before because we haven't used the logarithm of the dependent variable (share of capacity). While it is measured in the percentage points, we can conclude that the positive effect of the *Saturday* matches on the *share of capacity* is about 2,3 percentage points. This means that, considering other factors, scheduling matches on Saturday increases the share of stadium capacity by 2,3 percentage points. As a comparison, the average share of stadium capacity is 11 748, so 2,3% generally corresponds to 270 more tickets sold. This result is not far from the one obtained when the logarithm of the stadium attendance was a dependent variable.

It is worth discussing some other variables as well. As expected, the results confirm that the total *stadium capacity* positively correlates with the *stadium attendance.* We have found that 1% increase in *stadium capacity* contributes to 0,63% increase in *stadium attendance*. We have also found that *stadium capacity* negatively correlates with the *share of capacity*. The latter result was not evident before the regression analysis. However, it might be an important indicator that in Norway, where football matches are seldomly sold out, it is more difficult to fill bigger arenas. According to our calculations, a 1% increase in *stadium capacity* leads to a decrease in the *share of capacity* by about 0,196 percentage points.

Table 11. OLS estimation results	**Ln(Attendance)**	**p-value**	**Share of capacity**	**p-value**
Saturday (Yes = 1, No = 0)	0,044***	(0,001)	0,023***	(0,005)
Ln(Stadium capacity)	0,625***	(0,000)	-0,196***	(0,000)
Tournament position of home team before the match	- 0,003*	(0,070)	-0,001*	(0,097)
Tournament position of away team before the match	- 0,002	(0,130)	-0,001	(0,187)
ELO rating of home team	0,002***	(0,000)	0,001***	(0,000)
ELO rating of away team	0,0002*	(0,072)	0,0001**	(0,046)
Air temperature	- 0,0002	(0,863)	-0,0003	(0,617)
(Air temperature – 14)^2	- 0,0005***	(0,000)	-0,0003***	(0,000)
Stadium age	- 0,011***	(0,000)	-0,005***	(0,000)
(Stadium age)^2	0,0002***	(0,000)	0,0001***	(0,000)
Ln(Distances between the home and away team's stadiums, km)	0,005	(0,345)	-0,001	(0,787)
Match on the public TV (Yes = 1, No=0)	0,059***	(0,000)	0,036***	(0,000)
Match collides with EPL live broadcast on Norwegian TV (Yes = 1, No = 0)	- 0,028	(0,101)	-0,017*	(0,071)
Home team promoted to Eliteserien this season (Yes = 1, No = 0)	0,037**	(0,014)	0,020**	(0,028)
Away team promoted to Eliteserien this season (Yes = 1, No = 0)	0,025	(0,126)	0,013	(0,151)
Rosenborg is away team (Yes = 1, No = 0)	0,145***	(0,000)	0,099***	(0,000)
Derby (Yes = 1, No = 0)	0,271***	(0,000)	0,164***	(0,000)
Match takes place during the national matches week (Yes = 1, No = 0)	0,021	(0,283)	0,011	(0,341)
Match takes place during the World Cup or UEFA Euro (Yes = 1, No = 0)	- 0,055**	(0,049)	-0,032**	(0,041)
Home team plays before the European cup match (Yes = 1, No = 0)	0,092***	(0,000)	0,055***	(0,002)
Away team plays before the European cup match (Yes = 1, No = 0)	0,033	(0,186)	0,017	(0,268)
Home team plays after the European cup match (Yes = 1, No = 0)	- 0,011	(0,654)	-0,007	(0,672)
Away team plays after the European cup match (Yes = 1, No = 0)	- 0,038	(0,115)	-0,021	(0,153)
Match takes place on May 16 (Yes = 1, No = 0)	0,275***	(0,000)	0,183***	(0,000)
KOT between 15 and 16 (Yes = 1, No = 0)	- 0,003	(0,841)	-0,004	(0,709)
KOT between 16 and 17 (Yes = 1, No = 0)	0,026	(0,495)	0,013	(0,576)
KOT between 17 and 18 (Yes = 1, No = 0)	0,023	(0,659)	0,011	(0,754)
KOT between 19 and 20 (Yes = 1, No = 0)	- 0,020	(0,252)	-0,018*	(0,085)
KOT after 20 (Yes = 1, No = 0)	0,003	(0,837)	-0,004	(0,778)
Home team is already a champion (Yes = 1, No = 0)	0,191***	(0,001)	0,148***	(0,000)
Away team is already a champion (Yes = 1, No = 0)	0,027	(0,606)	-0,004	(0,897)
Home team is already relegated (Yes = 1, No = 0)	- 0,323***	(0,003)	-0,117***	(0,000)
Away team is already relegated (Yes = 1, No = 0)	0,060	(0,410)	0,025	(0,587)
Ln(Total population in the county of the team, thous.)	0,024*	(0,052)	0,018**	(0,010)
Constant	- 0,330	(0,250)	0,689***	(0,000)
Season dummies	Yes		Yes	
Week dummies	Yes		Yes	
Number of observations	2631		2631	

Some other interesting results have been found from the analysis of these specifications. Most estimations have the same sign and level of significance in both specifications (*Table 11*). The signs of the estimated coefficients of *tournament position* and *ELO rating* are, as expected, negative and positive, respectively, in all specifications. However, the *tournament position* of the away team for both dependent variables is not statistically significant. The *ELO rating* remains significant for both home and away teams.

We have found that the *air temperature* is not statistically significant, however, its squared deviation from the comfortable 14 degrees Celsius is significant and, as expected, has a negative effect on *attendance*. The weather in Norway changes a lot in different parts of the country, for example in Kristiansand (southern part) the maximum monthly air temperature is, on average, 3-6 degrees Celsius higher than in Tromsø

(northern part), but in both cities the average minimal monthly air temperature is less than 11 degrees Celsius, even in summer.[15] The matches allocated later in the evening will probably have the weather below comfortable 14 degrees Celsius, especially in the early spring and autumn. It might improve the average attendance if more matches took place during the bright part of the day when the air temperature is usually higher.

Both *stadium age* and *(stadium age)^2* are statistically significant and have negative and positive signs respectively. This indicates that there is a U-shape relationship between stadium *attendance* and *stadium age* - newer stadiums attract higher crowds. We haven't found enough evidence that the stadium *attendance* is correlated with the *distance between the stadiums* of home and away teams. It reason might be the fact that the distance in kilometers doesn't always represent the struggle of travelling to the stadium - the middle part of Norway is covered by mountains. In some specifications we have used the *distance between the stadiums* in minutes needed to travel between the stadiums by public transport, but the results of this analysis were not significant either. Another explanation might be that Norwegian fans don't usually travel to away matches if the stadium is located too far and is not reachable within a couple of hours by car or public transport.

Our results show a positive association between broadcasting on the *public TV* and the stadium *attendance* by 5,9% and the *share of capacity* by 3,6 percentage points. Moreover, we have found that the collision with the *EPL matches* might have a negative impact on the *share of capacity* (-1,7pp). As expected, away matches of *Rosenborg BK* are a big draw for fans, as they increase the stadium *attendance* by 14,5% and the *share of capacity* by 9,9 percentage points. Teams hosting *May 16* matches have a significant boost of 27,6% to the stadium *attendance* and 18,3 percentage points to the *share of capacity*. All these findings are similar to the results presented by Kringstad, Solberg & Jakobsen (2018). They use a different measure of attendance as a dependent variable and a different time period, so we can't make an accurate comparison in numbers, however, the significance and the signs of the estimations are the same.

Newly promoted to Eliteserien teams playing at home have a boost in stadium *attendance* by 3,7% and *share of capacity* by 2 percentage points compared to teams playing in Eliteserien their second or more seasons. The *derby* matches have, on average, bigger *audience* by 27,1% and higher *share of capacity* by 16,4 percentage points. The latter result is likely to be downward biased as the share of sold out matches among derbies is higher than in general. These results match in sign the Skjæveland (2011) findings. Based on the 2007-2010 data he calculated the 2,5-5,4% and 4,7-6,1% increase in attendance of *newly promoted* home teams and *derby* matches in Eliteserien, respectively.

[15] https://www.climatestotravel.com/climate/norway

The matches played during the *FIFA World Cup* or the *UEFA European Championship* have lower stadium *attendance* (-5,5%) and *share of capacity* (-3,2pp). The matches of a home team preceding the European cup match are characterized by an increased stadium *attendance* (9,2%) and *share of capacity* (5,5pp).

We have included dummies of different one-hour time slots of *kick-off time* to capture the differences in stadium *attendance* compared to the most common kick-off time at 18:00. The number of observations for matches with an unusual *kick-off* time was not high enough. None of the estimations were statistically significant except for the late matches with the *kick-off* time between 19:00 and 20:00 that have lower *share of capacity* by 1,8 percentage points compared to matches with the *kick-off* time between 18:00 and 19:00.

As expected, when the *home team is already a champion*, it has an average increase on stadium *attendance* (19,3%) and *share of capacity* (14,8 percentage points). The *already relegated* team loses, on average, 32% of the stadium *attendance* and 11,6 percentage points of the *share of capacity*. We have also found that the average *population* in the home team's county of residence has a positive effect both on stadium *attendance* and the *share of capacity*.

Chapter 6. Conclusion

The Norwegian league has recently demonstrated some increase in the TV-broadcasting income. Still, that increase cannot compensate for the loss in the stadium attendance and gate receipt revenue. The broadcasting growth has its limit, and when it plateaus, the overall revenues will probably go down. That is why it seems important to keep the other sources of income from falling, and the gate receipt is one of its major sources.

We used OLS method with control for various confounding factors to separate the effect of Saturday on stadium attendance and share of capacity in Norwegian Eliteserien league for the 2009-2019 seasons. Our calculations show that Saturday matches have a significantly higher attendance compared to other days of the week. They attract 4,4% higher audience and are associated with higher share of capacity of about 2,3 percentage points. Based on the communication with the Norwegian Football Federation, we understand that football clubs and TV broadcaster play an important role in scheduling the matches and choosing the day of the week. The results of our study suggest that an additional constraint should be integrated into the scheduling process to take into account the positive effect of scheduling matches on Saturdays. Increasing the average stadium attendance in Eliteserien will improve the clubs' gate receipt revenues and the overall financial situation.

Beyond the possible immediate financial benefit of the teams from the move to Saturdays, it is important to note that higher attendance of young fans is especially important, since these young fans have

a long-run perspective on clubs' support. Thus, the move to Saturday games avoid the obstacle of attending school early morning for the next day. In addition, such a move may benefit soccer players who can spend more time with their families on Sundays. Moreover, from the broader perspective, local businesses, such restaurants may benefit from a larger crowd after the game on Saturday compared to Sunday. Therefore, we call the Norwegian Football Federation to consider the increase in Saturday games.

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Appendix

Appendix A – Derby matches

Derby	Number of matches
Vålerenga Fotball vs. Lyn Fotball	2
Rosenborg BK vs SK Brann	20
Lillestrøm SK vs. Vålerenga Fotball	22
Molde FK vs. Rosenborg BK	22
Kristiansund BK vs. Molde FK	6
Sarpsborg FK vs. Fredrikstad FK	2
Strømsgodset IF vs. Mjøndalen IF	4
SK Brann vs. Vålerenga Fotball	20
FK Bodø/Glimt vs. Tromsø IL	10
Aalesunds FK vs. Molde FK	18
Viking FK vs. FK Haugesund	18
SK Brann vs. Viking FK	18
IK Start vs. Viking FK	14