

The Complex Challenge of Spectator Demand: Attendance Drivers in the Danish Men's
Handball League

Abstract

Research question: A growing number of studies of professional team sports have tried to understand the drivers behind match day attendance. However, no research has ever been conducted in relation to team handball. As existing literature mainly focuses on European football and US Major League sports, club managers from smaller sports lack the evidence that could assist them in developing strategies to increase attendance. This study is a step towards filling this gap.

Research methods: Using robust panel data regression models deployed on data from Danish men's team handball league matches in the seasons from 2011/12 to 2015/16, the study identifies the main determinants of spectator demand.

Results and findings: The findings are largely consistent with existing research, but also reveal new insights that seem to be specific to handball. These include: 1) negative effects on spectator demand due to simultaneous live television coverage of other league matches; 2) no obvious preferences for weekend matches; and 3) weather-related factors, whereby rain has a positive effect and snow a negative effect, while variations in temperature have no effect.

Implications: To maximize spectator attendance, we suggest that league managers and club representatives take the problem of simultaneous broadcasts from other league matches into consideration when planning the schedule in the future. Further, we argue that games should be placed in the time slots with highest spectator demand, while recognizing that this can be club-specific. Finally, we recommend that clubs increase their efforts in promoting games involving strong away teams.

Keywords: Professional Team Sports; Spectator Demand; Attendance; Match Day; Handball; Denmark

The Complex Challenge of Spectator Demand: Attendance Drivers in the Danish Men's Handball League

Danish league handball became commercialized in the 1990s, and the clubs started fielding semi- or fully professional teams from around 2000 (Storm & Almlund, 2006). The revenue growth resulting from this professionalization was fuelled by, and continues to be closely connected to increasing media coverage (Hedal, 2006). Danish television broadcasters increased transmissions times of league games following the league's commercialization, and in March 2017 a new television rights deal between TV2 and the Danish handball league association secured significant (live) coverage of league matches until 2025.

Even though television is the most important driver of team handball club revenues (Storm & Almlund, 2006), optimization of spectator demand is still very important to the clubs, because Danish team handball clubs are now suffering from financial problems (Storm, 2011). Large crowds create a lively atmosphere in the arenas, which in turn makes the matches more enjoyable to watch on television (Solberg & Mehus, 2014). This subsequently increases the value of the media rights and makes the club's brand more attractive to spectators and sponsors alike (Kringstad, Solberg, & Jakobsen, 2018). Therefore, raising demand from spectators is imperative, but are there enough fans to fill the arenas and maintain good television ratings at the same time? The development of average attendance at Danish men's league matches from 1992/93 to 2015/16 is displayed in Figure 1.

Figure 1: The Development in Average Attendance Figures, Danish Men's Handball League 1993–2016

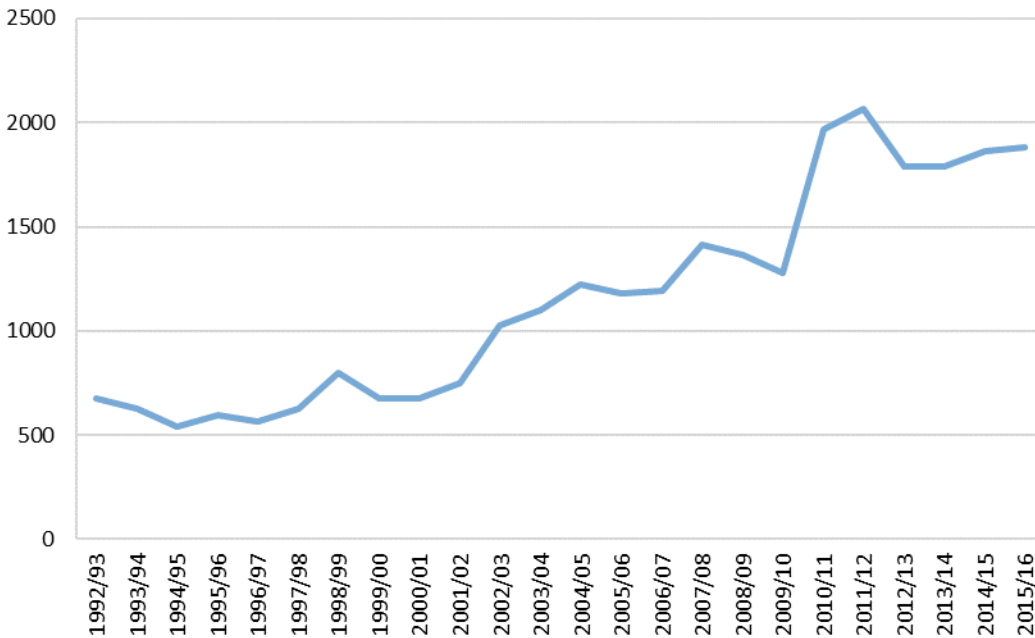


Figure 1 shows a positive trend with fluctuations. There may be several reasons for the increase in attendance, including upgrades of arenas and the construction of new facilities. The sporting success enjoyed by the Danish national team culminating in a gold medal at the Rio Olympic Games in 2016 may also be a factor. Downward trends could be partly due to increases in televised matches or competition from other spectator sports such as football, which is considered the number one professional sport in Denmark (Storm, Thomsen, & Jakobsen, 2017). This paper aims to move beyond this speculation and to find more concrete explanations for variations in spectator demand.

Although attendance demand has been intensively studied in other sports such as European football and American major league sports (García & Rodríguez, 2009), cricket

(Hynds & Smith, 1994), rugby (Baimbridge, Cameron, & Dawson, 1995; Hogan, Massey, & Massey, 2017), and Australian Rules Football (Borland & Lye, 1992), the results cannot necessarily be generalized and applied to team handball on which – to the best of our knowledge – no research on this subject has been undertaken to date.

Handball is a passing-based game played indoors where two teams field seven players (including one goalkeeper) with the aim of scoring in the opponent's goal. The match duration is two periods of 30 minutes. The team scoring the most goals wins the match and is awarded two points. If the teams draw, they are awarded one point each.

The Danish men's handball league competition consists of three phases. In the initial phase, 14 clubs face each other twice (home and away). The top eight advances to the winner's group phase where they are divided into two groups. The top two in each group advance to the semi-finals. The team in last place (14th) in the initial phase is relegated to the second tier while 12th and 13th play relegation/promotion matches against the second and third in the second tier respectively. Numbers 9–11 do not participate beyond the initial phase.¹ The initial phase is played from September to March. This is a different period than, for instance, European professional football. Further, handball is a rather limited sport commercially, which influences the strategies available to clubs for increasing attendance. Therefore, acquiring a better insight into factors affecting attendance in handball is crucial to support future initiatives at the club management level. To address this need and to expand on existing research on attendance

¹ In the seasons 2011/12–2013/14 the teams ranked from 9–13 participated in a group phase/playoff to avoid relegation. This was changed in the season 2014/15.

demand, we employ a set of (panel data) regression models on handball matches held over a period of five seasons (2011/12–2015/16) and interpret the results.

The paper is structured as follows: Following a review of existing literature on spectator demand for commercialized sport, we present our data and the models applied in the study. Then we present and discuss our results, and conclude by explaining the implications of the findings while offering perspectives for future research.

Literature review

Existing research on spectator demand covers a wide area of topics and approaches (Allan & Roy, 2008). As this study aims to contribute with new insights into handball, we believe that the broad approach based on Borland and Macdonald's (2003) framework is a sufficient structural starting point for identifying determining factors related to attendance demand in an underexplored sport like team handball.

Borland and Macdonald (2003) suggest that drivers of stadium attendance can be divided into five main categories: 1) consumer preferences, 2) economic factors, 3) quality of viewing, 4) characteristics of the sporting contest, and 5) supply capacity. We examine each area below. However, due to the limited space here, we do not undertake an in-depth approach to all factors that are considered important for attendance demand, but touch upon those considered the most important and relevant to this study.

Consumer preferences

Although ‘queue’ and ‘crowding-in’ effects have received theoretical consideration (Feehan, 2006), it is habit formation that has engaged scholars most when it comes to attendance demand (Borland & Macdonald, 2003). Sports teams typically enjoy a core level of support composed of loyal supporters – that is consumers who are unaffected by variations in match quality (Peel & Thomas, 1992; 1996). This group of consumers will – for example – usually attend regardless of their home team’s current form. Other supporters are more sensitive to the attractiveness of the match (Coates, Humphreys, & Zhou, 2014). Allan and Roy (2008) find that season ticket holders are more loyal, while Solberg and Mehus (2014) have found that during a regular season, season ticket holders attended more than twice the number of matches than non-season ticket holders.

Most empirical studies on the subject find habit to be an important driver of match-day attendance (Buraimo & Simmons, 2009; Forrest & Simmons, 2006; Pawlowski & Anders, 2012). However, Paton and Cooke (2005) have noted that previous attendance has no effect on attendance in English cricket.

Economic factors

Economic factors related to attendance demand include the total cost of attending (the price of admission, transportation, the price and availability of substitutes and complements), consumer income, market size and composition (Borland & Macdonald, 2003). Most empirical studies find that the price of admission affects attendance negatively (Borland & Macdonald, 2003; García & Rodríguez, 2009).

Evidence regarding the income effect is ambiguous. Professional sport is sometimes found to be a normal good (Feehan, Forrest, & Simmons, 2003), sometimes an inferior good (Borland & Lye, 1992; Madalozzo & Villar, 2009), and for some even a luxury good (Simmons, 1996). Scholars can even reach different conclusions on the type of good when looking within the same league (for an overview, see García & Rodríguez, 2009). Travelling to matches represents a cost as well, and for away fans travelling over large distances, the monetary and opportunity costs of time can be substantial. Thus, various studies report a negative relationship between travel distance and attendance demand (Buraimo, 2008; Meier, Konjer, & Leinwather, 2016).

The direct substitute of a handball match is the same match broadcast on television or through streaming services, while other sporting events or even other non-sports-related leisure activities can be classified as indirect substitutes (Borland & Macdonald, 2003). Various studies have considered the impact of broadcasting on attendance demand and most find zero or negative effects (Allan & Roy, 2008; Allan, 2004; Baimbridge et al., 1996; Buraimo, 2008; Buraimo et al., 2009; Buraimo & Simmons, 2008, 2009, Cox, 2012, 2015; García & Rodríguez, 2002).

Forrest, Simmons and Szymanski (2004) report mixed effects for the English Premier League depending on the broadcaster and platform. Forrest and Simmons (2006) focus on UEFA Champions League matches involving Premier League clubs as an indirect substitute for English lower division football and report negative effects. Buraimo et al. (2009) report similar negative effects for European matches involving English teams shown on terrestrial television, while no effect was found for subscription television.

Quality of viewing

Quality of viewing relates to the conditions under which the match takes place, for instance facility quality, weather conditions and scheduling (Borland & Macdonald, 2003). Studies find that a stadium's age can have a negative effect on attendance (Depken, 2001; McDonald & Rascher, 2000). Feddersen, Maennig and Borchering (2006) studied the effect of new/reconstructed stadiums in the German Bundesliga and found that a positive effect lasting for five years could best explain the 'novelty effect', testing alternate estimates.

It is plausible that weather conditions can affect the enjoyment of an outdoor event. It also represents an opportunity cost for an indoor event like handball, as 'bad' weather decreases the attractiveness of alternative outdoor activities. There is conflicting evidence on the impact of weather on attendance. For instance, Baimbridge et al. (1996) estimate non-significant effects for cold, windy and wet weather for English football, while Garcia and Rodríguez (2002) find that bad weather conditions discourage spectators from attending Spanish football matches. Iho and Heikkilä (2010) show that temperature has a positive impact on attendance, while rain (and snow) has a negative effect. Moreover, the scheduling of the match represents an opportunity cost, and as the available amount of leisure time is greater in weekends, the opportunity cost of attending is higher during normal weekdays (Feehan, 2006). Most studies support this and find that consumers are more reluctant to attend matches on weekdays (see for instance Buraimo et al., 2009; Forrest & Simmons, 2006; Madalozzo & Villar, 2009). Meier et al. (2016), however, do not find significant differences in attendance between weekday and weekend matches in Germany for women's football, but report negative effects of afternoon matches compared to late morning and evening matches.

Characteristics of the sporting contest

Consumers naturally prefer to watch teams of high quality (Buraimo, 2008). They like to watch successful clubs (Borland & Macdonald, 2003); they are concerned with the uncertainty of outcome (Rottenberg, 1956) and prefer matches which are of significant importance for the outcome of the championship (Jennett, 1984) or other sporting prizes (Scelles, Durand, Bonnal, Goyeau, & Andreff, 2013, 2016). The long-term sporting performance within a domestic league is determined by the clubs' relative level of talent. In competitive markets, the wage budget for players should reflect talent and hence team strength (Buraimo et al., 2009).

Various studies examine the wage budgets effect on attendance demand with mixed results. Buraimo et al. (2009) report positive effects of the home club's relative wage budget, but do not include a measure of the away teams wage budget, while Buraimo (2008) only finds significant positive effects on the away teams' budgets. He argues that fans of the home club get used to the local level of talent on display and are more sensitive to variations in the opponents' squads.

It is understandable that attendance rates would increase in relation to home club success. However, for away team success the evidence is mixed. Most studies on European sports report a positive relationship between away team success and attendance (Buraimo & Simmons, 2008; Hogan et al., 2017; Pawlowski & Nalbantis, 2015), with a smaller impact than home team success. This stands in contrast to Meier et al. (2016) who find away team success to be even more important than home team success in German women's football. For Forrest and Simmons (2002) as well as Simmons and Buraimo (2009), away team success does not have a significant effect on attendance demand.

Just as the spectators can be expected to respond positively to the overall strength of both clubs, they may also respond negatively to an imbalance of strength among the clubs. In his seminal paper, Rottenberg (1956) suggested that sports fans prefer an even contest in what came to be known as the Uncertainty of Outcome Hypothesis (UOH). However, as noted by Borland and Macdonald (2003), this assumption has been contradicted by several studies. The frequent rejection of the UOH has led to the suggestion that consumers of professional sport have reference-dependent preferences and are loss averse, and that some consumers therefore prefer the underdog role to attend an even contest (Coates et al., 2014). For an overview of the literature on uncertainty outcome, see e.g. Borland and Macdonald (2003) and Coates et al. (2014).

According to Jennett (1984) attendance is likely to be higher if the match is to determine which team will win the championship or lose the relegation battle. Yet, the results found in the literature are mixed. Jennett (1984) reports that matches which are important for the Scottish football championship result in increased attendance, while clubs that have already won the championship also enjoy a 'glory factor'. Clubs that can no longer avoid relegation experience decreased attendance, which he refers to as the 'despair' factor. In addition, he finds no significant effect from avoiding relegation. On the contrary, Baimbridge et al. (1996) does not find such evidence. Scelles et al. (2013) find that the points difference between the home team and its closest competitor with a different sporting stake has a negative relationship to demand, indicating that uncertainty in relation to sporting stakes is of importance. Further, Scelles et al. (2016) find that competition for all types of sporting prizes, and not just the championship and relegation battle, affects demand positively.

Another important aspect for fans is the rivalry with fans from other clubs as well as the competition for local domination, with matches against rivals and local derbies drawing larger

crowds. Such findings are provided by Allan and Roy (2008), Buraimo and Simmons (2009) and Paton and Cooke (2005).

Supply capacity

In cases where the stadium capacity constraint is relevant, true demand cannot be determined by attendance figures, and hence demand can be higher than the capacity (Simmons & Buraimo, 2009). This issue is discussed in connection to the methodology applied in the study presented in the following section.

Presentation of Data

The empirical dataset used in this paper has been collected in connection with a larger study on spectator demand in the Danish professional handball league(s) (men and women), co-financed by the Danish handball league association.² Based on the literature review we include a set of variables covering a large range of categories, which can be considered of importance to match-day attendance (see below).

The data covers five seasons (2011/12 to 2015/16) and a total of 910 matches from the initial phase. We excluded 39 matches from the data because these were moved to a different arena from the regular home arena. In total, 871 matches are included in the study. The number of seasons selected was determined by the quality of the available data. Due to the promotion

² Due to the limited space provided for the paper, we have chosen to focus only on men's handball here.

and relegation system in Danish team handball, 20 different teams played in the league during the period and nine remained in the league during all seasons.³

Variables

The dependent variable in the analysis is the total match day attendance in log-form, with the data being collected from the Danish handball league association and the Danish Handball Federation (DHF). It would have been interesting to split the spectator figures into different groups in order to run separate models for different categories. However, no disaggregated data on these strata exists.

In total, we deploy 27 independent variables categorized in accordance with the literature review. As our study is exploratory in nature – to the best of our knowledge no demand studies have previously examined handball – we have used a large data set where the variables are considered potentially important for attendance demand so as to test their individual relevance. We deploy our variables based on practical criteria to produce the broadest possible information relevant to the clubs. The specific number of variables was determined by the available data.

In relation to *consumer preferences*, we enter one variable: $\log(\text{HABIT})$. In accordance with common practice we take the natural logarithm of the previous season's average attendance of the home team (Pawlowski & Anders, 2012) which controls for habit persistence and core support under the assumption that a proportion of the fans attend regardless of match characteristics. However, the data reveals that for clubs having more than one home arena the

³ Please note that some of the clubs play their home games at more than one arena. In total, 25 arenas have been used by the 20 clubs included in the study.

level of support varies according to where the match takes place. Hence, we enter $\log(\text{HABIT})$ according to the previous season's average in the specific arena. This variable should, however, be interpreted with caution since one cannot simply capture habit persistence by using a lagged variable (Dawson & Downward, 2000).

Regarding *economic factors*, the study aims at testing whether live coverage of matches can be considered a substitute for live attendance. We distinguish between whether the match is broadcast or whether it clashes with another broadcast. Hence, we construct five dummy variables based on various subsets of data. To test the direct substitution effect, we register whether the match is broadcast live on the main channel of the television rights holder, TV2, or on a SECONDARY channel. During the period 2011/12 to 2015/16, 6.5% of matches in our sample were broadcast on TV2, while 14.8% of the matches were broadcast on secondary channels. TV2 is not a free-to-air channel but is publicly owned and is part of the standard cable or satellite television package in Denmark. The secondary channels broadcasting handball are not included in the standard television packages, and therefore reach fewer households. Hence, if any effects of broadcasting are to be found, we expect them to be stronger for TV2. There are no overlaps between matches on the two channels.

To test whether broadcasts of other league matches serve as substitutes to attending, we include two variables capturing whether the match clashes with a broadcast from another league match (CLASH TV2 and CLASH SECONDARY). In our sample, 7.9% of the matches clashed with a TV2 broadcast, while 14.8% clashed with a match broadcast on a secondary channel. Similarly, as the women's handball league enjoys a relatively high level of popularity in Denmark, we test whether broadcasts from the women's handball league had any effect on

attendance (CLASH WOMEN TV). In total, 6% of the matches clashed with a broadcast from the women's league.

Further, we include a linear measure of the distance (divided by 100) between home and away arena by car, obtained from the website *krak.dk* reflecting the away fans' travelling costs, expecting a negative relationship. We do not include other variables related to economic factors such as price of admission, travel cost, income or market size. First, there is no central registration of ticket (admission) price data in Denmark, and only a handful of clubs were able to supply data (and not for the whole period covered) when requested. Second, due to difficulties in assessing market size and the controversial nature of the income variable (Noll, 1974) we exclude these from the equation. In any case, we expect rather small variations in market size and income during the period, and they are hence partly captured by our fixed effects models.

Quality of viewing relates, among other things, to the arena in which the match takes place. We include two variables that aimed at grasping whether a new or expanded arena is related to demand. The variable NEW ARENA and EXP ARENA are dummy variables, which take the value of 1 if the match is played in an arena which has been established or expanded within the last 12 months. This corresponds with Coates and Humphreys (2010; 2012) operationalization of their 'new stadium' variable.

Although handball is an indoor sport, weather still represents an opportunity cost. We hypothesize that 'good' weather could influence spectator demand negatively because it raises the opportunity costs of practicing outdoor activities. Since precipitation can affect road conditions, and hence transportation, it is possible that rain and snow work in two directions. Precipitation reduces the opportunity cost, which increases demand. However, it also decreases mobility, which is expected to lead to a decrease in demand. We therefore enter the average

TEMPERATURE (continuous) during the game and dummies for RAIN and SNOW, as we have not been able to distinguish differences in the amount of precipitation. As weather data has been collected from airports closest to the match-day arena through *wunderground.com*, there could be some variation in weather at the airport's location and local weather conditions in proximity to the arena. But as the distances between the weather stations and the arenas are relatively small this is not considered a significant problem.

Another aspect believed to influence demand is the scheduling of the match. Although the opportunity cost is higher on weekdays (Feehan, 2006), interviews with the clubs revealed that the issue of scheduling is more complex, and that clubs have different opinions regarding the relationship between demand and scheduling. Thus, we examine the effect on demand of early weekday matches scheduled to start no later than 7 p.m. (reference group), late weekday matches scheduled after 7 p.m., early weekend matches (starting before 5 p.m.), and late weekend matches (starting at 5 p.m. or later). The variables are entered as WEEKDAY LATE, WEEKEND EARLY, and WEEKEND LATE respectively.

The *characteristics of the sporting contest* are naturally important for demand (Borland & Macdonald, 2003). To capture the quality of the teams we include variables reflecting objective home ($\log(\text{WAGE HOME})$) and away ($\log(\text{WAGE AWAY})$) team strength, constructed from the annual expenditure of staff (total wage budgets) taken from official club accounts. It should be mentioned that some clubs have a professional men's and women's teams, although the exact expenses associated with each team are not always disclosed in their financial reports. In such cases, the expenses have been estimated from information obtained from financial managers at the clubs. Further, we include the league position of the home (POSITION HOME) and away team (POSITION AWAY) reflecting home and away success. A dummy variable is also

included denoting whether the home team has a mathematical possibility of qualifying for the playoffs (PLAYOFF), with the assumption that teams still in contention for the playoffs attract higher attendances.

Further, we expect demand to increase as the season progresses, and hence expect the number of games played has a positive impact on attendance, and include a continuous variable indicating the round (ROUND). We also include a dummy variable testing the possible effect whereby the home (HOME CHAMP) or away team (AWAY CHAMP) is the defending champion, and a dummy variable indicating if the home team has been newly promoted (PROMOTER).

Although the tradition for derbies in Danish handball is limited, the matches between Team Tvis Holstebro (TTH) and Skjern Håndbold, as well as KIF Kolding København (Kolding IF until 2012/13) against Gudme Oure Gudbjerg (GOG), are considered rivalries. Thus, we include a RIVALRY (dummy variable) capturing these events.

Finally, we take into consideration the question of uncertainty of outcome by constructing a variable derived from betting odds corrected for the profit margin (for an overview of different approaches to estimating uncertainty of outcome, see Cox, 2015). Peel and Thomas (1992) suggest that bookmaker odds reflect all available match information, such as current form and injuries, which are not captured by other measurements, although it is argued that bookmaker odds are inefficient predictors of uncertainty of outcome (for a discussion on the topic, see Simmons, 2006). However, we assume betting odds to be an efficient indicator of uncertainty of outcome and test whether spectators prefer 'even' matches to 'certain outcomes' in accordance with the uncertainty-of-outcome hypothesis. Hence, we enter the probability of

home victory (HOME WIN PROB.) in linear form and its squared term (HOME WIN PROB.SQ) to capture non-linear effects.

Regression models and specifications

Based on the above descriptions, the overall model of our specifications appears as follows:

(1)

$$\begin{aligned} \log(Att) = & \beta_0 + \beta_1 \log(HABIT) + \beta_2 TV2 + \beta_3 SECONDARY + \beta_4 CLASH TV2 + \beta_5 CLASH \\ & SECONDARY + \beta_6 CLASH WOMEN TV + \beta_7 DISTANCE + \beta_8 NEW ARENA + \beta_9 EXP ARENA + \\ & \beta_{10} TEMPERATURE + \beta_{11} RAIN + \beta_{12} SNOW + \beta_{13} WEEKDAY LATE + \beta_{14} WEEKEND EARLY + \\ & \beta_{15} WEEKEND LATE + \beta_{16} POSITION HOME + \beta_{17} POSITION AWAY + \beta_{18} \log(WAGE HOME) + \\ & \beta_{19} \log(WAGE AWAY) + \beta_{20} HOME CHAMP + \beta_{21} AWAY CHAMP + \beta_{22} PROMOTER + \beta_{23} HOME \\ & WIN PROB. + \beta_{24} HOME WIN PROB.SQ + \beta_{25} PLAYOFF + \beta_{26} ROUND + \beta_{27} RIVALRY + \varepsilon \end{aligned}$$

Summary statistics for all variables entered are displayed in Table 1.

Table 1: Dependent and independent variables (N = 871)

Name	Mean	SD	Minimum	Maximum
<i>log(ATTENDANCE)</i>	7.238	0.645	5.247	8.648
<i>log(HABIT)</i>	7.202	0.686	5.455	8.780
TV2	0.065	0.247	0	1
SECONDARY	0.148	0.355	0	1
CLASH TV2	0.079	0.270	0	1
CLASH SECONDARY	0.148	0.355	0	1
CLASH WOMEN TV	0.064	0.245	0	1
DISTANCE	1.704	1.027	0.185	4.552
NEW ARENA	0.040	0.197	0	1
EXP ARENA	0.049	0.217	0	1
TEMPERATURE	16.766	5.885	1	33.5
RAIN	0.204	0.403	0	1
SNOW	0.044	0.204	0	1
WEEKDAY LATE	0.321	0.467	0	1
WEEKEND EARLY	0.315	0.465	0	1
WEEKEND LATE	0.090	0.286	0	1
POSITION HOME	7.641	3.974	1	14
POSITION AWAY	7.449	3.935	1	14
<i>log(WAGE HOME)</i>	8.856	0.730	7.023	10.560
<i>log(WAGE AWAY)</i>	8.857	0.724	7.023	10.560
HOME CHAMP	0.055	0.228	0	1
AWAY CHAMP	0.054	0.226	0	1
PROMOTER	0.172	0.378	0	1
HOME WIN PROB.	0.518	0.241	0.048	0.917
PLAYOFF	0.946	0.226	0	1
ROUND	13.527	7.513	1	26
RIVALRY	0.018	0.134	0	1

We summarize our results by presenting outputs from the two regression models we find most appropriate for representing our data.⁴ We investigate the whole (or close to the whole) sample of the matches in the Danish professional men's handball league during the period. We are thus generalizing with *stochastic model theory* rather than sample theory.

⁴ We have also tested other model specifications not presented in this paper. This is for robustness, to identify which variables are consistently significant under different model specifications. Additional models not presented here include random effects, pooled OLS, and Tobit models. The results of these were consistent with the models reported in our paper and are available upon request. A Hausman test indicates that fixed effects are preferred over random effects.

When following sample theory, we generalize from the sample to the population. According to this logic, when one looks at the entire population, they should result in a perfect prediction. However, in stochastic model theory, confidence intervals and levels of significance still make sense. According to this logic, we are generalizing from the observation made to the process or mechanism that brings about the actual data (Gold, 1969; Henkel, 1976; Mehmetoglu & Jakobsen, 2017).

Our starting point is a nondeterministic experiment, which implies that the results of the experiment will vary, even if we try to keep the conditions surrounding it constant. Thus, the use of confidence intervals and significance levels make sense, even if we are looking at the entire population. If there is a lack of statistical significance, then that can be viewed as an indication that the correlation produced by nature is no more probable than the one produced by chance (Gold, 1969).

The two models we present are one fixed effects with club and season dummies. As 58 of the matches included in the study reached at least 95% of arena' capacity, we also present a Tobit model with club dummies. The main advantage of fixed effects models is that they enable us to control for all time invariant variables and thus avoid much of the problem of spurious relationships, leaving us with a purer relationship between our X and Y . We look at the variation within each arena, thus ignoring differences between the clubs (e.g. that some clubs have a larger following than others, which is difficult to operationalize, but is taken into account in the fixed effects model).

Our Tobit model allow us to take right censoring into account. The reason for this is that we have a maximum attendance in each arena which can be viewed as right censoring because, in theory, the attendance could have been higher but is restricted by the number of seats in the

arena. Also, we acknowledge that it is not always possible to fill an arena to maximum capacity due to the presence of, for example, television or other broadcasting equipment or pre-booked, unused seats. In our Tobit model we set a limit of 95% or closer as our right censored maximum. The full results for all presented models can be found in the results section below.

Results and Discussion

The regression results from the two models are presented in Table 2. The variable $\log(\text{HABIT})$ (*consumer preferences*) is non-significant in both models controversially suggesting that no habit effects exist. We nevertheless argue that our fixed effects models capture most of the habit effect due to lack of variation in average attendance between seasons for the individual clubs. Although it is not presented here, we ran a model without club-specific effects where $\log(\text{HABIT})$ was highly significant.

Table 2: Attendance for Danish male handball league matches

Independent variable	FE + season		FE Tobit 95%	
	<i>B</i>	<i>SE B</i>	<i>B</i>	<i>SE B</i>
<i>log(HABIT)</i>	0.064	0.060	-0.004	0.010
<i>TV2</i>	0.057	0.046	0.088*	0.047
<i>SECONDARY</i>	0.061**	0.030	0.057*	0.031
<i>CLASH TV2</i>	-0.090**	0.035	-0.093***	0.036
<i>CLASH SECONDARY</i>	-0.004	0.028	-0.015	0.028
<i>CLASH WOMEN TV</i>	-0.002	0.036	-0.038	0.036
<i>DISTANCE</i>	-0.055***	0.010	-0.061***	0.010
<i>NEW ARENA</i>	0.226***	0.054	0.084	0.053
<i>EXP ARENA</i>	0.097**	0.046	0.090**	0.045
<i>TEMPERATURE</i>	0.001	0.003	0.003	0.002
<i>RAIN</i>	0.048**	0.022	0.045**	0.022
<i>SNOW</i>	-0.123***	0.045	-0.141***	0.046
<i>WEEKDAY LATE</i>	0.027	0.025	0.054**	0.025
<i>WEEKEND EARLY</i>	-0.074***	0.028	-0.083***	0.028
<i>WEEKEND LATE</i>	-0.047	0.040	-0.037	0.041
<i>POSITION HOME</i>	-0.019***	0.004	-0.017***	0.004
<i>POSITION AWAY</i>	-0.009**	0.004	-0.010***	0.004
<i>log(WAGE HOME)</i>	0.037	0.106	0.042	0.101
<i>log(WAGE AWAY)</i>	0.108***	0.023	0.118***	0.024
<i>HOME CHAMP</i>	-0.048	0.056	-0.026	0.055
<i>AWAY CHAMP</i>	0.126***	0.042	0.159***	0.044
<i>PROMOTER</i>	0.075*	0.043	0.032	0.040
<i>HOME WIN PROB.</i>	0.558***	0.206	0.588***	0.210
<i>HOME WIN PROB.SQ</i>	-0.282	0.191	-0.294	0.195
<i>PLAYOFF</i>	0.079*	0.044	0.106**	0.044
<i>ROUND</i>	0.008***	0.002	0.010***	0.002
<i>RIVALRY</i>	0.048	0.066	0.023	0.067
<i>SEASON 2012/13</i>	0.030	0.034		
<i>SEASON 2013/14</i>	0.039	0.033		
<i>SEASON 2014/15</i>	0.163***	0.033		
<i>SEASON 2015/16</i>	0.096***	0.032		
<i>INTERCEPT</i>	5.309***	0.810	6.583***	0.893
<i>R-SQUARED WITHIN</i>	0.319			
<i>R-SQUARED BETWEEN</i>	0.652			
<i>R-SQUARED OVERALL</i>	0.495			
<i>PSEUDO R-SQUARED</i>			0.933	
<i>RIGHT-CENSORED</i>			58	
<i>GROUPS</i>	25		25	
<i>N</i>	871		871	

Note: *significant at 10 %, **significant at 5 %, *** significant at 1 %. Season 2011/12 as reference category. Beta values cannot be produced in clustered models.

In relation to the variables on *economic factors*, the regression models arrive at different conclusions regarding matches broadcast on TV2. While Tobit FE 95% reports a positive effect at the 10% level, FE + season does not find any significant effect, but also has a positive pre-sign. For *SECONDARY* both models report positive effects at the 10% and 5% levels respectively, suggesting that broadcasts on secondary channels surprisingly serve as a complementary good rather than a substitute. However, as broadcasters choose to air high quality

matches it is possible that this apparent positive effect is caused by selection bias. To test this empirically, we ran dyadic models confirming that the positive effect actually is caused by selection bias, and hence there is no significant effect (positive or negative) on attendance when a match is broadcast on TV2 or on a SECONDARY channel.⁵

We find negative effects on attendance at the 1% level in both models when a match clashes with another league match broadcast on TV2 (CLASH TV2). However, we find no significant effect if the match clashes with a league broadcast on another channel (CLASH SECONDARY). We argue that this is because TV2 reaches more households, and hence represents a higher opportunity cost than broadcasts on secondary channels. Nor do we find any effect if a match clashes with a broadcast from the women's league (CLASH WOMEN TV). Moreover, distance has a significant negative effect in both models at the 1% level, indicating that the travelling cost for away fans has a negative effect.

Quality of viewing. First, for teams playing in a new arena constructed (NEW ARENA) within the last twelve months, only FE + season is significant (at the 1% level) with the FE Tobit 95% reporting non-significant effects. Yet, both models report significantly positive effects of 5% for matches played in arenas which have undergone expansion within the last twelve months (EXP ARENA).

⁵ Our additional dyadic models (home/away team) show no significant effect for TV2, SECONDARY and CLASH SECONDARY, and a negative significant effect (at the 1% level) of CLASH TV2. The dyadic models deal with the issue of selection effect of which matches are televised. However, it is not an optimal way of modelling our data due to the relatively short time period under investigation. Thus, they are not part of our main modelling approach.

For weather, we find that RAIN (5% level) and SNOW (1% level) have a significant impact on attendance in both models, while TEMPERATURE is non-significant, and hence does not seem to influence demand. As the temperature from October to March is relatively low in Denmark, so is the general attractiveness of outdoor activities. RAIN shows a positive effect, while SNOW, on the other hand, reduces attendance demand. We argue that while both rain and snow reduce the opportunity cost, which leads to an increase in demand, snow also complicates transportation in a way that rain does not.

Whereas other studies typically report higher attendances at weekends (e.g. Forrest & Simmons, 2006, Buraimo et al., 2009; Madalozzo & Villar, 2009), both regression models show a significant decrease in demand for early weekend matches starting before 5 p.m. (WEEKEND EARLY) relative to weekday matches starting no later than 7 p.m. (WEEKDAY EARLY) (reference group). Further, FE Tobit 95% report significantly higher attendances for late weekday matches (WEEKDAY LATE) at the 5% level relative to the reference group, however, FE + season report the variable to be non-significant. There is no significant difference between matches played on early weekdays and late at weekends (WEEKEND LATE).

Characteristics of the sporting contest. Both models report non-significant effects for the home teams budget ($\log(\text{WAGE HOME})$), but positive effects at the 1% level for the away team budget ($\log(\text{WAGE AWAY})$). Buraimo (2008), reaching similar conclusions, argued that this could be due to the talent pool being fixed during the season, and the spectators of the home team getting used to the level of talent. Therefore, they only respond to changes in the talent pool of the away team, and hence highly talented away teams produce a positive externality.

The variables POSITION HOME and POSITION AWAY indicate that the current success of both the home and away clubs influence demand, with home team success being more

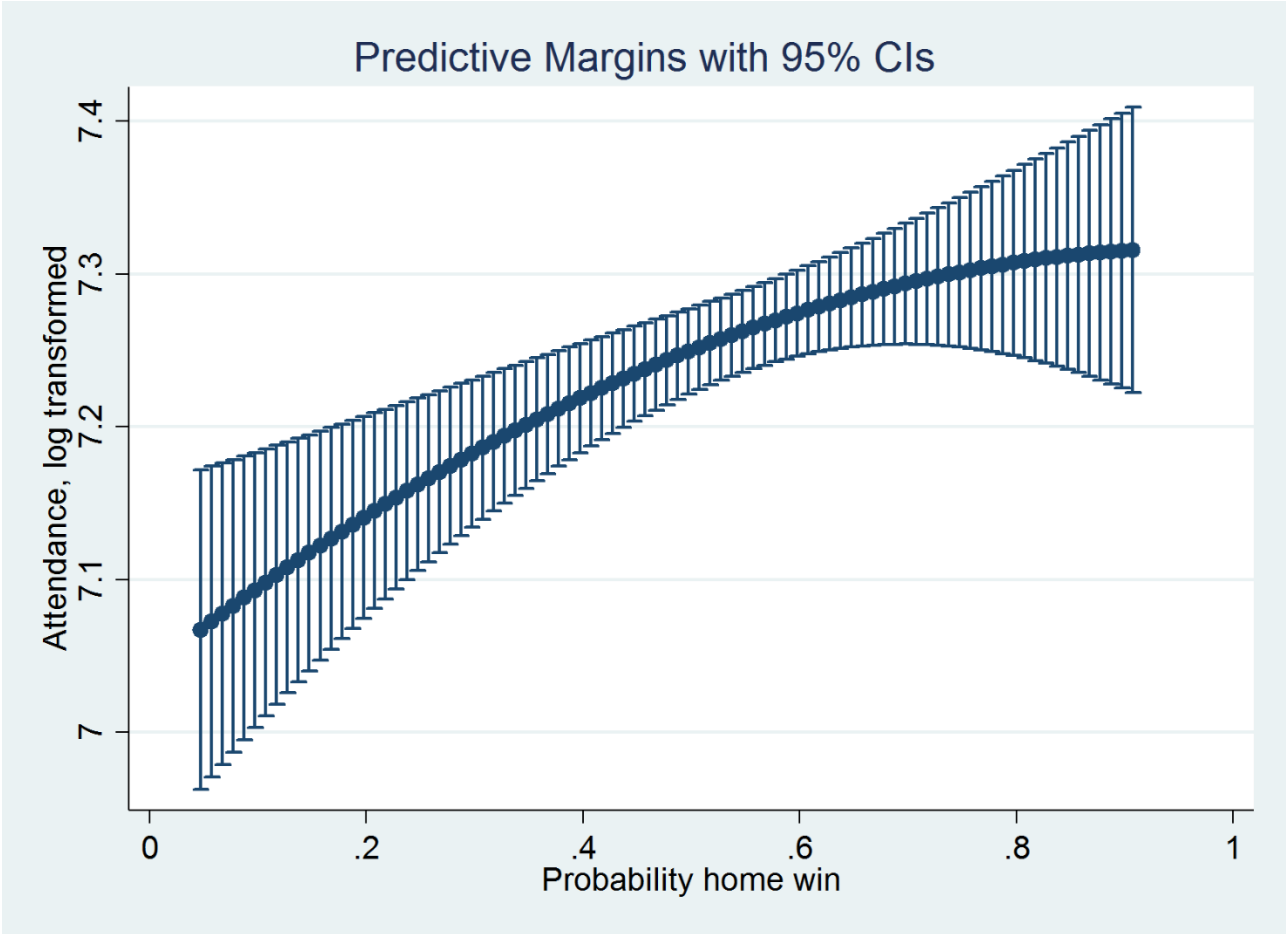
important (the sign is negative because the best league position is 1; the second best has the value 2, and so forth). Further, both models (FE + season and FE Tobit 95%) produce significant positive effects at 10% and 5% respectively if the home team still has a chance to qualify or has qualified for a playoff position. Moreover, as the season progresses demand rises as expected (ROUND).

Contrary to what may be expected, the home team being the defending league champion (HOME CHAMP) is non-significant in both models. However, if the away team is the defending champion (AWAY CHAMP), demand increases significantly at the 1% level. In line with Buraimo's (2008) 'fixed talent' argument with regard to wage budgets, it is possible that home fans quickly become accustomed to being the champions. However, as the champion only visits each team in the league once before the playoffs, it seems reasonable that they attract greater attendance than non-champions. The home team that is newly promoted (PROMOTER) has a positive sign, but is only significant at the 10% level in one of the models, and hence it is problematic to draw any specific conclusions. We do not find any significant effect for RIVALRY.

Figure 2 shows the relationship between the demand and probability of a home win (Fixed effects + season), which indicates that spectators have a high preference for home victories. In Table 2 it appears that HOME WIN PROB is significant and positive while the squared term (HOME WIN PROB.SQ) is non-significant with a negative sign. This means that spectator demand increases (at a decreasing rate) in correspondence with the (increasing) probability of home victory to a maximum level of 98.9% (FE + season), and hence Rottenberg's UOH is rejected in the sense that fans prefer an almost certain win (98.9%) to an even contest. Yet, it is also possible that the relationship among (log)attendance and home win probability is in

fact linear, as illustrated in Figure 2. We do not find any evidence that spectators prefer probable losses compared to more even matches, as proposed by Coates et al. (2014).

Figure 2: Effect of Probability of a Home Win on Attendance



Conclusion, Implications and Future Research Perspectives

Summary

Our aim has been to analyze the factors determining spectator demand in Danish men's handball league. To gather as much information on spectator demand as possible, a total of 27 variables have been tested when applied to different models with many of the results being consistent with previous findings. However, our analysis provides a new insight into circumstances that are specific to handball, thus adding to the overall body of knowledge on spectator demand.

First, we do not find previous attendance to have any effect when controlling for team-specific effects. This is in contrast to previous studies (Buraimo & Simmons, 2009; Forrest & Simmons, 2006; Pawlowski & Anders, 2012) – with the exception of Paton and Cooke (2005) – which claim that habit persistence is an important determinant of match attendance. Yet, $\log(\text{HABIT})$ is highly significant when fixed effects are not included. Caution should therefore be made when interpreting lagged attendance as a direct expression of habit (Dawson & Downward, 2000).

Another interesting finding is the impact of television broadcasts on live attendance. While the positive significant coefficients for TV2 (in one model) and SECONDARY (in both models) are explained by the selection effect (broadcasters choose high quality matches), we find that demand is affected negatively if a match clashes with another league match broadcast on TV2. This is in line with the findings of Forrest and Simmons (2006) and Buraimo et al. (2009) on English football where broadcasts of European matches involving Premier League clubs were found to displace attendance in the lower divisions.

Moreover, we do not find that spectators have preferences for weekend matches. Rather, our models show that demand is lowest when matches are scheduled before 5 p.m. at the weekend. However, we cannot rule out that preferences regarding scheduling are club-specific. It is possible that if a club has a history of playing at a specific day and time, its fans will grow accustomed to this, and prefer matches to be scheduled at the same time each week.

Furthermore, the study reveals interesting insights into the impact of the weather. As handball is played indoors, rain does not affect attendance negatively, but actually have a positive impact since it reduces the opportunity costs of other outdoor activities. Snow, on the other hand, while also reducing opportunity costs, complicates travel to games leading to fewer spectators. Temperature does not seem to affect attendance. The non-significant effects of temperature could be associated with the fact that team handball is played indoors and most of the handball season takes place during the winter when outdoor leisure activities are less attractive.

Managerial Implications and Future Research Perspectives

The results revealed in the analysis above have implications for Danish team handball clubs and the Danish handball league association. Even though some of the findings are related to areas over which the clubs have limited control (for example, the weather), the research presented here provides important information to the clubs which they can take into consideration when they form their spectator demand strategies. The findings – and some of the limitations of our study – also point towards future research areas.

To maximize spectator attendance, we suggest three areas that can be addressed inside

the arenas. First, matches clashing with other league matches broadcast on TV2 suffer in attendance. Therefore, clubs and league administrative personnel should consider the timing of matches, and potential competition from television when planning the schedule, although it may be difficult to avoid competition from broadcasts entirely as it would require up to seven different timeslots per match day, and hence possible conflict with early weekend matches, which would have a significantly negative impact on attendance. That finding that matches scheduled early in the weekend reduce attendance contradicts the findings of most other studies, but should also be considered in the scheduling of matches. However, to optimize scheduling, future research could apply individual level data collection methods and analyses to examine the preferences of different spectators more closely. Our regression models only provide an overall analysis of demand by the handball spectators, which is a limitation of the study.

Second, both of our regression models find positive effects of expanded facilities. We argue that an expansion of the arena is typically driven by the need to increase capacity, and that arenas are only expanded if matches are frequently sold out. On the other hand, whereas one of our models indicates positive effects of newly-constructed facilities (FE + season), the other (FE Tobit 95%) indicates non-significant effects. Previous research (Feddersen et al., 2006; Haugen, Hervik, & Gammelsæter, 2014) finds that the effects of new arenas are temporary as the spectators adapt to the new facilities. In the context of Danish professional football, it is well known that the increased capacity of new or reconstructed stadiums has resulted in larger stadiums that are underutilized (Bang, Alm, & Storm, 2014; Nielsen, 2017). Therefore, investing in new facilities as a way to increase attendance demand should be done with caution. Future studies could assist club managers to identify specific needs and plan more carefully in relation to capacity to limit the underutilization of (new) spectator facilities. For example, specific

catchment area or market size studies could be carried out to better understand the individual club's spectator and fan potential.

Third, another way to help increase spectator demand could be to increase promotion of the away team with special emphasis on strong and successful team visits, as these parameters are important determinants of match attendance. Yet, while clubs should try to increase the number of loyal supporters, they must also be careful not to draw attention away from their own team. As rivalries are limited in Danish handball, future management studies should look into how a strategy of promoting rivalries and derbies could be laid out in reality, for instance by cooperation through social media. Together with the recommendations described above, this would help to maximize the demand among fans and other potential spectators in the Danish men's handball league.

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