

Article

Professional Clubs as Platforms in Multi-Sided Markets in Times of COVID-19: The Role of Spectators and Atmosphere in Live Football

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Abstract: In-stadium spectators affect the emotional value and atmosphere of sport live broadcasts. Due to the COVID-19 pandemic, in Europe, the presence of in-stadium spectators, however, was suspended until further notice. Conceptualizing professional clubs as economic platforms, network effects due to the lack of in-stadium spectators may affect stakeholders' utility. Thus, the main aims of this study are to examine the influence of missing in-stadium spectators for professional clubs by investigating network effects on (1) TV viewers' emotional arousal and (2) TV viewers' attention towards sponsor messages during live football broadcasts. Using a quantitative research design, a controlled lap was conducted, and broadcasts were presented to $n = 26$ highly involved participants. Heart rate, eye-tracking, and betting odds data served as measurements of arousal, attention, and game outcome uncertainty and were aggregated on a second-by-second basis ($k = 140,400$). Multilevel regression analysis showed significant differences in viewers' arousal and attention to sponsors, contingent on the presence of in-stadium spectators and game outcome uncertainty. The presence of in-stadium spectators increased arousal, while attention towards sponsor messages decreased, depending on game outcome uncertainty. Based on the presence of network effects, implications to sustainably adapting professional football clubs' business models based on stakeholders' different interests can be given.

Keywords: COVID-19; football; spectators; arousal; visual attention; eye tracking; sport sponsoring



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1. Introduction

The COVID-19 pandemic has caused drastic changes for the whole society, including the sports industry. Since early March 2020, all across Europe, spectators have been banned from attending games of professional football leagues. Various leagues were completely suspended or finished the 2019–2020 season without any in-stadium spectators. However, staging sport live events with in-stadium spectators represents one main pillar regarding European football clubs' financial sustainability. Before the COVID-19 pandemic broke out, professional football clubs' revenues had continuously increased over several years with big clubs and leagues achieving high growth rates and global brand reach [1–3]. In-stadium spectators not only generate significant income from ticket sales, but also create an atmosphere that may produce important indirect benefits for several stakeholders such as sponsors or media rights owners, and thus contribute to diversifying revenue streams [3,4]. As a result, professional clubs and leagues with massive TV viewer audiences sell broadcasting rights and sponsorship deals, representing the two most important revenue streams for the major European football leagues [2]. Broadcasters pay substantial fees to sell subscriptions to customers and slots for ads in live broadcasts to advertisers, and sponsors invest in sport sponsorship deals, hoping to enrich and popularize their brands emotionally.

From an economic perspective, football clubs can thus be described as platforms in multi-sided markets that serve different, distinct customer groups who are indirectly connected by positive or negative externalities, so-called network effects [5]. For example, broadcasters could experience positive network effects if the presence of in-stadium spectators elicits emotions in TV viewers, as this may enhance their enjoyment and increase demand for broadcasts. Similarly, sponsors as further stakeholders in the multi-sided market of football make use of those network effects. The presence of in-stadium spectators, who create an atmosphere that elicits emotions and makes the sports industry unique, can enhance sponsor brands' emotionalizing, e.g., [6,7]. Thus, sponsors generally prefer platforms or clubs that attract greater in-stadium and live broadcast TV viewer audiences. However, the positive externality may not run in both directions [5], as consumers frequently attempt to avoid commercial stimuli in front of the TV [8], which could diminish sport sponsorship's effectiveness as a marketing instrument. As the COVID-19 pandemic banned in-stadium spectators from live sport events for a while, the unique opportunity to isolate their influence aroused and their impact on professional football clubs' financial sustainability as economic platforms could be investigated. As furthermore demonstrated by Gouveia and Pereira [9], European football is financially exposed and vulnerable to their main sponsors, and the increasing asymmetrical power relations of the broadcaster's rights are intensified due to the pandemic. Thus, this study aims to examine the network effects caused by the presence or absence of in-stadium spectators to better control and sustainably treat them, through in-depth knowledge, by answering the following research question:

RQ: Do in-stadium spectators significantly influence consumers' emotional arousal and consumers' visual attention to sponsor messages during football live broadcast and therefore create important network effects?

While brands can attempt to associate themselves with viewer emotions, i.e., make use of network effects created by in-stadium spectators and the sporting atmosphere, e.g., [7,10], visual attention is necessary to further process sponsorship-linked information, e.g., [11,12]. A quantitative research design was used to conduct a controlled lab study utilizing novel real-time measurement approaches. For the first time in academic sponsorship literature, full-length sport live broadcasts instead of sequenced video clips were used to address the call for more realistic study designs, e.g., [12,13], which makes the study unique and highly relevant. Furthermore, the study contributes to the academic body of knowledge regarding the effectiveness of sponsorship messages in live broadcasts. Additionally, practitioners obtain useful insights about diminished or strengthened network effects of the interplay between live spectators, TV viewers, and sponsors to assess the impact of COVID-19 and the possibility to adapt their business models sustainably, which are necessary based on consequences of the pandemic [9,14]. Results give hints on how to compensate or better balance the impact on biased stakeholders' utilities based on the changed sport products' attractiveness due to missing or modified factors in the economic platform system of football. Capturing the effects that the presence of one customer group (i.e., in-stadium spectators) has on two other customer groups (i.e., broadcasters and sponsors) in the multi-sided football market provides a glimpse into the possible long-term implications that the COVID-19 pandemic may have on the broadcast and sport sponsorship market.

2. Background

2.1. Literature Review

Sponsorship is frequently defined as "the provision of assistance either financial or in-kind to an activity by a commercial organization for the purpose of achieving commercial objectives" [15]. This commonly describes the contract-based relationship between a sponsor and a property rights holder, often from the fields of arts, sports, or culture [16]. Sponsorship expenditures have seen massive growth over the past few decades, and globally, spending is estimated to have exceeded \$65 billion [17]. This growth of sponsorship is part of a greater trend toward so-called indirect forms of marketing, including influencer marketing or product placement [18]. The common theme behind these approaches lies in

the integrated communication, which involves embedding brand messages in engaging contexts, such as sport broadcasts. Especially live sport broadcasts provide a valuable environment that encourages real-time engagement [19]. This growing relevance is also reflected by the fact that sponsorship has emerged as an increasingly important line of marketing research [16]. Numerous researchers have investigated the effects that sponsorship has on sponsor brands and the individual influences of various antecedents [20]. Amongst other effects, sponsorship has been shown to impact consumers' brand awareness, e.g., [21,22], as well as sponsors' brand images, e.g., [23,24], employees, e.g., [25], or firm value, e.g., [26].

As well as other industries, the sport industry was not spared the consequences that the COVID-19 pandemic caused. Sporting events all over the world were postponed or cancelled altogether, which resulted in stadium closures and the challenge of staging live events without in-stadium visitors, e.g., [14,27]. That is why the impact of the COVID-19 pandemic is also an evolving topic in the sport literature. Based on previous research regarding COVID-19, especially the absence of in-stadium spectators opens many challenges, but also opportunities, such as lower risk regarding crowd control and an overthinking of environmental byproducts produced by sport events, from a business perspective [14]. A study investigating games behind closed doors of the German Bundesliga highlighted that referees gave fewer fouls and yellow cards for the home team relative to the away team based on missing in-stadium spectators [28]. Furthermore, a Delphi-based scenario analysis on the social-economic impacts of COVID-19 on the European football ecosystem stated that the consequences of stakeholder groups differ and that the pandemic causes based on prevalence's various opportunities as well as threats [27]. This goes along with Gouveia and Pereira [9] demonstrating the financial exposure and vulnerability of European football to their main sponsors and exploring the increasing asymmetrical power relations of the broadcaster's rights as consequences caused by the pandemic.

2.2. *The Concept of Multi-Sided Markets in Professional Sports*

Multi-sided markets are characterized by the inter-correlation of at least two distinct customer groups, served by one supplier [29]. Generally, three factors must be required to describe markets as multi-sided. First, at least two distinct customer groups must be served by the same supplier; then, these groups need to be inter-correlated by indirect externalities, the so-called network effects; and finally, an intermediary could internalize the externalities created by one group for the other group [29]. The framework has been found to be a promising tool to analyze sports businesses in a holistic manner, e.g., [5,10]. Applying it to the present context, leagues in the European football industry are viewed as platforms in multi-sided markets that serve the three distinct customer groups: spectators, broadcasters, and sponsors [5]. Spectators buy tickets and attend live matches, broadcasters pay substantial fees to sell subscriptions to TV viewers or slots for ads in live broadcasts to advertisers, and sponsors hope to emotionally enrich and popularize their brands by investing in sport sponsorship deals. All groups can be distinguished from each other and are inter-correlated by the exemplarily named positive and negative externalities [29].

To empirically test the assertion by Budzinski and Satzer [5] that several positive and negative externalities will arise between these three groups, the effect that the presence of in-stadium spectators has on the other two customer groups (i.e., broadcasters and sponsors) of football leagues is examined using two constructs: emotional arousal and visual attention. First, broadcasters' utility generated by a football game is operationalized as the level of arousal elicited in TV viewers. Second, sponsors' utility is operationalized in two ways. Arousal serves as a measure for consumers' emotional reaction created by the broadcasts and visual attention to measure TV viewers' attention to the embedded sponsor messages. Therefore, in the following, first of all the theoretical predictions regarding the two concepts arousal and visual attention are given. Afterwards, a theoretical framework and research concept was developed as displayed in Figure 1 to strengthen the operationalization of concepts.

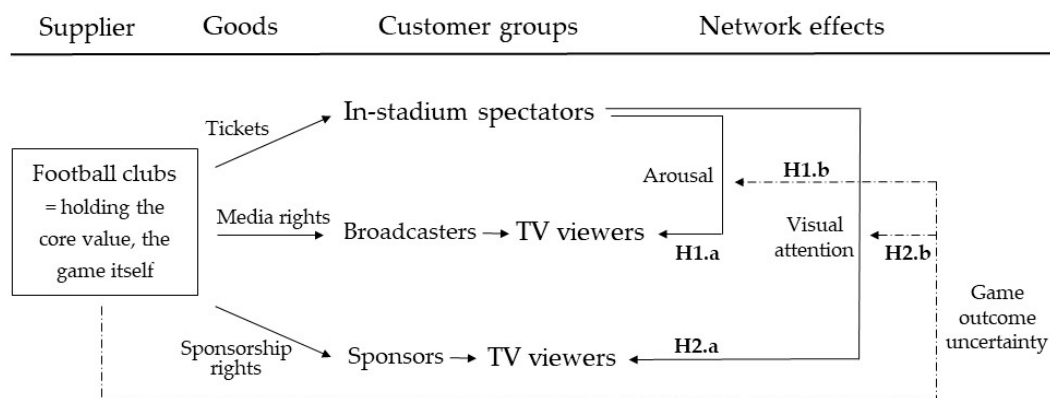


Figure 1. Theoretical framework: the multi-sided market football and its network effects.

2.3. Theoretical Predictions: Arousal

Recent research regarding the influence of emotions on sport event attendance postulates the idea that spectators are driven more by emotions than by economic reasoning when purchasing tickets for a game [30]. Pleasant emotions seem to positively influence future behavioral intentions among football spectators, e.g., [31,32]. Through the interaction with other involved football spectators, live football games can become highly emotional experiences, and in-stadium spectators generate an emotionally charged atmosphere that connects individuals in stadiums to a collective, e.g., [6,33]. This feeling seems to transfer to TV viewers as well, and the emotional richness and high value of broadcasts are well known in the academic literature, e.g., [7,34,35].

Among the emotions elicited by live sports broadcasts, arousal has received considerable attention in the literature so far, e.g., [36–38]. Arousal is defined as a component of lower-order or “type 1” emotions that individuals cannot control, but that occurs automatically as a reaction of the autonomic nervous system [39]. It has been shown to intensify positive as well as negative responses to a stimulus [35,40].

Researchers have theorized that large in-stadium spectator audiences not only enhance the experience character of the match, but the atmosphere they create also improves the broadcast, whereas an empty stadium would be less attractive to TV viewer audiences [5]. In other words, broadcasters should experience positive network effects if the atmosphere created by the presence of in-stadium spectators elicits significant emotions and enhances the TV viewers’ enjoyment, which in turn increases the demand for broadcasts. Additionally, sponsors use the emotional richness of live broadcast to increase the appeal of their brand through the positive in-stadium atmosphere [10,41], which thus seems to be a positive network effect increasing sponsors’ utility as well. To empirically test the assumption that the presence of in-stadium spectators affects viewers’ arousal and thereby influences broadcaster and sponsor utility, the following hypothesis is proposed:

Hypothesis 1a. *The presence of in-stadium spectators positively affects TV viewers’ arousal.*

In addition to the presence of in-stadium spectators, the dramatic nature of the sporting action itself and the outcome uncertainty of a game are capable of evoking various forms of emotions among spectators, e.g., [13,34,42]. The latter is central to creating an exciting atmosphere and eliciting emotions, as game outcome uncertainty attracts people and moves them to attend games as spectators [43]. Empirical findings indicate that the outcome of a game directly influences the emotions of in-stadium football spectators [44], and live broadcasts are characterized by outcome uncertainty resulting in strong emotional reactions [45]. Therefore, it can be assumed that viewers’ arousal during a live football broadcast is influenced by the outcome uncertainty of a game, with games with low outcome uncertainty creating less arousal in viewers, whereas close games with high outcome uncertainty elicit greater arousal. The positive externalities between in-stadium

spectators and both sponsors and broadcasters can thus be dependent on the outcome uncertainty of the specific game. Therefore, the following hypothesis is formulated:

Hypothesis 1b. *The presence of in-stadium spectators positively affects TV viewers' arousal, depending on the game's outcome uncertainty.*

2.4. Theoretical Predictions: Visual Attention

Visual attention has been recognized as a critical precondition for sponsor messages' effectiveness in sports broadcasts [11,12]. The limited capacity model of motivated mediated message processing model (LC4MP) conceptualizes individuals as biological organisms who have finite levels of cognitive resources available at a given point in time to allocate visual attention to media content [46,47]. The model considers that, during broadcasts, viewers' allocation of attention varies and that cognitive overload can occur when insufficient cognitive resources are available for processing [46]. In the context of sponsor messages embedded in sports broadcasts, in-stadium spectators can be considered a disruptive factor that distracts TV viewers' attentional focus. This network effect of the presence of in-stadium spectators on sponsor message effectiveness is reflected in the following hypothesis:

Hypothesis 2a. *The presence of in-stadium spectators negatively affects TV viewers' visual attention to sponsor messages on LED-boards.*

Furthermore, as the zoom-lens metaphor of visual attention suggests, a viewer's attentional focus can vary in size with a more narrow or wider focus of attention [48]. Thus, either a narrow area of a visual field can be focused sharply or a wider, larger part can be considered. Concerning football broadcasts, viewers can direct their attention at different wider or narrower areas of the screen. The degree of the suspense of a stimulus such as a football broadcast can significantly impact visual attention by widening or narrowing viewers' attentional focus [13,47]. In-stadium sponsor messages are often argued to be processed as peripheral signals rather than central ones. They compete for attention with the sporting content that the audience is most interested in, e.g., [49,50]. Previous research showed that attention to peripheral brand information is less likely during exciting sports broadcasts compared to less exciting broadcasts [51]. Therefore, a wider focus should increase visual attention to peripheral sponsor messages.

Following this reasoning, the network effects of in-stadium spectators on viewer attention to sponsors could be subject to the outcome uncertainty of a specific game. More precisely, in-stadium spectators' presence in combination with calm games that are associated with a broader attentional scope should result in TV viewers devoting more visual attention to peripherally presented in-stadium sponsor messages and vice versa. Therefore, the following hypothesis is put forward:

Hypothesis 2b. *The presence of in-stadium spectators negatively affects TV viewers' visual attention to sponsor messages on the LED-board, depending on the game's outcome uncertainty.*

2.5. Theoretical Framework

Figure 1 displays the theoretical framework based on the assertion of football clubs as multi-sided markets by Budzinski and Satzer [5] with the distinct customer groups of in-stadium spectators, broadcasters, and sponsors (the latter two operationalized as TV viewers) and their functions. These groups might be linked by network effects as explained in the theoretical predictions regarding the two operationalized concepts, arousal and visual attention, expressed by four proposed hypotheses. However, the possible positive externalities created by network effects might not run in both directions and therefore should be analyzed in detail through the following theoretical framework.

3. Materials and Methods

3.1. Research Design and Stimuli

Conducting a controlled lab study, a quantitative research design was used to test the hypotheses. To examine the influence of in-stadium spectators on TV viewers' arousal and visual attention, live games of the German football Bundesliga (first division) were presented to highly involved participants. Half of the games were taking place with in-stadium spectators as usual, and the other half were taking place under the COVID-19 restrictions without in-stadium spectators. Televised sports generally hold a unique emotional richness, e.g., [34,52], and create intense emotions among TV viewer audiences, making it suitable for this research purpose. Furthermore, football is unique in its extraordinary reach and massive audiences, qualifying it as one of the most popular sports for brands to sponsor [53]. Based on that, football live broadcasts provide clear sponsor visibility, employing LED-boards, which are available to sponsor brands, as standard in every German Bundesliga stadium. For the purpose of this study, exclusively sponsor messages displayed on LED-boards were of interest. Data acquisition was limited to the regular playing time of 90 min to secure a coherent and consistent assessment, which allows for the comparability of the games afterward.

3.2. Measurements

Up to two participants were watching the same football live broadcast on two identical TV screens. Arousal, visual attention towards sponsor messages, and game outcome uncertainty were measured in real-time. The resulting data were synchronized through the software Blickshift Recorder and assigned second-by-second time stamps.

3.2.1. Arousal

Two Shimmer3 GSR + systems collected biometric data on participants' emotional arousal, measuring participants' heart rates at 128 Hz throughout the broadcasts. The heart rate value represents the number of heartbeats-per-minute (BMP) and is a widely used autonomic measure for one part (arousal) of the study participants' emotional state, e.g., [13,39,54]. In contrast to self-reported measures of emotions, autonomic measures can overcome the bias of cognitive and social desirability constraints [39], as they reflect a physiological reaction, which is caused by changes in the autonomic nervous system, e.g., [55,56]. Heart rate shows the momentary increases or decreases in arousal, with lower values indicating low emotional arousal and higher values indicating high emotional arousal. The Shimmer 3 GSR+ system's electrode was placed on the second finger of the participants' hand. The acquired signals of two devices at a time were transmitted to the Blickshift Recorder software via Bluetooth. HR data were aggregated on a second-by-second basis for the consolidation. The recording software automatically assigned the data timestamps identical to those of the eye-tracking data.

3.2.2. Visual Attention

Two remote infrared eye-tracking systems (SMI REDn and REDm, 60 HZ) were used to track participants' eye movements on the TV screen simultaneously. Eye-tracking is a widely known and acknowledged tool to assess consumers' visual attention, e.g., [12,57]. The eye-tracking devices were connected to two different Windows 10 computers, running the SMI recording software iViewRED. Both computer clocks were synchronized by the Blickshift Recorder software, ensuring identical local timestamps for both gaze data files. Thus, the different data sources could be merged for the analysis. A nine-point calibration with subsequent validation was performed for each participant and each halftime until the x- and y-axis deviations were below 0.5 degrees. The deviation in measurement accuracy indicated by the SMI handbook amounted to less than 0.4°. As results are generally improved on a larger screen, where the deviation represents a smaller portion compared to a smaller screen [58], two 43"-TV screens were used as stimulus monitors. The gaze data were analyzed through the SMI software BeGaze. In all video sequences that included

clearly visible sponsor messages, LED boards were marked as “areas of interest” (AOIs). These areas were afterward matched with the participants’ gaze data. Thus, participants’ gaze hits on LED-boards with sponsor messages were recorded and served as a valid measure of visual attention [59].

3.2.3. Game Outcome Uncertainty

In the sports economics literature, betting odds have long been used as an objective indicator of game outcome uncertainty, e.g., [60,61]. In-play betting odds reflect all factors that impact the outcome of a game, for example goals, and thus provide information on the closeness or the level of suspense during a game. Odds data are easy to access, as bookmakers track them automatically on a second-by-second basis for all German football Bundesliga games and make them available online immediately after the game. The data incorporate the playing minute, which allows matching the in-play betting odds with the participants’ biometric data afterward. To utilize the betting odds as a measure of game outcome uncertainty, the absolute distance between the winning odds of both playing teams (“odds differential”) was calculated, with smaller distances indicating higher degrees of outcome uncertainty.

Furthermore, an even score at a given point during the game served as an additional indicator of game outcome uncertainty. Therefore, the dummy variable “score difference” was included in the study to specify where the game was uneven. Further, the variable “playing minute” was included to allow controlling for potential time effects of the course of play over the 90 min on viewers’ arousal or attention to sponsor messages.

3.3. Participants and Procedure

Following a pre-testing phase, the data collection took place during the second half of the Bundesliga season 2019–2020. Using convenience sampling, $n = 26$ participants with high involvement in football were invited to watch a home game of their favorite team to ensure a sufficiently strong emotional reaction. Football involvement was assessed beforehand utilizing the Personal Involvement Inventory of Zaichkowsky on a seven-point Likert scale [62]. Due to Germany’s COVID-19 restrictions, the Bundesliga was paused between 12 March and 16 May 2020. The last game of the season 2019–2020 with in-stadium spectators was on 8 March 2020. Afterward, all games took place without any spectators in the stadiums. For the present study, data with in-stadium spectators were collected during February and March. Data without in-stadium spectators were collected after the regulations were relaxed during May and June. Participants were briefed that the study aimed to measure football TV viewers’ emotional reactions regarding their home team playing in the home stadium. As material incentives, beverages and a gift bag were handed out to all participants. Beforehand, participants provided written consent to the experiment in accordance with the university’s ethical guidelines and reported normal or corrected to normal vision. A maximum of two participants at a time were allowed to watch the same football live broadcast on two identical TV screens with the same size, technical details, and manufacturer, ensuring an exact duplication of the setup. Additionally, participants were seated in identical armchairs and at the same distance to screens as well as to the eye-tracking devices. The setup and measurement systems are summarized in Figure 2.

To create a relaxed atmosphere and increase realism, participants were allowed to drink non-alcoholic beverages. After explaining the setup to the participants in general, the heart rate sensors were attached, and the eye-trackers were adjusted and calibrated. As the participants were allowed to stand up during the half time, the systems needed to be readjusted afterward. Gaze data were only included in the analysis if the eye-tracker’s tracking ratio was at least 80%. Due to the special circumstances of COVID-19, the second part of the data collection required hygienic and distance measures adherence. The researchers specifically informed the participants about the situation and complied with the university’s hygiene measures.

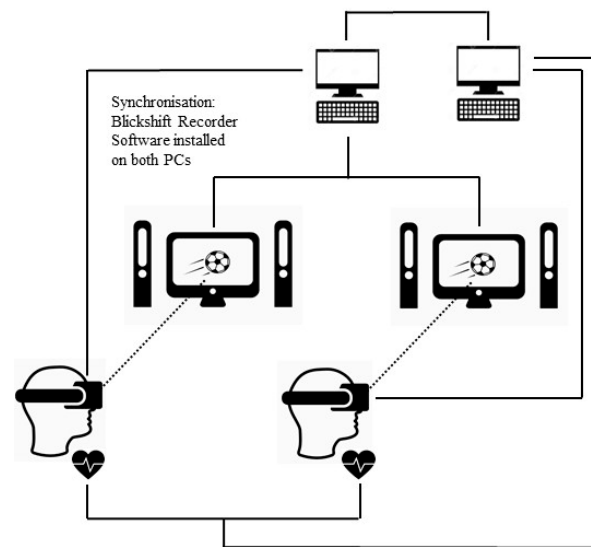


Figure 2. Study setup and synchronization of measurement systems.

3.4. Data Analysis

Data on game outcome uncertainty (1 Hz), as well as participants' arousal (128 Hz) and visual attention to sponsor signage (60 Hz), were merged after data collection and aggregated on a second-by-second basis. For this purpose, mean values for in-play betting odds and heart rate were computed. Based on the regular playing time of a game (90 min) and $n = 26$ participants, this resulted in 5400 possible observations per participant and 140,400 observations in total. Analysis regarding the dependent variable "arousal" were carried out with the total data set, whereas analysis regarding "visual attention" were only performed for those seconds during which sponsor messages were visible, which resulted in 111,954 observations. Thus, the final data sets were each comprised of 26 longitudinal clusters with either 140,400 or 111,954 observations in total. Multilevel modelling was applied to the data, with fixed and random effects to compensate for the violation of traditional regression's independence assumption that occurs when observations are clustered [63]. Furthermore, heart rate and gaze data highly depend on the individual participant, which require a within-subject design [13].

Multilevel models such as the Generalized Linear Mixed-Model (GLMM) are typically estimated with maximum likelihood methods. To exclude downwardly biased estimates of the variance components and the fixed effect standard errors on the lower level, which would result in inflated Type-I error rates, restricted maximum likelihood estimation was preferred [64]. This considers the degrees of freedom used for estimating the fixed effects, providing improved sample properties. The best method to use in combination with the restricted maximum likelihood estimation is the Kenward–Rodger adjustment [64]. However, the study's GLMM models seemed to be robust and showed no difference while using the residual method for larger sample sizes.

In total, four GLMMs with restricted maximum likelihood estimation and residual method were estimated for the dependent variables "heart rate" and "visual attention". For the dependent variable "heart rate", GLMMs were calculated with normal distribution and an identity link function, while "visual attention" is distributed binomially and a logit function was chosen. To include the independent variable "odds differential", a square root transformation ("odds differential^{0.5}") was performed based on a curve-fitting procedure to test nonlinear relationships. Furthermore, the continuous variable "playing minute" and the binary variables "spectators", as well as "score difference" were included as fixed effects. To address the influence of in-stadium spectators on TV viewers' arousal and attention depending on game outcome uncertainty, an interaction term of "odds differential^{0.5}" and "spectators" was created and included in the analysis, called "odds differential^{0.5} x

spectators". "Participants" and "games" served as random effects to control for individual and game biases. All models were estimated using IBM SPSS Statistics 26.

4. Results

4.1. Descriptive Statistics

An overview of the relevant variables and sample characteristics is provided in Table 1. Participants were on average 29 years old and highly involved with football and with one respective team of the German football Bundesliga. The dependent variable "arousal" varied between 48 BPM (low arousal) and 143 BMP (high arousal), whereas "visual attention" was binary coded and only had two characteristics (0 = no gaze hit on sponsor messages during a specific second, 1 = gaze hit on sponsor messages during a specific second). In total, 1977 gaze hits were detected for 111,954 observations. The independent variables "spectators" and "score difference" were dummy coded as well (0 = no in-stadium spectators, 1 = in-stadium spectators; 0 = draw/no score difference, 1 = at least a score difference of one). "Odds differential^{0.5}" varied between 0 (low game outcome uncertainty/no team is more likely to win) and 22.36 (high outcome uncertainty) and "playing minute" ran from 00:01 until 90:00 in steps of one second.

Table 1. Summary statistics and sample characteristics.

	With Spectators	Without Spectators	Total
Possible observations total (count)	70,200	70,200	140,400
Observations used for the analyses of visual attention (only if sponsors visible; count)	55,580	56,374	111,954
Arousal (M[SD] heart rate)	74.05 [14.96]	69.91 [13.29]	72.02 [14.31]
Visual attention (gaze hits; count)	1435	1542	2977
Participants (<i>n</i>)	13	13	26
Mean age of the sample	27 years	31 years	29 years
Gender (female; male)	15.4%; 84.6%	15.4%; 84.6%	15.4%; 84.6%

4.2. Hypothesis Testing

Grouping the data based on the variable "spectators", two independent *t*-tests were calculated (Level 1 data) before estimating the GLMMs. Arousal was significantly higher ($p \leq 0.001$) for participants who watched football broadcasts with in-stadium spectators ($M = 74.05$; $SD = 14.96$) than for participants who watched broadcasts during the COVID-19 restrictions without in-stadium spectators ($M = 69.91$; $SD = 13.29$). Visual attention differed significantly across the two groups as well. The number of gaze hits for participants who watched football broadcasts with the presence of in-stadium spectators (count: 1435) was significantly lower ($p \leq 0.001$) than the number of gaze hits for participants who watched broadcasts during the COVID-19 restrictions without in-stadium spectators (count: 1542). These findings display a first indicator that in-stadium spectators could influence viewers' arousal and attention to sponsor messages.

Table 2 displays the results of the GLMMs for the dependent variable "arousal". The first model estimated the influence of "odds differential^{0.5}", "spectators", "score difference", and "playing minute" on viewers' arousal. The additional measure for game outcome uncertainty "score difference" ($b = 0.361$) and the time effect variable "playing minute" ($b = 0.020$) significantly influenced arousal in a positive way ($p \leq 0.001$). Neither outcome uncertainty nor in-stadium spectators had a significant influence on arousal in this model. However, the second model, which additionally considers the interaction between the presence of in-stadium spectators and game outcome uncertainty, offered interesting results. While in-stadium spectators by themselves did not influence arousal, game outcome uncertainty, as well as the interaction of game outcome uncertainty and spectators in fact did have a significant influence. Arousal was significantly lower during games with lower outcome uncertainty ($b = -0.206$, $p \leq 0.001$). That said, in-stadium spectators' presence significantly increased TV viewers' heart rate when game outcome

uncertainty was greater ($b = 0.325, p \leq 0.001$). Game outcome uncertainty had both a significant influence on arousal on its own, and in interaction with in-stadium spectators. The variables “score difference” ($b = 0.164$) and “playing minute” ($b = 0.022$) were also found to be significant predictors of arousal in model two ($p \leq 0.001$).

Table 2. Results of the generalized linear mixed-models of arousal.

Model I	<i>b</i>	SE	<i>p</i>	Lower CI	Upper CI
<i>Fixed effects</i>					
Intercept	77.399	3.992	≤ 0.001	69.575	85.223
Odds differential ^{0.5}	−0.014	0.013	0.260	−0.038	0.010
Spectators	6.274	5.719	0.273	−4.934	17.483
Score difference	0.361	0.083	≤ 0.001	0.199	0.523
Playing minute	0.020	0.002	≤ 0.001	0.017	0.024
<i>Random effects</i>					
Participants (Covar.)	106.836	46.138	≤ 0.050	45.827	249.068
Games (Covar.)	52.740	55.003	0.338	6.830	407.250
<i>Information criterion</i>					
Akaike Corrected			590,264.42		
Bayesian			590,292.45		
Model II					
<i>Fixed effects</i>					
Intercept	76.781	3.998	≤ 0.001	68.945	84.616
Odds differential ^{0.5}	−0.206	0.016	≤ 0.001	−0.236	−0.175
Spectators	4.693	5.728	0.413	−6.533	15.919
Odds differential^{0.5}					
× spectators	0.325	0.016	≤ 0.001	0.294	0.356
Score difference	0.164	0.083	≤ 0.050	0.001	0.327
Playing minute	0.022	0.002	≤ 0.001	0.019	0.025
<i>Random effects</i>					
Participants (Covar.)	107.389	46.417	≤ 0.050	46.030	250.541
Games (Covar.)	52.759	55.276	0.340	6.769	411.242
<i>Information criterion</i>					
Akaike Corrected			589,857.53		
Bayesian			589,885.56		

Note. DV = arousal; $n = 26$ with 140,400 observations; Probability distribution: normal; Link function: identity; Testing of fixed effects: Residual method; Information criteria: $-2 \log$ likelihood (models with smaller information criterion values fit better); CI = Confidence interval; LL = Lower level; UL = Upper level.

The GLMMs for the dependent variable “visual attention” are summarized in Table 3 and closely resemble the results for “arousal”. The first model revealed a positive influence of “score difference” ($b = -0.219, p = 0.002$) and “playing minute” ($b = 0.006, p \leq 0.001$) on visual attention towards sponsor messages. Interestingly, visual attention to sponsor messages was greater during periods with an even score and at later stages of the game. Neither game outcome uncertainty nor in-stadium spectators appeared to significantly influence the visual attention towards sponsor messages. The second GLMM, which includes the interaction term of odds differential^{0.5} and spectators, also showed no significant influence of the variable in-stadium “spectators” on TV viewers’ visual attention. However, odds differential^{0.5} had a significant influence on visual attention ($b = 0.034, p = 0.032$), and the calmer a game was, the more visual attention is devoted to sponsor messages. In other words, a game with higher game outcome uncertainty offered less potential for sponsor gaze hits than a calm game did. If, however, in-stadium spectators were present, lower game outcome uncertainty led to less visual attention to sponsor messages on LED-boards ($b = -0.033, p = 0.037$). This suggested that the influence of in-stadium spectators had to be examined considering the outcome uncertainty of a game. Finally, the variables “score difference” ($b = -0.203, p = 0.004$) and “playing minute” were again found to be significant predictors of visual attention in model two ($b = 0.006, p \leq 0.001$).

Table 3. Results of the generalized linear mixed-models of visual attention.

Model I	<i>b</i>	SE	<i>p</i>	Lower CI	Upper CI
Fixed effects					
Intercept	3.550	0.291	≤0.001	2.979	4.120
Heart rate	0.000	0.003	0.913	−0.006	0.005
Odds differential ^{0.5}	0.012	0.011	0.300	−0.010	0.034
Spectators	0.020	0.276	0.944	−0.522	0.561
Score difference	−0.219	0.070	≤0.005	−0.357	−0.081
Playing minute	0.006	0.001	≤0.001	0.003	0.008
Random effects					
Participants (Covar.)	0.135	0.068	≤0.050	0.050	0.360
Games (Covar.)	0.169	0.120	0.159	0.042	0.681
Information criterion					
Akaike Corrected			443,022.24		
Bayesian			443,040.49		
Model II					
Fixed effects					
Intercept	3.418	0.294	≤0.001	2.842	3.993
Heart rate	0.000	0.003	0.964	−0.006	0.006
Odds differential ^{0.5}	0.034	0.016	≤0.050	0.003	0.064
Spectators	0.169	0.278	0.543	−0.375	0.713
Odds differential^{0.5}					
× spectators	−0.033	0.016	≤0.050	−0.065	−0.002
Score difference	−0.203	0.071	≤0.005	−0.342	−0.064
Playing minute	0.006	0.001	≤0.001	0.003	0.008
Random effects					
Participants (Covar.)	0.132	0.066	≤0.050	0.049	0.353
Games (Covar.)	0.156	0.113	0.170	0.037	0.649
Information criterion					
Akaike Corrected			443,332.09		
Bayesian			443,350.33		

Note. DV = Visual attention; *n* = 26 with 111,954 observations; Probability distribution: binomial; Link function: logit; Testing of fixed effects: Residual method; Information criteria: $-2 \log$ likelihood (models with smaller information criterion values fit better); SE = Std. Error; CI = Confidence interval; LL = Lower level; UL = Upper level.

5. Discussion

5.1. Interpretation of the Results and Academic Contribution

While previous studies have examined the influence of the COVID-19 pandemic on, for example, referees' decisions [16], a comprehensive analysis of the impact on the important stakeholders sponsors and broadcasters has not been published to date. Therefore, this study aimed to assess in-stadium spectators' influence on TV viewers' arousal and visual attention to sponsor messages by using full-length football live broadcasts. While previous studies either researched on-site and off-site spectators on their own or compared these two groups [42], this study is the first to systematically analyze the influence of in-stadium spectators on TV viewers with certain network effects.

The results of two *t*-tests revealed significant differences in viewers' arousal and visual attention, depending on the presence of in-stadium spectators. While arousal was significantly lower among TV viewers, who watched live broadcasts without in-stadium spectators, sponsor messages received greater attention in this group than among participants who watched games that were played in front of live spectators. In line with the LC4MP framework, it appeared that TV viewers watching games without in-stadium spectators have greater attentional resources to devote to sponsor messages on LED-boards [46,47].

Concerning the influence of game outcome uncertainty on arousal, the multilevel regression models showed interesting findings. Although researchers have assumed that the presence of in-stadium spectators could increase TV viewers' enjoyment of live broad-

casts [5], the mere presence of in-stadium spectators does not appear to have a significant influence on arousal. Therefore, H1.a has to be rejected. However, the second GLMM model that includes the interaction term of game outcome uncertainty and spectators revealed that the outcome uncertainty of a game has a significant influence on the arousal of TV viewers. Viewers' arousal varies depending on how close the game is, with close games leading to greater arousal and lower game outcome uncertainty resulting in less arousal. These findings are in line with previous literature, e.g., [13,44] and provide support for H1.b. Furthermore, the interaction term itself had a significant influence on arousal, suggesting that in-stadium spectators increased TV viewers' arousal, especially in broadcasts of games with less outcome uncertainty. In other words, spectators being present in the stadium significantly increased TV viewers' arousal, especially during calm games and games with low outcome uncertainty. This is in line with existing literature on stadium atmosphere being reinforced by spectators [6,65] and again supports H1.b.

Regarding visual attention to sponsor messages, the isolated effect of in-stadium spectators again did not appear to have a significant influence on visual attention. Thus, H2.a needs to be rejected. Furthermore, although the LC4MP model suggests a significant influence of game outcome uncertainty [46,47], game outcome uncertainty was not found to have an effect on attention in the first model. However, the introduction of the interaction term of odds differential^{0.5} and spectators in the second GLMM model again yield interesting insights. Game outcome uncertainty and the interaction term were significant predictors of visual attention towards sponsor messages, which supports H2.b. A game with low outcome uncertainty held the greater potential for sponsors to attract viewers' attention than a game with higher outcome uncertainty did. Regarding the presence of in-stadium spectators, a calm game, which was played in front of live spectators, led to less visual attention to sponsor messages. In terms of the LC4MP model, in-stadium spectators could act as an additional distraction during games [46,47].

Adopting a multi-sided market framework, this study sought to isolate in-stadium spectators' impact on professional clubs' financial sustainability by examining network effects that resulted from the presence or absence of in-stadium spectators. The findings revealed that sponsors and broadcasters could experience positive as well as negative externalities if games were played in front of in-stadium spectators, as the presence of them significantly affected TV viewers' arousal and visual attention to sponsor messages, depending on the outcome uncertainty of a game.

The present study is the first to analyze in-stadium spectators' effect on TV viewers' arousal and visual attention. By using full-length live broadcasts as stimulus material instead of recorded or manipulated video sequences, it further answered a recent call for more realistic study designs in the analysis of sponsorship outcomes [13]. Finally, by employing real-time measurements, it addresses important limitations of previous studies and adds to a growing literature that employs psychophysiological measures such as EEG, e.g., [66,67], electrocardiogram, e.g., [13], or fMRI, e.g., [68] to sport marketing and sponsorship research questions.

5.2. Practical Implications

Given the complex multi-sided markets that professional sport clubs and leagues find themselves in, the current findings further underline the importance of in-stadium visitors for the attractiveness of live sports for sponsors and broadcasters and point to multiple externalities that are of great practical relevance. First, the presence of in-stadium spectators results in greater arousal in TV viewers. Compared to games played under COVID-19 restrictions, this implies a greater attractiveness of such games for broadcasters and for sponsors that seek to associate their brands with highly emotional, arousing experiences. That said, while sponsors generally receive greater attention during games with lower outcome uncertainty, spectators' presence reduces attention to sponsor messages even in calm games. This suggests that, under certain circumstances, sponsors primarily seeking to build awareness among TV viewers may even profit from the absence of live spectators.

Broadcasters who fear that their product may become less attractive due to the absence of live spectators could implement measures to stimulate an emotional reaction in TV viewers. For example inserting audience noises in broadcasts could increase viewers' emotional arousal and therefore make them more appealing. Further, going against the present literature claiming a loss of sponsors due to the COVID-19 pandemic, football clubs should actually stress the potential for greater visual attention, which is created during games behind closed doors. Accordingly, some sponsors could consider a shift of strategies, as broadcasts might lose some of their potential to connect brands with the sport emotionally. Conversely, sponsor brands and broadcasters can benefit from in-stadium spectators creating an emotional atmosphere even in calm, "boring" broadcasts. Based on the present findings, closed stadiums present a threat, but also an opportunity, for European football clubs. Financial losses can be compensated by building upon areas that hold increased potential due to the pandemic. Enhanced visual attention to sponsorship messages can be actively promoted by football clubs and might be able to better balance the lack of stakeholders' utility during the tremendous time. As the study unveils the isolated effect of in-stadium spectators, for the future, robust plans can draw upon this to develop football clubs financial situation sustainably and in a long-lasting fashion.

6. Conclusions

By means of a controlled lab study, this research examines the effects of in-stadium spectators on consumers' arousal and visual attention regarding sponsorship messages and therefore underlying network effects in the multi-sided market football. The study's results unveil significant differences in viewers' arousal and attention to sponsors, contingent on the presence of in-stadium spectators and game outcome uncertainty. The presence of in-stadium spectators increased arousal, while attention towards sponsor messages decreased, depending on outcome uncertainty. This points towards the importance of the sporting action and the nature of the game itself, representing a new field of research in need of a theoretical underpinning and empirical research.

However, the present study still faces some limitations regarding ecological validity that future research needs to address. Notably, it was conducted as a controlled lab study, and the participants were not randomly assigned to the broadcasts but based on convenience and their football involvement. Further, only heart rate data were examined to analyze participants' emotional experience of the game. Future research could overcome these problems by including a wider range of participants and further biometric measures for emotions. Additionally, further viewer-related and game-related variables should be included in future studies, as the regression models showed significant inter-individual and inter-game effects. The present findings suggest that game-related factors could be highly influential concerning arousal and visual attention, supporting the importance of the game's nature and the sporting action itself. This could be explored further by assessing participants' sport media behavior, football involvement, or brand knowledge and analyzing relevant sporting events like shots on goal, fouls, etc.

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