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Winning Back Attendance: Effects of Winning Performance, Online Search, and the MLB Rule Changes for More Dynamic Games☆

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Abstract

As Major League Baseball (MLB)'s continuous decline in popularity has caused its game attendance to drop gradually, the league makes a desperate attempt such as game rule changes to remain relevant. Along with the introduction of new rules to make games more dynamic such as the pitch clock, bigger bases, and defensive shift limitations, it is important for MLB franchises to understand drivers for game attendance. We focus on the effect of accumulated winning performance of the two teams on game attendance, one of the key drivers of game attendance, and investigate how it is influenced by consumer and industry factors such as online search and game rule changes. We find that game attendance increases as the prior winning performance of the home (away) team increases (decreases). We also find that online search and rule changes for more dynamic games moderate the effect of winning performance on game attendance.

Keywords: Game attendance, Performance, Baseball, Online search, Rule changes, MLB, Sports management

1. Introduction

As one of the most traditional sports, baseball has long been part of American history, a sport watched nation-wide. However, the Major League Baseball organization (hereby MLB) has suffered a constant decline in the number of game attendances for years, with almost a 6% drop from 2019 to 2022 (Garcia 2023). Such decline is not spontaneous, as the league has watched its regular season game attendance drop for nine straight seasons, excluding the 2020 season which restricted ballpark visits due to the Covid-19 pandemic (Anderson 2023). With a collective worth of more than $70 billion (Sportico 2023), the league's 30 franchise teams have been subjected to risks based on the declining fanbase and game attendance for the sport. Various factors have been identified for the MLB's loss of appeal, starting from a lack of a salary cap for its players (compared to other major sports in the US), relatively low marketing, and lack of promotion for its star players. However, the nature of the game itself is also listed as one of the most critical factors for the decline of the sport, as fans require prior knowledge of the sport rather than just mere surface-level knowledge, and patience is a basic requirement for the long baseball games (Panacy 2013).

Previous studies have identified several factors which have an impact on game attendance. It is well-known that sports teams with a positive performance (i.e., winning performance) generally see their benefits in terms of attendance (Davis 2009; Paul and Weinbach 2011; Scully 1974). Other studies have shown that baseball game attendance of a team is positively related to the average rank or standing of the team in the season (Rottenberg 1956). Also, the effects of winning performance during a playing season increase throughout the season's progression (DeSchriver and Jensen 2002). In addition, consumer factors such as interests towards a specific

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team may influence the decision of the attendance of the focal game. Interestingly, game duration is also identified to have an impact on game attendance, where teams that usually played shorter games were rewarded with results of higher attendance compared to those that played longer games (Paul and Weinbach 2020).

As a result, the MLB has implemented three rule changes in the 2023 regular season with the goal of making games more dynamic. The pitch clock rule is the most dramatic rule change which sets a 15-second timer between pitches (20 seconds when a runner is on base) and a 30-second timer in between batters (Poindexter 2023). After its implementation, the average game time has shown a decrease by 28 minutes compared to the same point in time in the 2022 season (Randhawa 2023). In addition to the pitch clock rule, the other rule changes such as bigger bases and the limitation of defensive shifts aim to increase the offensive output of the game based on higher stolen base success-rates and hitting averages, according to the information provided by the MLB website. Since these new rules have been implemented recently, there is lack of research on the impact of those rule changes for more dynamic games on the attendance of baseball games.

In this research, we investigate the effects of winning performance on MLB attendance during the regular season. We focus on two winning performance variables—prior winning performance of the home team and that of the away team—to identify its association with game attendance. Also, we examine the moderating roles of online search and the MLB rule changes for more dynamic games on the effects of winning performance on game attendance. It is likely for fans to reflect association and interest in a team through online search about the team. Individuals with low levels of interest and less online search for a team could be more inclined to rely on easily identifiable cues such as winning performance. Furthermore, the MLB rule changes could increase the uncertainty of game outcome based on unexpected plays during the game by increasing the dynamic action of the game and creating a quicker pace of play. The anxiety related to the outcome uncertainty may lead consumers to set lower expectations for the winning performance of the home team, while creating higher expectations for the away team's winning performance to debilitate their disappointment in cases of negative game outcomes.

Therefore, this study addresses the following research questions:

- Does the prior winning performance of home and away teams influence game attendance?
- How does online search influence the effects of winning performance on game attendance?
- How do the MLB's rule changes for more dynamic games impact the effects of winning performance on game attendance?

By addressing these research questions, we aim to understand factors influencing sports game attendance and to provide valuable insights on how to utilize online search and rule changes to increase game attendance. We collect the data across various sites including the official MLB site and the websites sharing baseball statistics for each game. Using this combined data, we employ a truncated regression to examine the relationship between prior winning performance and game attendance, while also examining the moderating effect of online search and the MLB's recent rule changes for more dynamic games.

Our study provides several theoretical and managerial contributions. First, our study contributes to the sports marketing and management literature by investigating the drivers to increase sports attendance. In particular, we show that prior winning performance for games of the home team is positively associated with game attendance. Second, we contribute to the literature of digital sports marketing by providing the finding that online search could weaken the effects of a team's winning performance on game attendance. Finally, we explore the MLB's recent rule changes starting from the 2023 season and suggest how to recapture the interest of fans and increase game attendance. To the best of our knowledge, our research is one of the first to empirically investigate the influence of the recent MLB rule changes on game attendance and provides valuable insights into the MLB franchise teams to gain game attendance and viewership back.

2. Conceptual background

2.1. Effect of winning performance on game attendance

In the extensive literature of sports management, winning performance is a key component for fan interest. Attendance for baseball games of any team is positively related to the average rank of the team in the respective season (Rottenberg 1956). The winning percentage of a team is also positively associated with game attendance (Paul and Weinbach 2011; Scully 1974). Additionally, teams which maintain a positive performance (i.e., wins) generally see substantial benefits and long-lasting effects on game attendance (Davis 2009) as fans usually portray their support in games for the teams which are performing better during the playing season. The winning performance of both the previous and current seasons are also shown to be positively associated with game attendance. While the effects of the previous season's winning performance diminish as the season unfolds, those of the current season are shown to increase throughout the progression of the season (DeSchriver and Jensen 2002).

Empirical literature on Dutch professional football game attendance also shows that reference-dependent preferences and loss aversion are prevalent on the live attendance demand (Besters, van Ours, and van Tuijl 2019). Such results are also consistent with empirical investigations regarding the National Hockey League (NHL), where fans are expected to attend games in which the home team is expected to win, whereas the opposite occurs for games in which the winning probabilities of their team are low (Coates and Humphreys 2012).

Taken all together, we hypothesize that as the prior winning performance of home teams in the MLB regular season increases, the attendance for the games will increase, as teams with a positive past performance are more likely to win in future games. On the contrary, the attendance of live games will decrease when the winning performance of the away team increases.

H1a. *The home team's winning performance of the season is positively associated with game attendance.*

H1b. *The away team's winning performance of the season is negatively associated with game attendance.*

2.2. Moderating effect of online search

Consumers nowadays utilize internet to gather information regarding a product or brand to aid their decision-making process. In sports, the internet has played a critical role in providing the information about sport events and increasing sports attendance (Filo, Funk, and Hornby 2009). The attention consumers pay to specific subjects is represented by their online search (Li et al. 2021). Also, typing a brand name on a search engine signals a consumer's higher interest and awareness towards the brand (Simonov and Hill 2021). The increase in brand interest reflected in online brand search and online interactions affects the brand attitude of consumers and the likelihood of purchasing the brand (Kim, Liu, and Chang 2022). Product interest is also related to the product's ability to achieve higher levels of brand insistence, where a consumer loyal to a brand will accept no alternative in brand choices (Buchanan 1963). Hence, the importance of other product factors such as product quality and pricing may be lower for a consumer with high brand insistence. Similarly, in the context of sports, when fans take interest in a sport and consequently associate meaning with a team, their information search and emotional response towards the team increase (Pritchard and Funk 2010). Therefore, fans are more likely to attend games regardless of the team's characteristics and/or conditions. Also, the relationship between sport consumption and interest in men's baseball is higher for motives such as entertainment, skill, and effort compared to achievement and team affiliation (James and Ross 2004). This implies that when there are more consumers who already show interest in a sport team through more online search, they may rely less on the information about the team's objective performance in the decision of game attendance and are more likely to attend its games no matter what its recent winning performance has been like.

Furthermore, low-interest individuals are likely to have low processing motivation and hence evaluate and perceive messages regarding a product based on their positive and negative cues of a message (Petty and Cacioppo 1986). Also, a low-interest individual's heuristic processing is associated with the formation of judgement which requires minimal cognitive demands (Chaiken and Trope 1999). If consumers have a low level of interest in a specific team and less online search about the team, they would be inclined to evaluate their decision to attend games based on easy-to-identify positive and negative cues such as the team's winning percentage. Therefore, we hypothesize that online search could moderate the effects of winning performance on game attendance.

H2a. *Online search weakens the effect of the home team's winning performance on game attendance.*

H2b. *Online search weakens the effect of the away team's winning performance on game attendance.*

2.3. Moderating effect of the rule changes for more dynamic games

The MLB implemented major rule changes in the 2023 regular season which include the pitch clock, bigger bases, and defensive shift limitations to make games more dynamic by increasing the pace-of-play and action of plays. In the context of sports, changes in action can lead to numerous variations of subsequent actions (Araújo, Davids, and Hristovski 2006). The rule changes for more dynamic games may increase the number of unexpected actions in a game due to quicker pace and more dynamic plays, ultimately increasing the uncertainty of the game's outcome.

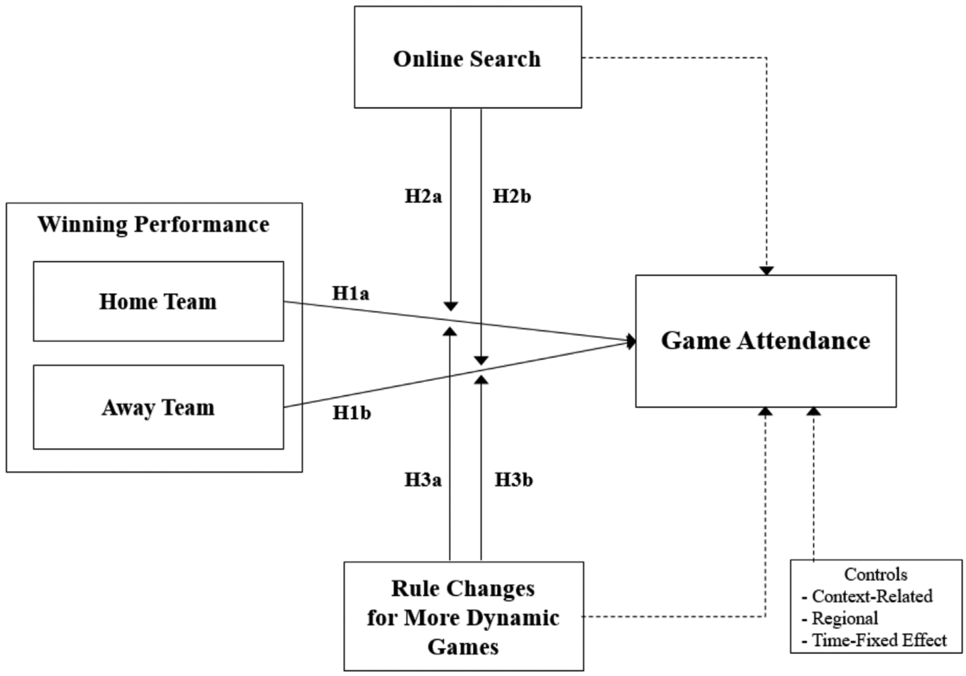

Fig. 1. Conceptual framework.

Uncertainty is a core feature that leads to worry and anxiety (Gu et al. 2020). Furthermore, in the presence of the pitch clock rule that sets the time limit for pitchers to throw a pitch and the time limit for batters to be in the batter's box, fans are aware of time progression as they remain alert for any type of violation of the rule which in turn is automatically penalized. Fans are also left to watch the game with a constant sense of time pressure, as they hope that their team plays within the respective time limitations. In cases where time pressure is chronic, it may manifest psychological and physical stressors commonly associated with fatigue and tension (Gunthorpe and Lyons 2004; Lehto 1998).

Norem and Cantor (1986) show that as a way of managing anxiety and stress, individuals strategically set low expectations in risky situations to avoid the outcome from becoming debilitating. Also, anxiety is associated with judgement of future positive events being unlikely, while negative events being likely (MacLeod et al. 1997). Therefore, as the rule changes for more dynamic games increase the uncertainty of the game's outcome, fans will set lower expectations for their team's winning performance and hence may be less willing to attend a game.

On the other hand, given that game attendance is mainly driven by the fans of home teams, they may feel less relevant and less stressful about the increase in uncertainties of the opponent's performance due to the rule changes. Since committed supporters of a sports team are less likely to be emotionally attached to other teams, they may accept argument or information related to other teams more rationally (Davies, Veloutsou, and Costa 2006). Therefore, the rule changes for more dynamic games may not create enough anxiety or emotions to moderate the effect of prior winning performance of the away team on game attendance. We thus propose the following hypotheses.

H3a. *The rule changes for more dynamic games weaken the effect of the home team's winning performance on game attendance.*

H3b. *The rule changes for more dynamic games do not impact the effect of the away team's winning performance on game attendance.*

In sum, the conceptual framework of our research is shown in Fig. 1.

3. Research methodology

3.1. Data

We collect data for the investigation across various baseball-related websites. The data ranges from a period of 2 entire regular seasons (2018–2019) plus the 2023 period collected up until July 31, 2023. The dataset consists of a total of 6,469 games for the three regular seasons.[1] We exclude the 2020 and 2021 seasons in our analysis because strong regulations due to the COVID-19 pandemic impeded the game attendance of MLB fans at that time, which makes it impossible to examine the drivers of game attendance. Hence, we include the 2018 and 2019 regular seasons instead which are the most recent seasons without the COVID-19 restrictions regarding game attendance and can be compared to the 2023 regular season.

More specifically, we collect the data regarding the daily standings of each MLB franchise team from the official MLB website. The variables in the data include the accumulated wins, accumulated losses, accumulated winning percentage, accumulated runs scored, and accumulated runs allowed of each franchise team during a given day of the regular season. Furthermore, an additional dataset for game-specific statistics is retrieved from the website called Retrosheet. This dataset consists of the variables per game such as game attendance, runs scored by the home team, runs scored by the away team, name of the ballpark, duration of the game, and information regarding whether the game was held either during the day or during the night. The average game attendance included in our dataset is 28,671 spectators per game, while the average prior winning percentages for the home and away teams was 0.50 and 0.49 across all seasons, respectively. Other offensive metrics for each franchise team such as home-game batting average, away-game batting average, relative ranking score, and batting average of the previous game are collected from the website called Team Rankings, a site publishing information regarding projection, stats, rankings, and odds for professional sports games.

To consider any regional factors on game attendance, we supplement our daily game data with region-specific information. We obtain weather data such as temperature, humidity, wind speed, and precipitation from the website Weather Underground. The state-level population data is collected from Statista, while the per capita personal income is retrieved from the US Census Bureau as a means of controlling for economic differences across the geographic locations of each team. Additionally, we collect data regarding the average annual ticket price of the stadium in which the game is played from the website called SeatGeek, the MLB's official ticket marketplace. Data regarding the maximum seating capacity of the stadiums for all 30 franchise teams is also collected from the official MLB website.

Lastly, we obtain daily online search data for all the 30 MLB franchise teams in the sports category in the U.S. from Google Trends which reflects consumer interest for each team. We utilize the Google Trends data as it is widely used in business research as an identifying tool of the searchers' current interests (Jun, Yoo, and Choi 2018). Google Trends data is normalized on a scale of 0–100 relative to the highest point of a specific time-period/location search query and consecutive daily data is available for periods up to 8 months. Therefore, we first collect the online search data for each regular season by using the team with the highest daily online search in the respective season as a reference point (e.g., Chicago Cubs in 2018, Milwaukee Brewers in 2019, and New York Yankees in 2023). Thus, we collect the data for a season by searching the reference team along with the remaining teams simultaneously in each search query so that the values in the same season are on the same scale of 0–100. Then, to make the scales of all three seasons comparable, we sequentially re-adjust the scales by utilizing the off-season data that overlaps by several days at the end and beginning of the two playing seasons, and matching the values to become equivalent by team and date across the datasets.

3.2. Variables

Dependent variables

We measure the dependent variable of game attendance ($Attendance_{jt}$) as the number of visitors for a game at the stadium j at time t divided by 1,000 during the regular MLB season. We use the subscripts j to denote the stadium in which a game is played and t for the time period. The attendance of each game ranges from a minimum of 2.064 to a maximum of 59.659, with a mean value of 28.671 (i.e., 28,671 spectators per game on average) for a daily game.

Main effect variable: Winning performance

To investigate the impact of the winning performance of both the home and away teams, we create two independent variables of winning performance: (1) home team's winning performance and (2) away team's winning performance. We note that teams which maintain a positive performance generally see their benefits in terms of attendance (Davis 2009). Also, fans are likely to attend games in large numbers when the home team is expected to win, contrary to games in which the winning probabilities are low (Coates and Humphreys 2012). Hence, we measure each variable of winning performance as percentages by dividing the number of cumulative wins by the total cumulative games played for each team during the season. Thus, these variables ($WinPerformanceH_{jt}$

[1] At the time of analysis, the 2023 regular season is on-going and our data covers 66% of the total games of the season.

and $WinPerformanceA_{jt}$) record the cumulative winning percentage of the home team and away team up to the point of the previous game.

Interaction effect variables

We operationalize daily online search of each team by measuring the daily amount of online searches in the previous day $t-1$ for the teams that will play at the stadium j at time t in Google Trends. We create the online search variable for the home team and away team separately ($OnlineSearchH_{jt}$ and $OnlineSearchA_{jt}$, respectively). Note that Google Trends offers a normalized value instead of the raw search frequencies and thus indicates relative search interest for each team.

Another interaction effect variable we use is $RuleChange_t$, a dummy variable which equals 1 if the game is held in day t during the 2023 season when the rule changes for more dynamic games are applied and otherwise 0.

Control variables

We measure control variables expected to be correlated with the game visitors' spectating behavior in regular season games to investigate the genuine effect of winning performance on game attendance. First, positive performances in terms of offensive metrics positively influence the attendance of an MLB game (Lee 2018). To control the outcome-related variables, we include offensive-level indicator variables for both the home and away teams in a daily game. We thus incorporate the variable of combined batting average, measured by calculating the average of the previous game metric of both teams that are going to play in a stadium j. We sum both teams' batting averages and divide by two for the calculation. The combined runs variable is measured by the sum of the total runs scored and allowed by both teams in stadium j in the previous game $t-1$.

We also control for the duration of the home team's game since total game time could also be correlated with the game attendance behavior of consumers. In general, teams that played games with shorter times are associated with higher attendance from their fans (Paul and Weinbach 2020). Therefore, we include the variable $DurationMinutes_{jt}$ as the total duration in minutes of a game played in stadium j at the previous game $t-1$. Also, we include the variable $RelativeRanking_{jt}$ reflecting the "hotness score" determined by a custom formula made by Team Rankings, which considers the relative rankings of the teams that will play in stadium j and indicates how closely contested the matchup is expected to be. This variable is related with winning expectancy and could partially control for the uncertainty of outcomes in the respective game in stadium j at time t.

In addition, we control for region-level variables of a stadium at that time, including daily temperature, precipitation, humidity, and wind speed of the stadium in which the game is played in. Also, we include month fixed effects to capture the seasonality and other monthly unobservable factors. A dummy variable which equals 1 if the game is played during the day, and 0 if it is played during the night is included to control for the effects of game starting time. We also control for team-level heterogeneity by including the home team's state population and per capita personal income with a log transformation. Lastly, the average ticket price of the game played in stadium j at time t and the maximum seating capacity of the stadium j with a log transformation are also included in our model.

Lastly, we control for the main effects of our moderating variables, online search and rule changes. Online search represents the attention consumers pay to subjects (Li et al. 2021) and online search for product information is positively associated with purchase intention (Shim et al. 2001).

We confirm that all the independent variables' VIFs are smaller than 3 (Hair et al. 2006), signaling that there is no significant evidence of multicollinearity among the variables. Table 1 shows the descriptive statistics of the variables in our analysis.

3.3. Empirical model

We employ two truncated regression models to examine (1) the relationship between winning performance and game attendance (H1a–H1b) and (2) the moderating effect of online search (H2a–H2b) and the MLB rule changes (H3a–H3b) on the effect of winning performance on game attendance. Truncated regression is a regression model for datasets where the values of the dependent variable below or above certain thresholds are excluded. Since the values of game attendance are always larger than zero, it is appropriate to use a truncated regression model for our models of game attendance. Furthermore, since standard errors can be clustered at the team-season level, we correct for heteroskedasticity by specifying the error variance as a linear function of the variables in our model. The equation for the main effect model is specified as:

$$\begin{aligned} Attendance_{jt} &= \beta_{1,0} + \beta_{1,1} WinPerformanceH_{jt} \\ &\quad + \beta_{1,2} WinPerformanceA_{jt} + \beta_{1,3} OnlineSearchH_{jt} \\ &\quad + \beta_{1,4} OnlineSearchA_{jt} + \beta_{1,5} RuleChange_t \\ &\quad + \theta_{1,1} Controls_{jt} + \theta_{1,2} MonthFixed_t + \varepsilon_{1,jt} \end{aligned} \tag{1}$$

Table 1. Descriptive statistics of variables.

Variables	Description	Mean	SD
$Attendance_{jt}$	Game attendance (divided by 1000)	28.67	11.10
$WinPerformanceH_{jt}$	Cumulative winning percentage of home team in the season at stadium j prior to day t	0.50	0.12
$WinPerformanceA_{jt}$	Cumulative winning percentage of away team in the season at stadium j prior to day t	0.49	0.12
$OnlineSearchH_{jt}$	Normalized online search of home team on the previous day $t-1$	7.02	7.12
$OnlineSearchA_{jt}$	Normalized online search of away team on the previous day $t-1$	6.40	6.54
$RuleChange_t$	The rule changes for more dynamic games applied (1: yes, 0: otherwise)	0.24	0.43
$BattingAverage_{jt}$	Previous game's average of both teams' batting average	0.24	0.05
$TotalRuns_{jt}$	Previous game's total runs of both teams	9.28	4.64
$DurationMinutes_{jt}$	Previous game's duration time (in minutes)	180.8	29.32
$RelativeRanking_{jt}$	Relative ranking score between the two teams of game j	76.88	12.04
$PerCapitaIncome_{jt}$	Per capita personal income of the state (log transformation)	10.93	0.15
$Population_{jt}$	Population (log transformation) of the state of stadium j	16.42	0.72
$Temperature_{jt}$	Temperature of the city of stadium j at time t	68.87	11.83
$Humidity_{jt}$	Humidity of the city of stadium j at time t	65.81	15.44
$WindSpeed_{jt}$	Wind speed of the city of stadium j at time t	8.30	3.22
$Precipitation_{jt}$	Precipitation of the city of stadium j at time t	0.10	0.36
$DayGame_t$	Day game dummy (1: day game, 0: night game) at time t	0.36	0.48
$AverageTicketPrice_{jt}$	Average ticket price of the game of stadium j of the year at time t	45.50	13.65
$MaxCapacity_j$	Maximum seating capacity (log transformation) of stadium j	10.67	0.10

The equation for the interaction effect model is specified as:

$$\begin{aligned} Attendance_{jt} &= \beta_{2,0} + \beta_{2,1} WinPerformanceH_{jt} \\ &\quad + \beta_{2,2} WinPerformanceA_{jt} \\ &\quad + \beta_{2,3} WinPerformanceH_{jt} \times OnlineSearchH_{jt} \\ &\quad + \beta_{2,4} WinPerformanceA_{jt} \times OnlineSearchA_{jt} \\ &\quad + \beta_{2,5} WinPerformanceH_{jt} \times RuleChange_t \\ &\quad + \beta_{2,6} WinPerformanceA_{jt} \times RuleChange_t \\ &\quad + \beta_{2,7} OnlineSearchH_{jt} + \beta_{2,8} OnlineSearchA_{jt} \\ &\quad + \beta_{2,9} RuleChange_t + \theta_{2,1} Controls_{jt} \\ &\quad + \theta_{2,2} MonthFixed_t + \varepsilon_{2,jt} \end{aligned} \tag{2}$$

In Equation (2), the main effect of the home team's winning performance ($WinPerformanceH_{jt}$) on game attendance is captured by $\beta_{2,1}$ and that of the away team's winning performance ($WinPerformanceA_{jt}$) is captured by $\beta_{2,2}$. The terms $\beta_{2,3}$ and $\beta_{2,4}$ measure the interaction effects between both teams' online search ($OnlineSearchH_{jt}$ and $OnlineSearchA_{jt}$) and winning performance. Likewise, $\beta_{2,5}$ and $\beta_{2,6}$ capture the interaction effects of the rule changes for more dynamic games on the winning performances of both teams. We also include the main effects of our moderating variables (i.e., both teams' online search ($OnlineSearchH_{jt}$ and $OnlineSearchA_{jt}$) and the rule changes ($RuleChange_t$)) as controls. The other control variables include offensive metrics, matchup score, relative ranking score, regional variables, and team characteristics as described in the *Variables* section and Table 1. Lastly, we control time-specific unobservable factors using the month dummies.

4. Results

Table 2 presents the estimation results of both the main effect and interaction effect models. The directions and significances of the parameter estimates of both models stay the same statistically and the hypothesis test results remain the same in both models; however, the smaller AIC value of the interaction effect model shows a better fit. Therefore, our discussion of the empirical findings centers on the interaction effect model.

We first discuss the main effect of winning performance for the home and away teams on game attendance, followed by how online search for both teams and the rule changes for more dynamic games moderate the effects of winning performance. Then, we discuss some interesting findings of the control variables.

4.1. Main effects

The empirical results show that the home team's winning performance is positively associated with the attendance of the MLB game ($\beta_{2,1} = 11.83$, $p < 0.01$), consistent with H1a. That is, game attendance increases when the prior winning performance of the home team increases, as fans are more inclined to attend games in which the team they are rooting for maintains a positive cumulative performance in terms of wins during the season.

On the contrary, the away team's winning performance is negatively associated with the attendance of the game ($\beta_{2,2} = -14.95$, $p < 0.01$), which also supports H1b and coincides with the previous literature on winning performance

Table 2. Estimation results.

Variables	Hypotheses	Main effect model		Interaction effect model	
		Estimate	SE	Estimate	SE
Main Variables					
WinPerformance_Home	H1a	2.56**	1.22	11.83***	1.74
WinPerformance_Away	H1b	−10.31***	1.17	−14.95***	1.67
WinPerformance_Home × Online Search_Home	H2a			−0.97***	0.17
WinPerformance_Away × Online Search_Away	H2b			1.01***	0.16
WinPerformance_Home × Rule changes	H3a			−12.48***	2.16
WinPerformance_Away × Rule changes	H3b			−3.20	2.06
Online Search_Home		0.45***	0.01	1.01***	0.09
Online Search_Away		−0.10***	0.01	−0.67***	0.09
Rule changes		0.77**	0.37	8.82***	1.73
Control variables					
Previous game's batting average of both teams		4.66*	2.40	4.60*	2.38
Previous game's total runs of both teams		−0.04	0.03	−0.03	0.03
Previous game's duration time		0.01***	0.00	0.01***	0.00
Per capita personal income		0.29	0.92	0.35	0.92
Population		0.93***	0.16	0.90***	0.16
Temperature		−0.08***	0.01	−0.07***	0.01
Humidity		−0.009	0.00	−0.006	0.00
Wind speed		0.07**	0.03	0.05	0.03
Precipitation		−0.52*	0.29	−0.54*	0.29
Relative ranking score		0.37***	0.01	0.37***	0.01
Day game		1.05***	0.21	1.02***	0.21
Average ticket price		−0.006	0.01	−0.02**	0.01
Max capacity		23.38***	1.09	23.57***	1.08
Month – March		14.08**	5.99	15.57	5.94
Month – April		12.17**	5.92	13.05	5.87
Month – May		14.81**	5.91	15.57***	5.87
Month – June		18.16***	5.91	18.84***	5.86
Month – July		19.73***	5.91	20.36***	5.86
Month – August		17.50***	5.91	18.14***	5.86
Month – September		15.76***	5.91	16.39***	5.87
Log Likelihood		−22,221		−22,165	
AIC		44,495		44,392	

Note: Number of observations for the analysis (N = 6,317).
***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

(Davis 2009; DeSchriver and Jensen 2002; Rottenberg 1956). Considering that most of the spectators in a game are fans of the home team, they would be less inclined to attend games in which the away team has a positive winning performance. Loss aversion is prevalent on live game attendance (Besters, van Ours, and van Tuijl 2019) and fans are less inclined to attend games in which the home team's winning probabilities are lower (Coates and Humphreys 2012). Therefore, fans are more likely to attend the games in which the home team's prior winning performance is high and the away team's prior winning performance is low.

4.2. Interaction effect of online search

Our results of the interaction effect model show that online search of the home team weakens the positive effect of accumulated winning performance of the home team on game attendance ($\beta_{2,3} = -0.97$, $p < 0.01$), which supports H2a. Online search for a brand signals higher consumer interest (Simonov and Hill 2021), while product interest is associated with the product's ability of attaining higher brand insistence (Buchanan 1963). It is then likely that consumers with high brand insistence will perceive lower levels of importance towards other product qualities. Also, a fan's interest and associative meaning with a sport team increases emotional response and information search towards the team (Pritchard and Funk 2010). Thus, consumers who reflect interest in a team through higher online search are more likely to rely less on information regarding the team's past winning performance.

On the other hand, online search of the away team weakens the negative effect of cumulative prior winning performance for the away team ($\beta_{2,4} = 1.01$, $p < 0.01$), also supporting H2b. Low processing motivation is likely to be associated with low-interest individuals, leading them to perceive and evaluate a product's message on its positive and negative cues (Petty and Cacioppo 1986). Also, the heuristic processing of low-interest individuals is associated with judgement formation requiring minimal cognitive demands (Chaiken and Trope 1999). Therefore, fans with low levels of interest and online search about a team could thus be inclined to evaluate their game attendance decisions on objective cues such as prior winning performance, as they are easily identifiable positive and negative cues.

4.3. Interaction effect of the rule changes

We find that the effect of the home team's winning performance on game attendance is also weakened by the rule changes for more dynamic games ($\beta_{2,5} = -12.48$, $p < 0.01$), thus supporting H3a. A possible explanation is that the quicker pace and more dynamic plays caused by the rule changes increase the number of unexpected plays during the game, ultimately increasing the uncertainty of the game's outcome. The anxiety related to the outcome uncertainty could lead fans to set lower expectations for the home team's winning performance as a way of mitigating disappointing feelings based on a possible loss.

However, the rule changes for more dynamic games have no significant effect on the effect of the away team's winning performance ($\beta_{2,6} = -3.20$, $p > 0.10$), which also supports H3b. Considering that the majority of spectators are composed of fans of the home team, the rule changes for more dynamic games may not create enough emotional attachment or anxiety to change the effect of the away team's winning performance on game attendance.

4.4. Results of other variables

Most of the control variables in our model have significant effects on game attendance. First, we control for the main effect of our moderating variables (online search of the teams and the rule changes) and the home team's online search is shown to be positive and significant, contrary to the away team's online search which is negative and significant. This implies that as the majority of fans attending the games are most likely fans of the home team, their online search for the home team would lead to game attendance. On the other hand, higher online search for the away team implies that the away team is popular. Therefore, fans of the home team would thus be less willing to attend games in which the away team has many fans.

Second, the batting average of both teams at the previous games show a positive association with game attendance. However, the effects of the combined total runs of the two teams' previous games are statistically insignificant. Such findings imply that while the total amount of runs itself doesn't have much impact on game attendance, fans are more inclined to watch games where batting offensive metrics are higher. Second, the duration of the previous game is positively associated with game attendance, meaning that fans generally prefer games with longer durations. The relative ranking score based on the matchup between the home team and away team also shows to be significant and positively associated with the game attendance.

As for the regional control variables, higher temperature and precipitation are unsurprisingly shown to be negative and significant, which shows that fans are less likely to attend games in hotter and rainy days. On the other hand, humidity and wind speed are not statistically significant on game attendance. The average ticket price shows a negative and significant association with game attendance, as fans have a lower inclination to attend games with more expensive ticket prices. Furthermore, we find through the significant result of the day game dummy variable that fans are more inclined to attend games which take place during the day compared to night games, while stadiums which have higher maximum seating capacities are associated with higher game attendance. Lastly, state-level control variables such as per capita personal income is shown to be statistically insignificant, while population is positive and significant.

5. Conclusion

Despite the long history and popularity of Major League Baseball as a sport watched nation-wide, the continuous decline in game attendance stands as a major threat to the longevity of the league. By empirically investigating the daily baseball game data, we explore the effects of winning performances for both the home team and away team on game attendance simultaneously. Furthermore, we investigate how online search and the rule changes for more dynamic games moderate the effect of the team's prior winning performance on game attendance.

Our main findings are the following. The home team's winning performance is positively associated with game attendance, while the away team's winning performance shows a negative association. Furthermore, as consumer interest in a team is reflected by a larger amount of their online search for the team, the effects of winning performance on game attendance are weakened by online search of the team. Finally, when the rule changes for more dynamic games are implemented, the effects of the home team's winning performance on game attendance are weakened, while no significant effect is shown on the effects of the away team's winning performance.

5.1. Theoretical implications

This research makes several theoretical contributions to the literature on sports management and marketing. First, our research contributes to the literature on the factors influencing game attendance. Although winning performance has been researched profusely (Coates and Humphreys 2012; Davis 2009; DeSchriver and Jensen 2002; Scully 1974), findings of the effects of winning performance on game attendance are generally based on the winning performance of the home team only. That is, despite the importance of the away team's performance as a key factor in game attendance, limited research examines the separate effects of both the home and away teams. We fill the gap in the literature by distinguishing the effects of winning performance between the home teams and away teams in a matchup. We confirm that both variables result in opposite effects on game attendance.

Second, we contribute to the literature of digital marketing by considering the moderating effect of online search in understanding the effect of winning performance on game attendance. To the best of our knowledge, little-to-no research has examined the simultaneous effect of online search and winning performance interactions. In the digital era, it is essential to understand how online search affects consumers' sport viewership and attendance. We confirm that online search should be taken into consideration in understanding the decision process of game attendance by consumers.

Finally, our study provides contributions to literature on rule changes in professional sports. We consider the moderating effect of the MLB rule changes for more dynamic games on the effect of prior winning performance on game attendance. Despite the implementation of the pitch clock, bigger bases, and limitations in the defensive shift to make games more dynamic, the effects of these rules on game attendance are yet to be examined. To the best of our knowledge, our research is one of the first to empirically investigate the influence of the recent MLB rule changes on game attendance.

5.2. Managerial implications

We provide insightful and strategic guidance in managing game attendance and utilizing online search and rule changes for sports game attendance, particularly at MLB. First, based on the positive (negative) main effect of winning performance for the home (away) team, we confirm that targeted promotions for the home fans of a specific team would be much more effective than those covering all the targets in increasing game attendance.

Second, recall that online search moderates the effect of the winning performance on game attendance for both home team and away team. This finding suggests that franchise teams may have to increase interest towards the home team through various social media and digital marketing tactics, especially when the team is underperforming during the season. Thus, although the cumulative winning record plays a major role in game attendance, adequate digital marketing strategies will be efficient in increasing the game attendance during the regular season. Social media campaigns and contests could encourage fans to engage with content related to the home team, increasing their association with the home team's community. Also, when the away team with a higher past winning performance is visiting for a game, more digital marketing may be effective to increase game attendance.

Lastly, we provide practical insights regarding the implementation of the MLB rule changes for more dynamic games. While the MLB rule changes in 2023 has a positive effect in increasing game attendance, it moderates the effect of the prior winning performance of the home team on game attendance. This implies that the effect of the rule changes on game attendance may differ depending on the home teams' winning performance. Thus, the rule changes would become less effective in increasing game attendance as the winning performance of the home team increases. It may be because the rule changes could cause anxiety and worry based on the uncertainty of the game's outcome especially when their teams are performing well. Hence, while the MLB organization should still promote their recent rule changes to induce higher numbers of game attendance, the teams with outstanding winning performance should try to provide more fun experiences at the stadium, such as raffles with exciting rewards during games, which aim to decrease anxiety caused due to the rule changes and increase the overall enjoyment of fans apart from game-specific factors.

5.3. Limitations and future research

The current study has some limitations which could open potential opportunities for future research exploration. First, although we examine the effects of winning performance of the home and away team on game attendance, we do not focus on the impact of defensive, pitcher-specific metrics such as Earned Run Average (ERA) and Fielding Independent Pitching (FIP). Future research can further investigate the effects of these factors along with prior winning performance on game attendance. Second, we utilize the normalized search interest from Google Trends as a proxy measure for online search, considering it is extensively used in fields of quantitative business research. However, there may be other measures of the fans' interest in a team as nowadays sports fans use various sport-related platforms to check daily match scores, watch videos, and stream live events. In addition, future research could incorporate different activities of social media as new moderators and validate whether the moderating effects still remain significant. For example, online comments and word of mouth about products in social media can influence consumers' purchase behavior (Jeon et al. 2019; Noreen and Han 2015). It would be valuable to examine how these online activities affect game attendance simultaneously. Finally, the MLB implemented the rule changes starting from the 2023 regular season and the season is still on-going. Future research could validate the findings of this research using the full regular season data once this season is over. It would be also valuable to investigate how the rule changes affect game attendance and online viewership differently in a regular season and the MLB playoffs.

Conflict of interest

The authors declare that there is no conflict of interest.

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