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THE IMPACT OF COVID-19 ON FAN ATTENDANCE TO SPORTS EVENTS: THE CASE OF MAJOR LEAGUE BASEBALL

Alondra Aleman

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THE IMPACT OF COVID-19 ON FAN ATTENDANCE TO SPORTS EVENTS:
THE CASE OF MAJOR LEAGUE BASEBALL

A Project
Presented to the
Faculty of
California State University,
San Bernardino

In Partial Fulfillment
of the Requirements for the Degree
Master of Science
in
Information Systems and Technology:
Business Intelligence and Analytics

by
Alondra Aleman
May 2023

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ABSTRACT

The COVID-19 pandemic impacted the world in 2020 causing nationwide lockdowns in many countries. During this time in 2020, the MLB shortened their regular season and played with no spectators in attendance. This project aims to provide insights into the impact of the MLB stadium closures on fan attendance. The research questions asked are: (Q1) How did MLB stadium closures during the COVID-19 lockdowns affect individual teams' attendance in the seasons after COVID-19? (Q2) What factors influenced MLB stadium attendance pre-COVID-19? (Q3) What factors influence MLB stadium attendance post-COVID-19? An empirical model was developed through recommendations from past studies. The data collected covers all 30 MLB teams from 2018 to 2022 and consists of attendance rates and on-field influencing factors.

The research questions were analyzed through methods of regression analysis and through comparing attendance rates before and after the 2020 season. The findings and conclusions for each question are: (Q1) In comparing the total seasonal attendance for MLB teams in the 2019 and 2021 seasons and found that every team experienced a decrease in attendance rates. (Q2) The factors that influence MLB attendance before the stadium closures are stadium capacity, winning percentage, runs per game, home runs, runs batted in, slugging percentage, and payroll. (Q3) The results from the second model that utilizes data from 2021 and 2022 demonstrate there are changes in the factors that affect attendance compared to the pre-COVID-19 period. Areas for further

study include analyzing the long-term effects on fan attendance after the stadium closures in 2020.

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CHAPTER ONE

INTRODUCTION

“Take Me Out to The Ballgame”

The 1908 song, “Take Me Out to The Ballgame” has resonated with Major League Baseball fans for over a century. In 1903, the National League (NL) and American League (AL) merged to form a professional Major League Baseball (MLB). Since the formation of MLB, millions of fans from all over the nation have attended baseball games at stadiums located throughout the country. One question that has interested researchers for decades is the study of the antecedents and determinants of stadium attendance in Major League Baseball (Rottenberg, 1956; Ahn & Lee, 2014; Lee, 2018).

Sports economists and other researchers have studied the demand for Major League Baseball for decades. One of the first to publish work on the subject was Simon Rottenberg, an economics educator, who studied baseball players' labor market (Rottenberg, 1956). This work became significant because it incited future studies related to the demand for Major League Baseball. Recent studies have analyzed the factors that affect individual team ticket sales and found that MLB sports teams' attendance can significantly vary by team (Park, et al., 2013). Ahn and Lee analyzed the factors that affect MLB attendance using data from 1904 to 2012 and found that the determinants of attendance have changed in recent years placing a greater emphasis on outcome uncertainty, stadium age and quality, and on-field performance (Ahn & Lee, 2014). Ahn and

Lee focused on estimating the determinants of MLB attendance patterns using panel data for individual teams in a pooled OLS model (Ahn & Lee, 2014). Recent studies have also shown that greater access to transportation has allowed fans to travel to away games (Lee, 2018). Lee's study seeks to identify common factors in determining MLB attendance by implementing a sequential test method (Lee, 2018). Lee's findings are significant because it shows that fans are influenced by the characteristics of both the home and away team when visiting an MLB stadium (Lee, 2018). Recent studies relating to MLB stadium attendance have determined that demand for MLB baseball varies by team, common factors can change over time, and fans are influenced by characteristics of both home and away teams. One area that Ahn and Lee determined a need for further study is to examine the factors that affect stadium demand and produce temporal variations in attendance (Ahn & Lee, 2014). Previous research has also found that there is a need to study the disparities in ticket sales between MLB teams (Park, et al., 2013). Studies also find that common factors affecting stadium attendance are subject to change over time and need to continuously be analyzed to better understand fan preferences and provide information for team-managers and policy decision makers (Ahn & Lee, 2014). This study expands on the previous literature to investigate the determinants of MLB attendance.

Problem Statement

The main objective of this culminating experience project is to examine the common factors of MLB demand and provide explanations for questions relating to stadium attendance. Previous research showed there is a need to study temporal variances in attendance investigated in this paper. The main objective of this study is to examine the common factors of MLB demand and provide explanations for questions relating to stadium attendance.

This project will seek to answer the following questions:

1. How did MLB stadium closures during the COVID-19 lockdowns affect individual teams' attendance in the seasons after COVID-19?
2. What factors influenced MLB stadium attendance pre-COVID-19?
3. What factors influence MLB stadium attendance post-COVID-19?

This culminating experience project is organized as follows: chapter 2 reviews past literature, chapter 3 is project methodology and data collection, chapter 4 is an analysis of the results, and chapter 5 is a discussion of the findings, conclusions, and recommendations for future research.

CHAPTER TWO

LITERATURE REVIEW

Several studies have been conducted regarding the antecedents or events that influence MLB home-game attendance. Sloan (1989) conducted one of the earliest studies to focus on fan-focused factors, their motives, and the behaviors of sports consumers. Sloan's approach sought to understand the factors that influence sports attendance (1989). Since the seminal work of Sloan, researchers have continued to study the factors that influence attendance in MLB. Major League Baseball has the highest number of home games compared to other major sports, with each season typically hosting 81 games (Barilla et al., 2008). Maximizing home-game attendance is important to MLB franchises since ticket sales along with parking, concessions, and souvenirs, are the team's largest revenue sources (Barilla et al., 2008). Barilla et al. (2008) used a multivariate regression model to study the effect of promotions on home-game attendance in MLB. The results indicated that promotions can be an effective tool marketing managers can utilize to maximize MLB home-game attendance (Barilla et al., 2008). In a recent study from Pyun et al., (2020), researchers attempted to estimate the marketing performance of individual MLB team franchises with the use of a stochastic frontier model. Stochastic frontier models are commonly used in economics where the frontier represents the highest output of an input. In this case, Pyun et al., (2020) used this stochastic frontier model to estimate the marketing performance of MLB teams. The benefit of

estimating marketing performance for individual MLB teams is that it enables researchers to measure the effect marketing has on attendance and revenue (Pyun et al., 2020). The marketing performance of MLB teams is a factor that contributes to home-game attendance. Through a meta-analysis of the literature, Kim et al., (2019) found that the driving factors of MLB attendance can be decomposed into three subcategories: fan, relationship, and product-focused factors. It has been found that fan-focused and relationship-focused factors have a greater effect on attendance than product-focused factors such as cost and winning percentage (Kim et al., 2019). The literature demonstrates the antecedents of MLB home-game attendance are varied and are composed of contributing factors.

Researchers have utilized various methods to explore the determinants of demand attendance. For example, Rottenberg (1956) analyzed the factors that affect major league baseball players' labor market. Additionally, Ahn and Lee (2014) examined factors models from the years 1904 to 2012 with team-level panel data and identify the common influences on attendance between teams. The data was separated into two time periods: 1904-1957 and 1958-2012 (Ahn & Lee, 2014). Before 1958, the United States' MLB market was primarily found in the eastern region, which changed once the Dodgers and Giants relocated from New York to Los Angeles and San Francisco respectively. Ahn and Lee used the aforementioned periods to examine the changes in determinants as the MLB market expanded throughout the United States (2014). The researchers

developed a panel attendance model, where the dependent variable of the logarithmic average of attendance per game and the independent variables of commonly observed factors were analyzed through a multilinear regression model (Ahn and Lee, 2014). The regressor vector used in Ahn and Lee's pooled Ordinary Least Squares, OLS, model included team, league, and event-specific variables that consider disruptions in the regular season such as player strikes and mega-events (2014). Some team-specific variables that were utilized within the regression model included stadium capacity, winning percentage, and offensive slugging and the aggregate variables included average runs per game, home runs per game, slugging percentage, and more (Ahn and Lee, 2014). Ahn and Lee (2014) concluded that fan preferences have become increasingly multifaceted in recent years (1958-2012), compared to the initial period of professional baseball (1904-1957). Further research is needed to explain temporal variations and differences in team-level attendance (Ahn & Lee, 2014). The factors that influence attendance at the team level may explain large disparities in home-game attendance for teams such as the Los Angeles Dodgers, who had 2.8 million fans in attendance, compared to the Miami Marlins a team who only had an estimated 640,000 total fans in the 2021 season (2021 MLB Attendance - Major League Baseball - ESPN, n.d.). Lee (2018) expanded on previous research by attempting to identify common factors that influence MLB attendance with a sequential test method using team-level panel data from 1904 to 2012. The purpose of this study was to expand on Lee's prior study of

common factors by applying a sequential test method using identified common factors rather than potential factors (Lee, 2018). Lee references using a similar model with common factors previously used by Ahn and Lee in 2014. These factors are again distinguished by team-specific, league-specific, and event variables (Lee, 2018). The data from the years 1904 to 2012 was, again, split into two periods to indicate the Dodgers and Giants relocating to California, as was done in Ahn and Lee's study from 2014 (Lee, 2018; Ahn and Lee, 2014). The results of Lee's study indicated that fan preferences became multifaceted in the second period as fans considered more factors such as offensive performances and away-team characteristics (2018). These results confirm that fan preferences and the common factors of MLB attendance can change with time. Park et al. (2013) utilized individual team panel data to examine the differences in ticket pricing by using an Error Correction Model to estimate elasticities of demand. This study conducted by Park et al. (2013) contributes to the literature by confirming that ticket prices, income, and location are significant factors influencing MLB attendance. The factors of MLB attendance require further research to investigate the variations in attendance and disparities in attendance among teams (Ahn & Lee, 2014; Lee, 2018; Park et al., 2013).

In 2020, the COVID-19 pandemic shocked the world, and many countries were placed on a nationwide lockdown to slow the spread of the novel coronavirus. The COVID-19 lockdowns caused unprecedented professional sports events. For the first time in history, the Olympics were postponed for a

year until 2021 (Horky, 2021). The COVID-19 lockdowns caused a standstill in live sporting events which up until the pandemic was unheard-of. Regional football in Europe paused live matches during the 2020 lockdowns, which is significant because regional football continued during the two world wars (Reade and Singleton, 2021). The COVID-19 lockdowns were a significant event that affected many aspects of the world including live professional sporting events.

There are many studies conducted to analyze the antecedents and determinants of attendance in MLB. Recent studies have expanded on the previous literature of professional sports demand by exploring the potential impacts of the COVID-19 pandemic. Studies have analyzed the effects that COVID-19 caused on professional sports and the various policies governments implemented during the pandemic outbreak in 2020. Reade et al. analyzed stadium demand during the pandemic crisis in Belarus, a country that did not go into a national lockdown (2021). The Belarussian Premier League did not postpone its season which was scheduled to start on March 19, 2020, at a time when many countries were in quarantine (Reade et al., 2020). This contrasted with other European countries that either postponed the season or reopened without spectators. Reade and Singleton conducted a study to analyze the impact of the COVID-19 lockdowns on the top five European football clubs, including the English, Spanish, Italian, French, and German leagues (Reade & Singleton, 2021). Additionally, recent studies investigate the impact of no spectators at live sporting events from a financial perspective (Horky, 2021). The

results of Horky's study indicate that since the COVID-19 lockdowns in 2020, professional sports teams have begun relying less on matchday revenue and more on gaining sponsorships and broadcasting rights to grow their revenue (2021). These studies were conducted to understand the demand for professional sports during a public health emergency (Reade et al., 2020; Reade and Singleton, 2021; Horky 2021).

The literature presented in this chapter investigates topics relating to the antecedents and determinants of MLB stadium attendance and recent studies have begun to study the impact of the COVID-19 pandemic on the sports industry. The present study seeks to contribute to the existing literature on MLB attendance by further investigating the changes in common factors that may have occurred due to the COVID-19 pandemic. Since the 2020 stadium closures, studies such as those from Reade and Singleton and Horky mentioned previously, have begun to analyze the impact of lockdown on sports attendance (Reade et al., 2020; Reade and Singleton, 2021; Horky 2021). This study takes common factors of MLB attendance identified by prior research to determine if COVID-19 closures significantly impacted ticket sales.

CHAPTER THREE

DATA AND METHODOLOGY

Data

This chapter describes the procedures and methods used for data collection and analysis for this culminating experience project. The data used in this project was collected for all 30 MLB teams from the 2018 to 2022 season. For this project's purposes, it is important to examine all 30 MLB teams and collect seasonal data for the seasons before and after the 2020 stadium closures. The dataset used was derived from collecting data from *www.baseball-reference.com* and *www.mlb.com*. The dataset consists of 150 observations for the seasons of 2018 to 2022 and contains team-specific data points for 8 variables. The software used to collect the data and perform the analysis was Microsoft Excel. The variables of interest for which data was collected were seasonal attendance for each MLB team from 2018 to 2022. Winning percentage runs per game, home runs, runs batted in, slugging percentage, and stadium capacity, and payroll statistics were collected from *www.baseball-reference.com*. The remainder of this chapter covers the data collection and research design.

Methodology

As noted in Chapter 1, this project will seek to answer the following questions:

1. How did MLB stadium closures during the COVID-19 lockdowns affect individual teams' attendance in the seasons after COVID-19?

2. What factors influenced MLB stadium attendance pre-COVID-19?
3. What factors influence MLB stadium attendance post-COVID-19?

This chapter provides the methods that will be used to answer each question.

Question 1: How did MLB stadium closures during the COVID-19 lockdowns affect individual teams' attendance in the seasons after COVID-19?

Previous studies have noted a distinct difference in total season attendance depending on the MLB team (Ahn & Lee, 2014; Lee, 2018; Park et al., 2013). The first question in this project focuses on the effect of the 2020 stadium closures on the individual 30 MLB teams' attendance in the 2021 and 2022 seasons. Prior research has yet to address the change in total seasonal MLB attendance per team. This study aims to provide insight into whether seasonal attendance has increased or decreased since the impact 2020 season. The methods used to measure the changes in MLB teams' attendance after COVID-19 disrupted the regular season schedule are by taking the percentage change by season for each team. Attendance for the 2019 season is used as the comparative pre-COVID-19 period, compared to the 2021 post-COVID period. These two periods before and after the pandemic, 2021 and 2022, can also be compared visually with charts to visualize each team's ticket sale levels per season. These methods are intended to compare 2021 and 2022, MLB teams' attendance rates to the pre-COVID-19 period and examine if the closures affected each team differently.

Question 2: What factors influenced MLB stadium attendance pre-COVID-19?

Previous studies on MLB stadium attendance have applied methods of multilinear regression model to test for the factors that influence attendance. Question two is investigated by developing an empirical model to estimate MLB attendance based on the factors found in past studies. The results of the empirical model can examine the factors that influence attendance in the pre-COVID-19 period by using the data from 2018 to 2019. The following section will cover the estimation model and describe the independent variables and their use in prior research.

Empirical Model

The empirical model describes the estimated equation between the dependent and independent variables.

$$ATTENDANCE_i = \beta_0 + \beta_1 CAPACITY_i + \beta_2 WINPCT_i + \beta_3 RPG_i + \beta_4 HR_i + \beta_5 RBI_i + \beta_6 SLG_i + \beta_7 PAYROLL_i + \varepsilon_i$$

Table 1: Data Description

Variable	Description
Attendance	<i>total tickets sold in home games per season</i>
Stadium Capacity	<i>total seating and standing capacity in MLB stadium</i>
WinPCT	<i>win percentage is calculated (wins / (wins + losses))</i>
RPG	<i>runs allowed per game</i>
HR	<i>home runs allowed</i>

RBI	<i>runs batted in</i>
SLG	<i>slugging percentage</i>
Payroll	<i>estimated payroll - may not include every bonus the team paid in a season or players called up or acquired mid-season</i>

Note: Description of variables. Source: (MLB Stats, Scores, History, & Records | Baseball-Reference.com, n.d.)

Variables

The dependent variable is Attendance, which measures total stadium seasonal attendance for each MLB team. Prior research has measured the impact of on-field performance and other variables on stadium attendance (Ahn & Lee, 2014; Lee, 2018; Park et al., 2013). The explanatory independent variables in this study are as follows: stadium capacity, winning percentage, runs per game, home runs allowed, runs batted in, and slugging percentage. This study aims to measure the effect of the independent variables on stadium attendance and understand the way the COVID-19 lockdowns could have altered these effects.

The first independent variable is stadium capacity, CAPACITY, which is a measurement of total seating and standing capacity at each MLB stadium. Previous studies have used stadium capacity as an explanatory variable, and it is predicted that teams with a larger stadium capacity will in turn have higher attendance rates (Woltring, 2018). The following independent variable is the winning percentage, referred to as WINPCT, a measurement of seasonal total

wins divided by total wins and losses for each MLB team. Winning percentage is predicted to hold a positive effect on stadium attendance as previous studies have found that a high winning percentage could positively increase stadium attendance (Kim et al., 2019). The next independent variables are related to on-field performance for each individual MLB team and are the measurements for runs per game, RPG, home runs, HR, runs batted in, RBI, and lastly slugging percentage or SLG. Individual team on-field performance has key factors that have been previously used in studies to measure the effect of performance on stadium attendance (Ahn & Lee, 2014; Lee, 2018; Park et al., 2013). The measurements of runs per game, home runs, runs batted in, and slugging percentage are found on www.baseballreference.com. The last explanatory variable used in this study is estimated payroll referred to as PAYROLL which estimates the total seasonal payroll for each individual MLB team. Previous studies have tested whether payroll has a positive effect on attendance and if teams with a higher payroll have greater attendance rates than those with lower salaries (Woltring, 2018).

Question 3: What factors influenced MLB stadium attendance post-COVID19?

The methods used in this project are derived from previous studies on the common factors that predict MLB ticket sales. The factors that influence attendance in post-COVID-19 period are examined by testing the estimation

model for the 2021 and 2022 seasons. The empirical model used in this project estimates the total seasonal attendance for the two periods being examined, the pre- and post-COVID-19 lockdowns. Question three focuses on the impact on the influencing factors in the time after the stadiums reopened to full capacity in the 2021 and 2022 season. The estimation results can help determine the relationship between the dependent variable attendance and the independent variables of interest.

The data collection in this chapter provides a dataset that contains data for all 30 MLB teams for 8 variables from 2018 to 2022. At the time of this study, there is a limited number of studies that have focused on the effects of the COVID-19 pandemic lockdowns on major sports leagues (Elrich et al., 2021; Reade et al., 2020; Reade and Singleton, 2021; Horky 2021). This study aims to understand the effect of stadium closures during the lockdown on individual MLB teams and analyze the factors influencing attendance before and after the COVID-19 stadium closures through the methods described in this chapter. This chapter described the methods used to offer insights to the three research questions. The following chapter will provide the analysis and findings.

CHAPTER FOUR

ANALYSIS AND FINDINGS

This chapter describes the analytical procedures utilized to provide insights to the questions discussed in the previous chapters. This study seeks to understand the effect of the 2020 stadium closures on individual teams and the MLB overall. The analysis was performed on Microsoft Excel with the MLB dataset described in earlier chapters. The main objective of this chapter is to give an explanation to the three research questions:

Question 1: How did MLB stadium closures during the COVID-19 lockdowns affect individual teams' attendance in the seasons after COVID-19?

The COVID-19 pandemic was a critical moment in history that caused MLB stadiums to close during the 2020 season. Prior studies have identified that further research should investigate variations and disparities in ticket sales amongst MLB teams (Ahn & Lee, 2014; Lee, 2018; Park et al., 2013). This section covers the attendance figures for each MLB team in 2021 and 2022, the seasons after the stadium closures, and compares to total seasonal attendance in 2019. To address the question of the effect of the 2020 stadium closures on individual MLB teams in the seasons after COVID-19 an analysis of attendance figures for all teams were compared across the 2019, 2021, and 2022 season.

The change in MLB team attendance was calculated to measure the differences between 2019 and the two seasons post-COVID-19. Table 2 presents the percentage change for each MLB team comparing 2019 to 2021 and 2021 to 2022. Table 2 shows the teams that had the largest decline in stadium attendance in the 2021 season compared to 2021. The 2021 MLB seasonal attendance was lower for each team compared to the 2019 pre-COVID-19 season.

Table 2: Attendance After the 2020 Stadium Closures

Team	<i>Attendance - 2019</i>	<i>Attendance - 2021</i>	<i>Attendance - 2022</i>	<i>Change from 2019 to 2021</i>	<i>Change from 2021 to 2022</i>
Arizona Diamondbacks	2,135,510	1,043,010	1,605,199	-51.2%	53.9%
Atlanta Braves	2,654,920	2,299,647	3,129,931	-13.4%	36.1%
Baltimore Orioles	1,307,807	793,229	1,368,367	-39.3%	72.5%
Boston Red Sox	2,915,502	1,725,323	2,625,089	-40.8%	52.2%
Chicago Cubs	3,094,865	1,978,934	2,616,780	-36.1%	32.2%
Chicago White Sox	1,649,775	1,596,385	2,009,359	-3.2%	25.9%
Cincinnati Reds	1,809,075	1,505,024	1,395,770	-16.8%	-7.3%
Cleveland Indians	1,738,642	1,114,368	1,295,870	-35.9%	16.3%
Colorado Rockies	2,993,244	1,938,645	2,597,428	-35.2%	34.0%
Detroit Tigers	1,501,430	1,102,621	1,575,544	-26.6%	42.9%
Houston Astros	2,857,367	2,068,509	2,688,998	-27.6%	30.0%
Kansas City Royals	1,479,659	1,159,613	1,277,686	-21.6%	10.2%
Los Angeles Angels	3,023,012	1,515,689	2,457,461	-49.9%	62.1%
Los Angeles Dodgers	3,974,309	2,804,693	3,861,408	-29.4%	37.7%
Miami Marlins	811,302	642,617	907,487	-20.8%	41.2%
Milwaukee Brewers	2,923,333	1,824,282	2,422,420	-37.6%	32.8%
Minnesota Twins	2,303,299	1,310,199	1,801,128	-43.1%	37.5%
New York Mets	2,442,532	1,511,926	2,564,737	-38.1%	69.6%
New York Yankees	3,304,404	1,959,854	3,136,207	-40.7%	60.0%
Oakland Athletics	1,670,734	701,430	787,902	-58.0%	12.3%
Philadelphia Phillies	2,727,421	1,515,890	2,276,736	-44.4%	50.2%
Pittsburgh Pirates	1,491,439	859,498	1,257,458	-42.4%	46.3%

San Diego Padres	2,396,399	2,191,950	2,987,470	-8.5%	36.3%
Seattle Mariners	1,791,109	1,215,985	2,287,267	-32.1%	88.1%
San Francisco Giants	2,707,760	1,679,484	2,482,686	-38.0%	47.8%
St. Louis Cardinals	3,480,393	2,102,530	3,320,551	-39.6%	57.9%
Tampa Bay Rays	1,178,735	761,072	1,128,127	-35.4%	48.2%
Texas Rangers	2,132,994	2,110,258	2,011,381	-1.1%	-4.7%
Toronto Blue Jays	1,750,144	805,901	2,653,830	-54.0%	229.3%
Washington Nationals	2,259,781	1,465,543	2,026,401	-35.1%	38.3%

Note. This table presents the seasonal total attendance in 2019, 2021, and 2022 for each individual MLB team. The percent change in total seasonal attendance is calculated to compare 2019 figures to 2021 and 2022.

The five teams with the greatest percent decrease in attendance from 2021 compared to 2021 are the Athletics, - 58%, Blue Jays, -54%, Diamondbacks, -51.2%, Angels, - 49.9%, and Phillies, -44.4%. Compared to the rest of the MLB: the Athletics, Blue Jays, Diamondbacks, Angels, and Phillies had the highest decline in seasonal attendance compared to their total attendance from 2019. This indicates that the 2020 stadium closures could have had adverse effect on ticket sales in future seasons. Another comparison that can be made of the MLB teams' seasonal attendance from 2021 vs. 2019 is the five teams that had the least decline. Contrary to the teams mentioned before they had the largest decline in attendance comparing 2021 to 2019. The teams with the lowest drop in attendance from 2021 compared to 2019 are the Rangers, -1.1%, White Sox, -3.2%, Padres, -8.5%, Braves, - 13.4%, and Reds, -16.8%. These percentages suggest that the Rangers, White Sox, Padres, Braves, and

Reds' total seasonal attendance in 2021 decreased compared to 2019, pre-COVID-19, but these teams did not experience as great declines as others.

These findings are consistent with previous studies that have compared the ticket sale disparities amongst MLB teams.

The COVID-19 lockdowns caused all MLB stadiums to close during the 2020 season and officially reopened to full capacity in the 2021 and 2022 seasons. The seasons post-COVID-19 have shown a decrease in seasonal attendance compared to the 2019 MLB season. Figure 1 is a chart that provides a visual aid to compare the change in attendance in comparing 2019 and 2021 which are treated as pre-COVID-19 and post-COVID-19.

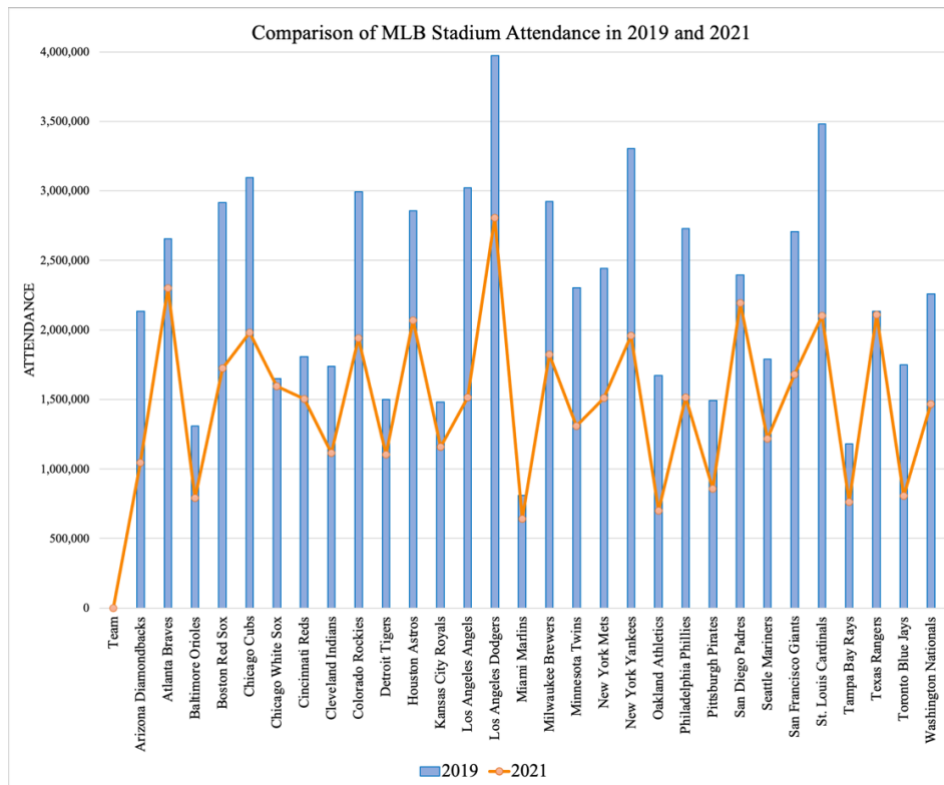


Figure 1: Comparison of MLB Seasonal Attendance in 2019 and 2021.

Note: The chart demonstrates the change in total seasonal stadium attendance for each MLB team in the years 2019 and 2021. The figure was generated in Microsoft Excel with statistics from the dataset references in Chapter 3.

Figure 1 shows the total seasonal attendance for each MLB team in 2019, represented by blue bars. Seasonal attendance for 2021, the first season after the COVID-19 pandemic, is visualized with an orange line that overlaps the blue bars that represent 2019. Figure 1 provides insights into the disparities in ticket sales across teams that has been identified as an area for further study in MLB stadium demand (Ahn & Lee, 2014; Lee, 2018; Park et al., 2013). Based on the findings in Figure 1, each MLB teams seasonal attendance varies by team as has been previously found in prior studies (Park et al., 2013).

Question 2: What factors influenced MLB stadium attendance pre-COVID-19?

Results of Empirical Model

The following section analyzes the common factors that influence the dependent variable of Attendance. The independent variables are stadium capacity, WinPCT, RPG, HR, RBI, SLG, and Payroll the full description for each variable can be found in Table 1 and is derived from previous studies on MLB stadium attendance (Ahn & Lee, 2014; Lee, 2018; Park et al., 2013, Woltring,

2018). The regression results in Table 3 have the coefficient and standard error for each dependent variable for Model 1 and Model 2.

Table 3: Regression Analysis Results

<i>Attendance</i>				
	<i>Model 1</i>		<i>Model 2</i>	
Variable	B	SE	B	SE
Intercept	-644021.49	1979919.67	3170684.68	3115723.42
Stadium Capacity	46.91**	12.58	22.43	16.5295423
WinPCT	2235505.58**	1080334.12	2141061.94*	1118811.82
R/G	21566.55	27911.45	-70539.09	76089.89
HR	5435.68	3799.72	-251.33	9633.73371
RBI	775.37	2205.70	-3011.23	2755.58386
SLG	-7785915.53	7856661.17	-6403732.04	8208860.88
Payroll	0.01**	0.001	0.009*	0.002
R ²	0.75		0.58	
Adjusted R ²	0.71		0.52	

*Note: N = 60 **p<.05 *p<.10*

Note: The regression results for the empirical model described in Chapter 3 with attendance as the dependent variable.

In this project, Model 1, (as shown in Table 3), depicts the pre-COVID-19 period of 2018 and 2019. Table 3 provides the regression analysis results for Model 1, which is designed to examine the factors that influence attendance before the stadium closures in 2020. The B column in Table 3 represents the coefficients for the estimated regression equation. For example, in Model 1, the coefficient of Stadium Capacity is 46.91 which means for every one percent increase in capacity is expected to increase stadium attendance by 46.91, all else is held constant. The estimated coefficient for each independent variable is

found in column B and aims to measure the effect of the explanatory variables on stadium attendance. The *SE* column from Table 3 represents the standard error of each estimated coefficient. Each estimated coefficient for Model 1 has a positive value except the intercept and SLG. Model 1 predicts that slugging percentage has a negative relationship with the response variable, attendance. The R^2 represents the value of the R-squared or the coefficient of determination that represents the percentage of the variations in the independent variable that can be explained by the dependent variables. The R-squared value of Model 1, the pre-COVID-19 period, is .75 which means that 75% of the variation in MLB stadium attendance can be explained by the dependent variables in this model. The results of Model 1 indicate that the explanatory variables used are significant in influencing MLB stadiums from the time of 2018 to 2019 before COVID-19 stadium closures.

Question 3: What factors influenced MLB stadium attendance after COVID-19?

The factors that influenced attendance after the pandemic crisis are estimated in Model 1 and Model 2 in Table 3. Model 2 are the regression results for post-COVID-19, 2021 and 2022 season. The results of Model 2 varied from Model 1 the pre-COVID-19 estimate. Table 3 provides the estimated coefficient and standard error for the intercept and explanatory variables. The estimated coefficient for the on-field performance factors: RPG, HR, RBI, and SLG are

negative in Model 2. Winning percentage influences attendance in both Model 1 and 2, which is consistent with estimations in prior studies (Ahn & Lee, 2014). The changes in Model 2 compared to Model 1, suggest the impact of COVID-19 and stadium closures may have affected MLB attendance in future seasons.

This chapter has presented the analysis process that provides insights into the three research questions relating to the effect of COVID- 19 on MLB teams attendance. The first question compared each MLB teams' seasonal attendance before and after the stadium closures in 2020. The second and third question investigated the common factors of MLB attendance prior to the crisis and after stadiums opened. Chapter 5 next, provides a discussion, conclusion, and recommendations for further research.

CHAPTER FIVE
DISCUSSION, CONCLUSION, AND RECOMMENDATIONS FOR FURTHER
RESEARCH

This last chapter will discuss the project findings, and provide a conclusion, and areas for further study for each of the three questions.

Question 1: How did MLB stadium closures during the COVID-19 lockdowns affect individual teams' attendance in the seasons after COVID-19?

Question 1 focuses on the changes in MLB seasonal attendance per team in the seasons after the 2020 stadium closures. The results in Chapter 4 find that each MLB team's seasonal attendance declined compared to 2019 attendance rates. This project adds prior studies on the determinants of MLB stadium attendance by considering the effect of the COVID-19 lockdowns on future MLB seasonal attendance. The results from question 1 suggest that MLB teams suffered a decline in seasonal attendance in 2021 compared to 2019, the pre-COVID-19 season. The limitation of this finding is that there are only two seasons that have occurred at the time of this project to study the long-lasting effects of stadium closures on attendance.

There are many areas for further study in this subject, considering the COVID-19 pandemic recently occurred and has not ended as of the time of this project. The results from question 1 suggest that MLB teams are experiencing a

decline in total seasonal attendance in the seasons after reopening. Further research is needed to continue to analyze the changes in seasonal attendance after the 2020 stadium closures. This project focused on MLB attendance by all 30 MLB teams, future studies may analyze the effects of stadium closures on one individual team or a sample of teams.

Question 2: What factors influenced MLB stadium attendance pre-COVID-19?

Question 2 analyzed the determinants of stadium attendance in the 2018 and 2019 seasons before the COVID-19 pandemic. The results of question 2 found that the empirical model, described in Chapter 3, estimated MLB stadium attendance utilizing factors related to stadium capacity and on-field performance. The major finding from question 2 was determining the estimated coefficient for the explanatory variables and estimating the effect of each variable on attendance. The results of question 2 find the factors that influence MLB seasonal attendance during the pre-COVID-19 period. The limitations of this project could be the limited time series analyzed which could have affected the results of the regression analysis.

Further research may perform an in-depth analysis of the factors that influence MLB attendance prior to the COVID-19 crisis through long-term analysis. Previous studies have analyzed MLB attendance through long-term factor models and found that fan preferences changed over time (Ahn and Lee,

2014). Future studies may focus on different common factors than those that were analyzed in this model. Fan preferences are constantly changing and will require further analysis to determine the factors that influence attendance.

Question 3: What factors influence MLB stadium attendance post-COVID-19?

Question 3 examined the factors that influence MLB attendance in the seasons after the pandemic. Model 2, (as shown in Table 3) demonstrates the results of the 2021 and 2022 season after the stadium closures. There are changes in the estimated coefficients in Model 2 compared to Model 1, the pre-COVID-19. In Model 2, RPG, HR, RBI have negative coefficients compared to their estimated coefficients in Model 1 which may suggest a change in fan preferences. The differences in the results for Model 1 and Model 2 indicate the 2020 closures may have effects on the factors that influence attendance.

Future studies can further analyze the effects of historical events, such as the COVID-19 pandemic on fan preferences in the sports industry. This project only focused on the effects of the COVID-19 pandemic on MLB but there are areas for further study within the NFL, NBA, and NHL, as well as other sports leagues outside of the United States. The determinants of MLB stadium attendance have been widely covered in prior research and continue to offer further areas of study. This project's importance is to shed light on the pandemic's effects on fan attendance at major sports events.

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