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Take me out to the Ball Game? The Effect of Crime on Major League Baseball Game Attendance

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Abstract

Major League Baseball attendance has been examined since the league's establishment in 1869. Winning percentage, opponent quality, and stadium quality have all been deemed significant determinants of increasing attendance, but deterring factors have yet to be closely examined. Since a majority of professional sports stadiums are constructed in economically poor, crime ridden areas, it seems natural to assume that crime could have an impact on people's desire to attend Major League Baseball games. Panel data collected on twenty-eight teams over the course of ten years was used to determine whether or not crime rates have a significant effect on attendance.

Keywords

Sports Economics, Economics, Urban Economics, Crime

I. INTRODUCTION AND LITERATURE REVIEW

On April 25, 2015, in the interest of public safety, The Baltimore Orioles closed the gates of Camden Yards, leaving the Orioles and Chicago White Sox to play America's pastime in an empty stadium. Until the Baltimore riots of 2015, there was nothing that could hinder a willing and able fan from attending a Major League Baseball game. This occurrence sparked interest in the idea that crime could deter fans from wanting to attend sporting events, specifically, Major League Baseball games. Through this study, I hope to uncover the hidden costs of crime—like missing fans at baseball games.

The factors that go into choosing whether or not to attend a Major League Baseball game—and the structure of Major League Baseball itself—are relatively consistent from team to team, but these consistencies come with a decent amount of complexity. Regardless of fan turnout, the ultimate goal of Major League Baseball owners and managers is to make a profit. They rely on fan loyalty (Winfree 2004) and the idea that pricing for Major League Baseball games is relatively inelastic (Winfree 2004). Fan loyalty is the backbone of Major League Baseball. Teams can typically rely on consistently filling at least a quarter of their seats despite how well or poorly they perform.

Performance is also a key factor in determining the demand for Major League Baseball tickets. If you play well, they will come (Horowitz 2007). A fan's reaction to his team winning or losing varies throughout the league (Davis 2009) but winning is always a strong determinant of attendance (Davis 2009). Some variations exist among this assumption, including who the opponent will be (Winfree 2004) and outcome uncertainty (Ahn and Lee 2014). The closer in location two teams are, the lower the demand is for tickets (Winfree 2004). Interleague play tends to bring in an additional 12% of fans to the stadiums, thanks to increased media coverage

and well-known rivalries (Davis 2009). That being said, the more likely a team is to win a game, whether it be interleague or not, the more fans it attracts (Ahn and Lee 2014).

When attempting to discern whether or not crime rates have an effect on Major League Baseball attendance, it is important to look at the location of the stadiums. A majority of Major League Baseball stadiums are built in economically poor cities, with a false hope that a professional sports stadium will generate revenue and growth for the surrounding area (Abraham 2006). Since the 1990s, crime rates in cities have been continuously declining, (Ellen and O'Reagan 2010) which is largely due to urban flight—or the movement of people living in cities to the suburbs. The relationship between sporting events and crime has been studied, but has shown little to no evidence that there is a relationship between the two (Braumann, Ciavarra, Englehardt, and Matheson 2012). Previously examined were the Olympics hosts, which experienced a 10% increase in property crime, and Super Bowl hosts, which experienced a 2.5% decrease in property crime (Braumann, Ciavarra, Englehardt, and Matheson 2012). I expect the results of this study to be different than the Olympics and the Super Bowl, because I am using evidence from an entire season rather than one major sporting event. It is possible to assume that large events like the Olympics and the Super Bowl have substantial amounts of security to ensure the safety of all patrons—more so than the security provided at smaller events—such as regular season Major League Baseball games. The increased security at events like the Olympics and Super Bowl could deter certain crime that is typically present at centralized events that occur in the same area, like the crime seen in the cities of Major League Baseball teams.

Through this study I will keep all of these determinants in mind while examining the extent to which crime affects Major League Baseball game attendance. Though questions about

crime in urban areas and the location of sports stadiums have been answered, I seek to uncover the relationship between the two.

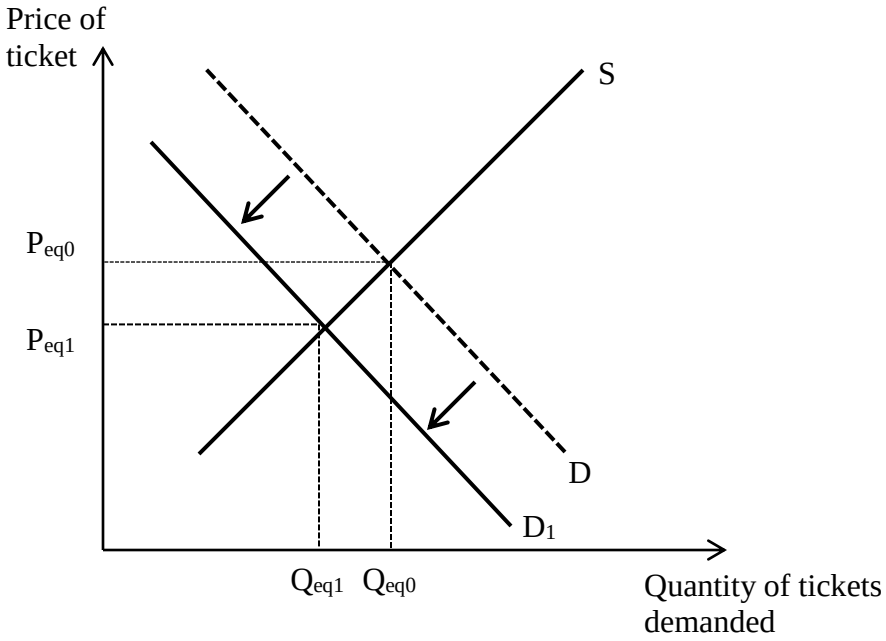
II. ECONOMIC THEORY

A simple supply and demand model, as shown in Figure 1, can demonstrate the relationship between Major League baseball game attendance and crime rates.

FIGURE 1.

SUPPLY AND DEMAND

FOR MAJOR LEAGUE BASEBALL TICKETS



To the extent that crime rates influence people's decision to attend Major League Baseball games, I expect the demand for tickets to decrease as crime rate increases.

The dependent variable of this study is attendance, which is represented as a percentage of seats that are filled of the total available seats in each ballpark. Some ballparks fill over capacity, possibly by selling standing room-only tickets, which is an explanation for the

percentages that are over 100%. The main explanatory variable is the crime rate in each city, which is represented as a composite number with weight placed on violent crime such as homicide and assault, as reported by Advamed, Inc. One must keep in mind that the average crime rate in the United States is 294.7 (Advameg Inc. 2015). It could be the case that Major League baseball stadiums are built in economically poor areas, but the presence of a professional sports stadium stimulating the economy of that area. This could be because the crime in these neighborhoods is deterring fans from coming to games. I expect this coefficient to be negative. As crime index increases, I expect attendance to decrease. Crime can be represented as a negative externality to someone attending a baseball game—thus increasing the social cost of attending a game. This cost is reflected at every quantity of tickets demanded, which in turn shifts the demand curve to the left—decreasing the price of tickets and quantity of tickets demanded.

Major League Baseball game attendance varies widely from team to team and year-to-year—and the reasoning behind choosing to attend a game is based on a multitude of factors. A team's performance is an obvious assumption—fans are more willing to pay to attend a baseball game for the assurance of a higher quality of play and a positive crowd atmosphere. The assumption holds true that "fans prefer to watch good teams play, regardless of their uniforms" (Horowitz 94). I expect this coefficient to be positive. As winning percentage increases, I expect attendance to increase. A division win and a World Series win could be an important determinants of attendance. It could be that if a team wins their division or the World Series the year prior, they would have increased attendance at the following year's games due to expected wins that season. I expect both coefficients to be positive.

The actual price of a ticket is another factor that could either encourage or discourage people from attending a game. The lower the price of a Major League Baseball ticket, one would assume, the more attractive attending a game becomes to marginal fans. If the price of a ticket is high, the opposite effect would take place. This assumption only holds for the portion of ticket pricing that is elastic, or, to put it in more relevant terms, for the marginal fans, because there is "substantial evidence in favor of demand [of Major League Baseball tickets] being highly price inelastic" (Fort 89). I expect this coefficient to be negative. As ticket price increases, I expect attendance to decrease.

The average statewide income could be an important determinant of the demand for Major League Baseball tickets. Though the demand for baseball tickets is relatively inelastic, it can be assumed that there would be lower attendance for Major League Baseball games in states with lower average incomes than in states with higher average incomes. I expect this coefficient to be positive. As state income increases, I expect attendance to increase.

Another variable included is the number of additional sports team in the given city. There could be a comparative factor among professional sports leagues. A city with both a Major League Baseball team and a National Football League Team may experience varying levels of competition for attendance based on the "product" of a game experience that they are able to offer fans. Therefore, it could be possible that the presence of another professional sports stadium could decrease demand for Major League Baseball tickets due to substitution. I expect this coefficient to be negative. As the number of professional sports teams in a city increases, I expect attendance to decrease.

The Major League Baseball industry is extremely profit oriented. Team owners are always looking for ways to make money off of their players and the people who come to watch

them play. There's a reason why people pay $8 for a hot dog when attending a game; and it's the same reason why many teams don't have the same first baseman for more than 5 years: money. Cities with high crime rates tend to be struggling economically, or could have a high level of low wage labor, or general unemployment (Abraham 2006). Having a Major League Baseball stadium—or any professional sports stadium in an area with high crime makes economic sense. Bring the people with money to impoverished areas to stimulate the economy—sounds like an easy fix, but unfortunately, it does not seem to have an effect. Despite the 1990s drop in crime across the country, cities with high crime rates tend to stay that way (Ellen and O'Reagan 2010), whether they have a Major League Baseball stadium or not. It could quite possibly be crime itself that is deterring willing and able fans from spending money at a ballpark in an economically poor area.

To accurately estimate the impact of crime on baseball attendance it is necessary to control for the other variables that influence demand. I am using a fixed effects model because I believe there are immeasurable differences between cities.

III. METHODOLOGY AND RESULTS

To accurately estimate the impact of crime on baseball attendance it is necessary to control for the other variables that influence demand. I am using a fixed effects model because I believe there are immeasurable differences between cities.

The model I will be using is as follows:

$$Ln\ (Attendance)_i = \alpha - \beta Crime\ Rate_i + \gamma_1 Stadium\ Capacity_i + \gamma_2 Winning\ Percentage_i + \gamma_3 Average\ Ticket\ Price_i + \gamma_4 Lagged\ World\ Series\ Win_i + \gamma_5 Lagged\ Division\ Series\ Win_i + \gamma_6 Num\ Additional\ Teams_i + \gamma_7 Average\ Income_i + FE + \varepsilon_i$$

The teams included in my dataset include all Major League Baseball teams except for the Toronto Blue Jays, Washington Nationals, Detroit Tigers, and the Minnesota Twins, due to lack of available information. I retrieved winnings data from mlb.com, ticket pricing from The Business of Baseball, crime indices from Advameg, Inc., and demographical data from the US Census. An overview of the measurable, numerical data collected is shown in the table below.

TABLE 2. SUMMARY STATISTICS

	Mean	Standard Deviation	Min	Max
Crime Index	598.66	220.13	225	1335.3
Winning Percentage	.49	.07	.30	.70
Average Ticket Price	22.39	8.14	11.79	52.32
State Income (1000s of dollars)	38.02	13.46	36.42	65.63
Attendance (% of seats filled)	69.21	18.45	23.6	104

N = 260

The table shows that the crime index for each city being studied is highly varied, which is expected. Not shown in the table, but notable, is the number of cities that were at some point below the national crime index. Only four of the twenty-six cities, Anaheim, California, San

Diego, California, Los Angeles, California, and New York City, New York, had a crime index that was at one point below the national average. Also notable is the average crime index, which is about three hundred points higher than the national average. This helps to solidify the assumption that a majority of Major League Baseball stadiums are built in economically poor, crime-ridden areas—which could be a factor in deterring fans from attending games. The percentage of seats filled is another variable with a considerable sized standard deviation. The percentage ranges from 23.6% to 104%, with the average calculated as 69.21%. Because the lowest percentage shows almost a quarter of the seats in a stadium being filled, it solidifies the claim that there is always some demand for Major League Baseball tickets. The other variables have relatively similar and normal-sized standard deviations. The standard deviation of the winning percentages is fairly small, but the range of the data is only 40% or, as shown in the table, 0.4.

With these statistics in mind, I will estimate my model. In order to properly estimate my model, I ran a variety of tests. Since I am working with panel data, I found it appropriate to use either a fixed effects or a random effects regression. In order to determine the proper specification, I used a Hausman test. My p-value was .0115, which allowed me to reject the null hypothesis and confirm that using fixed effects would be better than random effects in my model. After this test, I tested the parameters of my equations to see if a fixed effects model would even be necessary. According to my F-value of .7898, I reject the null hypothesis and conclude that a fixed effects estimation is not necessary for my model. Thus, I estimate my model using Generalized Least Squares, which is typical for panel datasets. The results of this estimation are shown below.

TABLE 3. REGRESSION RESULTS

Intercept	3.13
	(.021)
Crime Index	-0.0001
	(0.0002)***
Winning Percentage	0.016
	(0.0002)**
Average Ticket Price	-0.013
	(0.0005)***
Additional Teams	-0.0305
	(0.0166)*
Lagged World Series	-0.011
	(0.012)
Lagged Division Win	-0.007
	(0.006)
Average Income	0.0000002
	(0.00000006)
R^2	0.98
N	140

Note: Standard Errors in parentheses

* Denotes significance at the 90% confidence level.

** Denotes significance at the 95% confidence level.

***Denotes significance at the 99% confidence level.

From a dataset of twenty-six major league baseball teams and their respective cities, I regress each city's crime index along with all of the other control variables to test its effect on each team's respective attendance. The results are shown in Table 3.

The R^2 is high at .98, which is due to the fact that this model contains a times series variable, response variable, and a predictor variable that all have significant trends over time and across entities. Four variables in this study came back statistically significant: crime index, winning percentage, average ticket price, and additional teams in the same city.

Crime index is important to note, considering it is the main variable in this study. The negative (-0.0001) coefficient indicates that for every 1-point increase in crime, Major League Baseball game attendance decreases by 0.01%. The high standard deviation of the crime index indicates that this is significant both statistically and economically. Over the course of ten years, the crime rate in a city with a Major League Baseball team tends to fluctuate, on average, 220.13 points. If this trend is entirely positive over the course of ten years, it could mean that Major League Baseball teams are losing .01 of their game attendance each year, which averages out to about 7,700 fans lost each year, if there is an increase of 220.13 points in one year. To make things more realistic, we can divide the standard deviation of crime by 10, which equates to a change of 22.013 points per year in the crime index. This would mean a loss of 770 fans per year, and a total of 7,700 fans over the course of 10 years. When multiplied by the average ticket price of $22.39, teams are losing $17,240 in ticket prices alone per year. Considering the average fluctuation in the crime rate over the course of ten years, this loss could amount to $1,724,030. This cost is not factoring in the Fan Cost Index, which accounts for the purchases of concessions and souvenirs at ballparks. With those aspects factored in, the losses would likely double or triple.

Winning percentage, not surprisingly, came back as statistically significant. With a relatively large coefficient of 0.016, it shows how great of an impact winning percentage has on game attendance. This coefficient indicated that for every point increase in a team's winning

percentage, attendance increases by 1.6%. This suggests that if a team's winning percentage increases from .490 to .500 in a year, the attendance for that team would increase by about 560 fans. The more a team improves, the more fans it will attract. As mentioned in the literature review, winning percentage is a large determinant of demand for Major League Baseball tickets. Fans are more willing to pay for higher quality of play, which explains the positive correlation between winning percentage and attendance.

As a consequence of the demand for Major League Baseball tickets being considered inelastic, ticket price was an unexpected significant determinant. The coefficient for ticket price was negative, as expected at -0.013. This indicates that for every $1 increase in a team's average ticket price, attendance decreases by 1.3%. The standard deviation of average ticket price is moderate at 8.17, so it can be assumed that this effect applies to most teams in a similar way. This coefficient suggests that for a dollar increase in ticket price, a Major League Baseball team could see a drop in attendance of 455 fans.

The final significant variable was the number of additional professional sports teams in the same city as a Major League Baseball team. This variable was only significant at the 90% level, but is still important to discuss. The negative coefficient of -0.0305 indicates that for each additional professional sports team in the same city as a Major League Baseball team, attendance tends to decrease by 3.5%. This could be due to conflicts of interest and overlapping schedules. If a team has a National Hockey League or a National Basketball Association team, for example, the beginning of Major League Baseball season coincides with the playoff season of both other leagues, this decreasing the attendance of Major League Baseball games.

Though crime index was significant, the coefficient was extremely small. I was interested to see what the effect would be specifically for cities with high crime. To calculate what a "high"

crime rate would be, I drew from the average crime rate for cities with a Major League Baseball team. This average was 598.66, so I simply rounded that index to 600 points and made that the baseline for being considered a city with "high crime." The high crime variable is a dummy variable that is represented by a 1 if the city has a crime index at some point above 600 points, and a 0 if it does not. My updated model is as follows:

$$Ln\ (Attendance)_i = \alpha - \beta Crime\ Rate_i + \gamma_1 Stadium\ Capacity_i + \gamma_2 Winning\ Percentage_i + \gamma_3 Average\ Ticket\ Price_i + \gamma_4 Lagged\ World\ Series\ Win_i + \gamma_5 Lagged\ Division\ Series\ Win_i + \gamma_6 Num\ Additional\ Teams_i + \gamma_7 Average\ Income_i + \gamma_8 High\ Crime_i + \varepsilon_i$$

The results with this added variable are shown below. I expect the high crime coefficient to be negative and more economically significant than the crime index variable.

TABLE 4. REGRESSION RESULTS

Intercept	3.13
	(.021)
Crime Index	-0.00008
	(0.00002)***
Winning Percentage	0.016
	(0.0002)***
Average Ticket Price	-0.001
	(0.0005)***
Additional Teams	-0.0305
	(0.0163)*
Lagged World Series	-0.011
	(0.012)
Lagged Division Win	-0.007
	(0.006)
Average Income	0.0000002
	(0.00000006)
High Crime (>600)	-0.027
	(.01)***
R^2	0.98
N	140

Note Standard Errors in parentheses

* Denotes significance at the 90% confidence level.

** Denotes significance at the 95% confidence level.

***Denotes significance at the 99% confidence level.

The inclusion of the high crime variable caused important and promising changes in the regression results. Winning percentage became statistically significant at the 99% confidence level, and the high crime coefficient was statistically and economically significant at the 99% confidence level. The negative -0.027 coefficient on the high crime variable indicates that for every 1-point increase in the crime index, Major League Baseball game attendance decreases by -2.7%. This coefficient is over one thousand times larger than the crime index coefficient for all cities. This indicates that cities with high crime are more prone to losing fans at Major League Baseball games. Economically, the coefficient calculates to a loss of about 945 fans for every one-point increase in the crime index, using the average game attendance of 35,000. When multiplied by the average ticket price, over 10 years, teams in cities with a crime rate over 600 could be experiencing a loss of $211,585 over the course of 10 years. This dollar amount, however, is only for an increase of one a point in the crime index. If the index were change at the amount of the standard deviation of total crime index, which is 220.13 points, the dollar amount lost would be significantly higher over the course of 10 years at $12,575,605. Considering the fact that the average salary for a Major League Baseball player is 4,250,000, this loss could be detrimental to the profits and signing abilities of Major League Baseball teams located in areas of high crime.

VI. CONCLUSION

Although the coefficient for crime index was fairly small and the economic impact was slight, the statistical significance of that variable gives ground to assume that crime can be classified as a negative externality that causes deterrence to those who are willing and able to attend Major League Baseball games. The inclusion of the high crime variable proved to be eye opening in this model. The coefficient for high crime was over one thousand times larger than the coefficient of crime index as an aggregate among all teams, indicating that teams in cities with higher crime are more susceptible to experiencing losses in attendance as the crime index of their particular city increases.

The correlation between crime index and attendance seems promising, but it is important to note how people view Major League Baseball stadiums, or even sports venues in general. Although many of today's Major League Baseball stadiums are constructed in economically poor areas, fans do not necessarily get to experience the negative effects of these places. In fact, some of the cities studied are so large; it is highly unlikely that the average fan will even get remotely close to these areas of high crime. Professional sports stadiums could be seen as a "safe place" for people attending games in crime ridden areas. Going to a sports event could be a way for people to experience a city without having to worry about being the victim of a crime, thus keeping the effect of crime as a negative externality on the demand for Major League Baseball tickets relatively moderate.

Ideally, the experiment would have been more precise if I had found even more specific crime indices. I was able to separate the crime data for the research by police jurisdictions, but even so there was overlap for teams in the same city. This would have eliminated the additional points on the crime index that come along with using the crime data of an entire city. I would

also like to find a larger number of variables to help more accurately explain fluctuations in Major League Baseball game attendance. Many models in previous literature have upwards of 30 independent variables, which is a number I will strive for when I expand upon this research.

For future research, I would suggest a larger data set, perhaps including other leagues of sports teams, such as The National Football League or National Hockey League. This would expand the number of cities being researched, and allow a researcher to see if the negative externality of crime is constant across different professional sports leagues.

Regardless, the statistical significance of the crime index variable leads one to believe that crime has a level of effect on Major League Baseball game attendance. The findings of this study uncover the hidden costs of crime—costs that may not only be faced by Major League Baseball teams—but by society as a whole.

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