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# Bringing Business Back to the Ballpark

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BRINGING BUSINESS BACK INTO THE BALLPARK

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AN HONORS THESIS

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The Faculty of the Department of Business and Economics

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In Fulfillment of the Requirements for

Honors in Applied Economics

By

David P. Drea

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# BRINGING BUSINESS BACK INTO THE BALLPARK

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Applied Economics

## **Abstract**

This study uses ordinary least squares and quantile regressions to discover the determinants of total attendance for Major League Baseball teams. Furthermore, the study seeks to discover whether or not the average time length of a baseball game has any significant effect on total attendance. The data ranges from the year 2016 until 2018 and includes all thirty professional teams. The purpose of the quantile regression is to gain a deeper understanding of total attendance's determinants and to see which distributions in the data are most affected. The results were that home runs are a significant stimulant in attendance and that average time length of a game does not significantly affect total attendance. These results indicate that the current remedies to address the attendance problem in Major League Baseball are insufficient.

KEYWORDS: (Attendance, Baseball, Major League Baseball, Sports Economics)

## INTRODUCTION

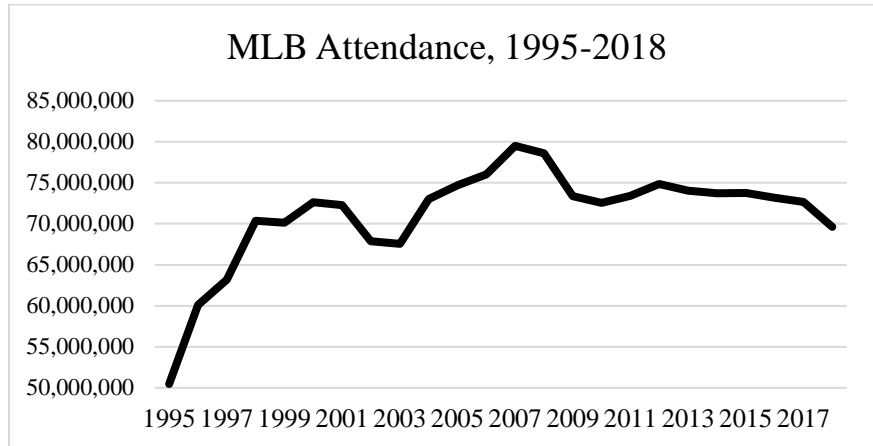
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The American literary icon Walt Whitman once described baseball as “America’s game” and that it “belongs as much to our institutions, fits into them as significantly, as our constitutions [and] laws.” (Folsom 1980) Since its inception in 18<sup>th</sup>-century England, baseball has become a game played around the world, but in no country is it more popular than the United States. This popularity afforded the game the title of “America’s pastime” and helped create the professional association, Major League Baseball (MLB). The league, established in 1903, currently operates with 30 professional teams and set an professional sports industry record in 2017 by eclipsing \$10 billion in revenue (USA Today Sports 2017). Further, the average age of a major league player in 2018 was 28.91 years (Associated Press 2018). This average has been decreasing over the past five years, indicating a younger league that has been introducing the sports world to talents such as Bryce Harper, Mike Trout, Mookie Betts, and Noah Syndergaard. However, despite the record-breaking revenue and rise in more popular youthful talent, an attendance problem persists within Major League Baseball.

Over the course of the last fifteen years, Major League Baseball attendance has plummeted by 8.6% overall and in 2017, the average attendance was below 30,000 for the first time since 2003 (Baseball Reference 2018). As seen below in Figure 1, the MLB attendance soared to record heights in the late 1990s and in 2007. However, the concern for attendance stems from the prolonged decrease in the attendance numbers from 2008 to the present day. Since his appointment in 2015, Commissioner Rob Manfred has expressed deep concerns for these statistics and has drawn the conclusion that “the length of games, preponderance of defensive shifts, and reliever usage” (Tayler 2018) are the reasons for the decline. Due to these

conclusions, Manfred has implemented “pace of play” rules that he believes will remedy the length of games issue.

**Figure 1** MLB Attendance 1995-2018



These rules limit the number of mound visits per game, warm-up time between innings, and eliminate the pitching requirement for intentional walks. The hope is that these rules will result in quicker games and therefore attendance will no longer be affected by the game’s length of time.

In this study, the MLB’s declining attendance will be addressed and the current remedies for pace of play by Commissioner Manfred will be assessed. Moreover, this study will seek to determine which baseball statistics, whether offensive, defensive, or pitching, are the best stimulant for total attendance. Given these stimulants, professional teams could then build a roster well-suited to attract attendance. Granted the purpose of a professional sports team is to do more than simply attract attendance (i.e. win games and generate revenue), however it is hypothesized that those statistics which increase winning percentage will also yield an increase in total attendance as well. Further, this study will employ multiple econometric tactics, including quantile regression, in order to develop a better understanding of the MLB attendance issue. Baseball is the American pastime but that title is in jeopardy with the recent attendance

declines. With this study, a more effective framework for addressing this issue will be made and the hope is that baseball will successfully bring business back into the ballpark.

## LITERATURE REVIEW

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In much of the literature regarding professional sports attendance, it is found that attendance is affected by a number of factors ranging from winning percentage to market size (Langhorst, 2014; Ormiston, 2014; Berri, 2004; Rottenberg, 1956; McEvoy, 2005). These factors can be categorized into three distinct subfields: team factors, fan behavior factors, and economic factors. The teams factors include those that can be controlled by the players and the front office and include performance statistics and payroll. The fan behavior factors analyze how fans act during and about the decision-making process of attending a baseball game. This could include decisions regarding the weather on game day or fan loyalty. Finally, economics factors include the unemployment rate and the market sizes of the cities in which the teams play that will broadly affect both teams and fans.

As seen in Langhorst (2014), professional baseball teams “can and should” conduct business with the “motivating stimuli” for fans at the forefront of operations. It was determined that “game-to-game factors like ticket discounts, giveaways, or fireworks are overestimated” when it comes to determining attendance, and other factors such as payroll and on-field performance must be considered. Of the overestimated game-to-game factors, giveaways are the most prominent. Bobbleheads and memorabilia promotions are the only giveaways that significantly and positively impact MLB attendance (Barilla et. al 2008). Although certain promotions, such as posters, photographs, and wearable apparel promote brand equity, of the

2,431 games observed in the 2005 MLB season, these promotions did not significantly affect the attendance.

The importance of payroll pertains to the number of “elite” players on the roster and although expensive, does draw fans to come to the ballpark to see them perform. This subsection of a roster is the most significant driver of attendance over other subsections, such as “homegrown” players or “one-club” players. (Ormiston 2014) Homegrown players are described as players that “remained true to their city”, meaning the professional team for which they played resides in the same city that the player was born or raised. One-club players are described as players that have “remained true to their team” and, throughout at least one free agent exploration, have elected to remain with one team for most or their entire career. These players may be fan favorites, but their significance in determining attendance is “simply anecdotal evidence.” (Ormiston 2014) Moreover, it is reiterated in Rivers and DeSchriver (2002) that it is of no surprise that the teams that spend the most money on total payroll also have the highest average attendance. However, the study interestingly finds that also “[t]he teams with the smallest variation with team payroll, as measured by the coefficient of variation, also had the highest average attendance.” The findings of this study suggest that the best strategy for payroll, in relation to attendance, is to distribute payroll equally across all players.

Additionally, on-field performance is paramount to the determination of attendance since fans prefer to watch in-person a winning team or a team with enough talent to give off the impression that it will win consistently. This idea, although apparent, originated in Berri (2004) in regards to National Basketball Association (NBA) teams. Put simply, the fans of NBA teams prefer to see winning teams. In this study, it was found that each additional win contributed to a 13.5% increase in gate revenue. Although star power, as Berri notes it, is significant, the ability

of a team to generate wins appears to be the engine that drives consumer demand. (Berri 2004) In the realm of baseball, studies into minor league baseball, such as Gitter and Rhoads (2010), have seen similar results to the models in Berri (2004). Although the study is focused on minor league baseball, it is emphasized that “[the study] treats minor league baseball and MLB as substitutes” because “fans of minor league baseball are primarily fans of the game of baseball.” In MLB, “each game above .500 adds between 138 and 380 fans per win above .500” (Davis 2009) and therefore it is argued in Davis (2009) that teams should realistically pursue the .500 record and proceed off of that record. The glaring limitation in this study, however, is that only half of the teams in MLB are included in the data and further that most of the teams are not in the smaller markets. Withholding the other half of the MLB teams, many of which were in larger markets, limits this analysis since the incomplete data set does not account for the larger markets and the underlying possibility that a larger market yields a higher payroll which has been found to increase winning percentage. Although the findings are useful and interesting, a complete data set would allow for a better conclusion to be determined.

Furthermore, the prospect of championship caliber teams, rather than game-to-game wins, is an important component to attendance. As first noted in Rottenberg (1956), “[a]ttendance at the games of any given team is a positive function of... the average rank standing of the team during the season in the competition of its league.” Further, this rank coupled with “championship prospects motivate fan interest” and “all else equal, an actual division championship in the previous season is associated with a current season attendance increase of about 13 to 16 percent.” (Whitney 1988)

Another dimension of attendance is the fan-base loyalty. In its comparative study between American and Korean baseball fans, Lee and Smith (2008) recognize that the full



baseball game experience is not captured in the price of a ticket, rather other concessions and memorabilia play a role financially and behaviorally. In the United States, it is commonplace for “fans of MLB to wear caps or logos...and to gather in bars or other social settings when watching games” and thus there is evidence of fan loyalty. This study argues further that fan loyalty is directly related to a team’s reputation, thus the reputation of a team will need to be accounted for. Finally, this study states that “habit formation appears to be an important determinant of attendance in the United States.” (Lee and Smith 2008) This habit formation is the culmination of many factors that have developed into the baseball game experience. These factors can be expressed as the fan cost index (FCI). The index “assumes a family of four purchases a fixed number of products (four hot dogs, four sodas, two peanuts, two caps, four mid-level tickets, and parking).” (McDonald and Rascher 2000) These purchases are unique to “the ballpark” experience and therefore these authors conclude that Americans baseball fans have a desire of wanting this experience at every game. However, professional sports tickets prices have “skyrocketed... [thus] shutting the regular fan out of the game” (Scott 2005). The price of the average MLB ticket has soared 45% since 2006, which is less than the increases seen in the NFL (60.7%) and the NBA (89.4%). This vast increase is found to be independent from the increase in player salaries, which although surprising, reaffirms the idea that “professional sports team owners will charge as much for tickets as they can, whether player salaries go up or down.”

Furthermore on the ballpark experience, it has been found that new ballparks have increased attendance in their infant years and McEvoy et. al 2005 coins this as the “honeymoon effect”. This effect is “strongest in the initial year... and decreased over the first 48 years of a facility’s existence.” This study is unique to others on the subject given that it takes into account

the nostalgic effect of older ballparks, for example Fenway Park (107 years old) or Wrigley Field (105 years old). The study finds that this effect begins to take shape after the first 48 years. Ballparks that withstand the test of time like these older ballparks will reap the benefits of a nostalgic effect that increases attendance. This conclusion is limited however given that in the current MLB, there are only 5 stadiums that were built prior to 1971, which would be the current year for the 48-year threshold. It is important to note that these 5 stadiums are also in the larger markets of Chicago, Boston, and Los Angeles.

Moreover on fan behavior, Denaux et. al (2011) discovered that fan's reactions towards certain events, such as weather, opponents, or month and day of game, "affect the attendance negatively up to some level, after which attendance increases". This means that fans only respond to negative events, such as rain or lesser opponents, in terms of attendance. Few fans observe good weather and then decide to go to a baseball game, rather they observe bad weather and then decides *not* to go to a baseball game.

It is worth noting that some studies suggested that the recent attendance crisis is a prolonged result of the recent 2008 economic downturn. One of the first articles to coin the MLB attendance problem as a "crisis" is Hong et. al (2013). The authors explain that "widespread unemployment and reduced incomes [meant] tighter budget constraints causing consumers to alter their spending patterns." Hong et. al (2013) aggregates the important economic indicators into a coincident index comprising of "nonagricultural payroll employment, unemployment rate, average hours working in manufacturing, and real wage and salary disbursements." This research finds that the economic recession only contributed in part to a decline in MLB attendance over the period 2008 through 2009, which is to be expected.

Given the significance of winning percentage as it relates to attendance, it is then imperative to understand the most significant factors that affect winning percentage. The overarching understanding among baseball academics and statisticians is that getting on base, by any means, will result in a greater winning percentage (Houser 2005). In his study, Houser (2005) finds that on-base percentage (OBP), slugging percentage (SLG), and batting average (BA), are the most impactful significant factors in contributing to winning percentage. Furthermore, the instance of the Tampa Bay Rays noted in the article contradicts these findings as the Ray heavily invested in home runs and SLG and still poor record and dwindling fan base. This indication of a limitation in the analysis is noted and shows that other factors can explain attendance simply outside of winning percentage factors.

Given the nature of these contradictory and fascinating findings, more research into this attendance problem must be done. The limitations in the research have been identified and this study will ensure that a more thorough understanding of MLB attendance can be made. This study's main objective to build upon this literature and to create a model that can utilize player's performance statistics as a stimulant for attendance. Thus, executives and the Commissioner's Office can begin to address this attendance issue without removing integral aspects of the game that have made baseball so unique over the ages.

## QUANTILE REGRESSION

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Given the variance of the variables in this particular study, it is most appropriate to not run models such as ordinary least squares (OLS) which assumes that associations between independent and dependent variables are the same at all level. The variables in this study are not

all at the same level, such as payroll, total attendance, and average time length of game, so another means of analysis is required. The best alternative for this study is a quantile regression. This section introduces this econometric technique by relying on Despa 2007, Hilmer & Hilmer 2013, and Rodriguez & Yao 2017.

A quantile regression offers a “more comprehensive picture of the effect of the predictors on the response variable.” (Despa 2007) When using a linear regression, namely OLS, the coefficients in the model denotes that an increase/decrease by one unit on the response variable will produce an increase/decrease in the predictor variable associated with the coefficient. In relation to this study, a linear regression can answer the questions of “is the average time length of game important?” or “do home runs positively affect a team’s total attendance?”. Conversely, a quantile regression parameter estimates the change in a specified quantile of the response variable produced by a one unit increase/decrease in the predictor variable. In relation to this study, a quantile regression can answer the questions of “does average time length of game affect attendance more in mid-markets or big-markets?” or “do home runs influence total attendance differently for teams with below average payrolls?”

Furthermore, quantile regressions estimate the marginal effects at different points in the distribution by minimizing a loss function rather than a sum of squared residuals (Hilmer & Hilmer 2013). The most commonly used points in the distribution that are used are the 10<sup>th</sup>, 25<sup>th</sup>, 50<sup>th</sup>, 75<sup>th</sup>, and 90<sup>th</sup> percentiles. Instead of simply using the mean, like a linear regression would do, dividing the data into this percentiles offers a better understanding of the relationship between the response and predictor variables.

The table below is directly taken from Rodriguez & Yao 2017 and offers a simple comparison of the two regressions. For this study, a quantile regression will be used because it better satisfies many of the items in this list. The regression predicts conditional quantiles which

**Table 1** Comparison of Linear Regression and Quantile Regression

<b>Linear Regression</b>	<b>Quantile Regression</b>
Predicts the conditional mean $E(Y/X)$	Predicts conditional quantiles $Q_\tau(Y/X)$
Applies when $n$ is small	Needs sufficient data
Often assumes normality	Is distribution agnostic
Does not preserve $E(Y/X)$ under transformation	Preserves $Q_\tau(Y/X)$ under transformation
Is sensitive to outliers	Is robust to responsive outliers
Is computationally inexpensive	Is computationally intensive

will offer a better understanding of the total attendance problem in Major League Baseball. The study has sufficient data whose distribution is unimportant given a quantile regression is distribution agnostic. The regression’s ability to be robust to responsive outliers and preserve the quantiles under transformation suits itself well to the dataset used in this study.

## DATA

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The data for this study were collected for every regular season for the 30 Major League Baseball teams for the years 2016, 2017, and 2018. The sample includes 90 data points and these points were collected from multiples sources, including Baseball-Reference.com, Matt Trueblood’s market size assessment from Bleacher Report, the Bureau of Labor Statistics, and FanGraphs. The variables used in the OLS and quantile regression analyses are abbreviated and defined in Table 2 on the next page.

**Table 2** Variables Defined

<i>TotATT</i>	Total attendance for <i>ith</i> team in a season	<i>MidMkt</i>	Dummy variable equal to 1 if the <i>ith</i> team is in a mid-market, 0 otherwise
<i>TotHR</i>	Total home runs for <i>ith</i> team	<i>BigMkt</i>	Dummy variable equal to 1 if the <i>ith</i> team is in a big-market, 0 otherwise
<i>Pay</i>	Total payroll for <i>ith</i> team in U.S. dollars	<i>Unemploy</i>	Unemployment rate for the city where the <i>ith</i> team resides
<i>AvgTime</i>	Average time length of game for <i>ith</i> team measure in minutes		

The OLS model will use dummy variables, *MidMkt* and *BigMkt*, to signify whether a team is in a mid-market or big market, respectively, as determined by Bleacher Report. It is important to note that included in the dataset is the Toronto Blue Jays, the only Major League Baseball team not based in the United States. However, the team's statistics, market size, and other pertinent variables are similar to their United States counterparts. Descriptive statistics for the variables used in the quantile regression model and OLS model are presented in Table 3 below. The largest total attendance recorded for this sample was 3,857,500 provided by the 2018 Los Angeles Dodgers. The team that hit the most home runs for this sample was the 2018 New York Yankees (267). Finally, the dataset includes the average time length of a game for each team measured in minutes. The range of this variable is 24 minutes with the 2017 Boston Red Sox playing the longest games (200 minutes) and the 2016 Oakland Athletics (176 minutes) playing the shortest.

**Table 3** Descriptive Statistics for Predictor Variables

<b>Variable</b>	<b>Mean</b>	<b>Std Dev</b>	<b>Minimum</b>	<b>Maximum</b>
TotAtt	2,394,545.7	663477.08	811,104	3,857,500
TotHR	192.222	31.3937580	122	267
Pay	138,186,043	46,000,870.66	62,161,191	268,745,494
Unemploy	4.1511	0.8288674	2.4	6.3
AvgTime	186.18889	4.6757669	176	200
MidMkt	0.33	0.4740455	0	1
BigMkt	0.33	0.4740455	0	1

THEORETICAL MODEL

$$\text{TotAtt}_i = \beta_0 + \beta_1 \text{TotHR}_i + \beta_2 \text{Pay}_i + \beta_3 \text{AvgTime}_i + \beta_4 \text{Unemploy}_i + \beta_5 \text{MidMkt}_i + \beta_6 \text{BigMkt}_i + \varepsilon_i$$

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The theoretical model above reflects the hypotheses that this paper will test. The dependent variable is total attendance (TotAtt). Of important note is the unobserved heterogeneity that exists within baseball which might make it difficult to capture all of the variation in the dependent variable. This unobserved heterogeneity includes variables such as consumer preferences as well as player drive and motivation because these variables are hard to measure consistently.

Table 4 below indicates the expected signs for each of the independent variables. It is expected that the total number of home runs will have a positive effect on attendance given the large entertainment value that home runs provide. Moreover, payroll is expected to have a positive effect given that it is hypothesized that a team with a larger purse can acquire more big name players to attract attendance. Finally, given the new emphasis on pace of play by the Commissioner's Office, average time length of game is expected to be negative since it is argued

that longer games have led to decreased attendance. This study hypothesizes that the time of game does not significantly affect attendance so this variable is also expected to be insignificant.

**Table 4** Expected Signs for Predictor Variables

<b>TotHR</b>	Positive	Houser 2005
<b>Pay</b>	Positive	Rivers & DeSchrive 2002
<b>AvgTime</b>	Negative	Taylor 2018
<b>Unemploy</b>	Negative	Hong et. al 2013
<b>MidMkt</b>	Positive	Davis 2009
<b>BigMkt</b>	Positive	Davis 2009

In this model, the  $i$  indicates the team, the  $\beta$ s are the parameters to be estimated, and the  $\varepsilon$  is the stochastic error term which encapsulates the variation that cannot be accounted for by the independent variables.

## EMPIRICAL FINDINGS

In this section, the empirical results from the ordinary least squares (OLS) regression and quantile regression are reported. Table 5 reports the regression results from the OLS regression analysis with the inclusion of the mid-market and big-market variables. This regression model reported a 59.4% adjusted  $R^2$  and that average time length of MLB games is an insignificant predictor of attendance.

The insignificance of the AvgTime parameter estimate indicates that however long or short a professional baseball game is, it does not affect the total attendance of a team over a given season. This result merits attention and may provide evidence for this study's claim that the pace of play rules being implemented by MLB are irrelevant.



The parameter estimate for TotHR was positive and significant as expected as well. For each additional home run hit, total attendance increases by 2,778. For the simple OLS model, this provides a broader sense of how home runs can be used as an attendance stimulant for the average MLB team. The quantile regression will go into further detail about which teams within the data distribution are most affected by home runs.

**Table 5** Ordinary Least Squares Regression Analysis

<b>Variable</b>	<b>Parameter Estimate</b>	<b>t-value</b>	<b>Pr &gt;  t </b>	<b>Variance Inflation</b>
Intercept	-1,008,685	-0.50	0.6181	0
TotHR*	2,778.95	1.80	0.0748	1.165
Pay***	0.00965	8.22	<0.001	1.454
Unemploy	14,104	0.26	0.7983	1.036
AvgTime†	7,128.98	0.65	0.5202	1.328
MidMkt***	299,873	2.49	0.0147	1.622
BigMkt	148,436	1.07	0.2887	2.163
$R^2 = 0.5943$		DW = 2.557	N= 90	$X^2: 24.02^\dagger$

\*\*\* Significant at 99%   \* Significant at 90%   † Insignificant

In the table above, the variance inflation factor is included to understand the multicollinearity in the model. As seen, none of the variables have a VIF greater than 5.0, thus indicating that the model does not have multicollinearity. The table also reports the Durbin-Watson statistic of 2.557. This statistics falls outside of the upper bound for the serial correlation test for a sample of 90 and 6 independent variables. Lastly, the residual plots for each of the individual variables appear random therefore suggesting homoscedasticity. The White Test is used to ensure homoscedasticity and the resulting  $X^2$  statistic is 24.02. This statistic is insignificant confirming homoscedasticity. These econometric tests ensure the soundness of the model and that the analysis is not being misconstrued by underlying and unseen effects.

**Table 6** Quantile Regression Analyses

<b>Variable</b>	<b>Parameter Estimate</b>	<b>t-value</b>	<b>Pr &gt;  t </b>
<i>Quantile Level : 0.10</i>			
Intercept	422,693.1	0.16	0.8763
TotHR	1218.534	0.44	0.6631
Pay***	0.0093	5.19	<0.001
Unemploy	29875.49	0.35	0.7235
AvgTime	-1434.24	0.19	0.8496
MidMkt	49675.58	1.50	0.1363
BigMkt	298698.0	-0.10	0.9234
<i>Quantile Level: 0.25</i>			
Intercept	-1,332,593	-0.69	0.4928
TotHR	1,715.752	0.97	0.3371
Pay***	0.0088	7.57	<0.001
Unemploy	42569.24	0.71	0.4784
AvgTime	8235.55	1.62	0.4424
MidMkt**	257301.6	2.26	0.0263
BigMkt	276795.2	0.77	0.2887
<i>Quantile Level: 0.50</i>			
Intercept	1258673	0.50	0.6216
TotHR	2837.189	1.32	0.1907
Pay***	0.0104	10.96	<0.001
Unemploy	14544.13	0.21	0.8370
AvgTime	-6666.41	-0.46	0.6487
MidMkt***	548876	3.31	0.0014
BigMkt**	280831	1.99	0.0495
<i>Quantile Level: 0.75</i>			
Intercept	-3334806	-0.93	0.3558
TotHR	2690.903	1.03	0.3068
Pay***	0.0119	5.31	<0.001
Unemploy	87185.78	0.97	0.3343
AvgTime	18348.24	0.96	0.3383
MidMkt*	380537.5	1.63	0.1070
BigMkt	-52522.9	-0.20	0.8389
<i>Quantile Level: 0.90</i>			
Intercept	-5786688	-1.25	0.2131
TotHR***	6365.086	3.31	0.0014
Pay***	0.0122	4.56	<0.001
Unemploy	51031.97	0.49	0.6286
AvgTime	30950.24	1.33	0.1874
MidMkt	82752.32	0.32	0.7478
BigMkt	-509819	-1.57	0.1202

\*\*\* Significant at 99%    \*\* Significant at 95%    \* Significant at 90%

Given that there is no serial correlation, multicollinearity, and heteroscedasticity in this model, the results and conclusions derived from this analysis are reliable for this sample.

Table 6 on the previous page reports the regression results from the quantile regression analysis. It is important to note again that the omission of the dummy variables for market size was purposeful. The theoretical structure of quantile regression will internally control for market size. Similar to the OLS model, it is seen that the average time length of game is insignificant ranging across all market sizes. It is of important note that even with a regression analysis that provides a deeper understanding than that of a simple OLS model, the time length of a game is still insignificant. This provides even further justification for the claims against the pace of play rules and their ineffectiveness on attendance changes.

The variable for payroll is positive and significant at the 99.9% level in each of the quantiles indicating its vast significance on total attendance. A \$100,000 increase in payroll will result in a total attendance increase of 930 (0.10 level), 880 (0.25 level), 1,040 (0.50 level), 1,190 (0.75 level), and 1,220 (0.9 level). This indicates that across the different market sizes, payroll is a significant factor in determining attendance. A surprising result with this variable is that the largest estimates occurred in the higher quantiles (0.5, 0.75, and 0.9). This indicates that teams with larger payrolls see greater effects on attendance if they choose to expand their payroll. This is not to say that teams with smaller payrolls will not see positive effects, however, these effects will not be as substantial as the teams with larger payrolls.

The variable for home runs is positive and significant *only* at the 0.90 quantile, where it is 99.9% significant. For teams in the highest percentile, for every additional home run hit, total attendance increases by 6,365. This is another surprising result of the analysis given that this indicates that only the teams in the 90<sup>th</sup> percentile and above in total home runs hit see a positive

effect on total attendance. Due to this indication, it appears as though teams should strive to build a roster that can be close to or eclipse the 90<sup>th</sup> percentile for total home runs hit because then it would see significant increases in attendance. It is clear with this result that teams with more home runs can better understand and attract attendance simply because the team hits more home runs.

Finally, it is evident that the metropolitan area's unemployment rate is insignificant in all of the quantiles. This control for economic conditions in the surrounding metropolitan areas sought to ensure that simply macroeconomic factors were not the reason for the attendance problem in professional baseball.

**Table 7** Differences between OLS and Quantile Regression

<b>Variable</b>	<b>OLS Estimates</b>	<b>QR 0.25 Quantile</b>	<b>QR 0.50 Quantile</b>	<b>QR 0.75 Quantile</b>	<b>QR 0.90 Quantile</b>
Pay	0.00965***	0.0088***	0.0104***	0.0119***	0.0122***
TotHR	2,778.95*	1,715.752	2,837.189	2,690.903	6,365.09***
MidMkt	299,873***	257,301**	548,876***	380,537*	82,752
BigMkt	148,436	276,795	280,831**	-52,522	-509,819
QR = Quantile Regression					
*** Significant at 99%		** Significant at 95%		* Significant at 90%	

In the table above, the differing results between the OLS regression and quantile regression are shown. The varying magnitudes and significances across some variables indicate the need for the quantile regression. For example, in the OLS regression, the TotHR variable has a magnitude of 2,778.95 and is significant at the 90% level. However, in the quantile regression's 0.90 level, the TotHR variable has a considerably larger magnitude of 6,365.09 and is significant on a higher level (99%).

## CONCLUSION

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The steady decline in total attendance across Major League Baseball and its teams in the past 10 years leads to one question: is baseball still America's pastime? The record-breaking revenues for the league and star-studded, youthful rosters would lend one to believe that baseball is stronger than ever. However, the seats remain empty. The league has attempted to address this problem with pace of play rules that avid fans feel question the history and integrity of the game. This paper could serve as a first step to finding a remedy to this problem. Furthermore, it is clear from this sample that the pace of play rules have been ineffective in addressing the problem.

Using data from the 2016, 2017, and 2018 seasons, the focus of this paper has been to determine if home runs can be an effective stimulant for total attendance and if average time length of games were a significant factor in total attendance. The findings are that home runs are an effective means of stimulating attendance, especially for the teams in the 90<sup>th</sup> percentile for total home runs hit. Moreover, the average time length of games being insignificant renders most arguments for a quicker-paced game unconvincing.

If baseball wishes to bring business back to the ballpark in the near future, it will look towards its most entertaining aspect, the home run. Teams should focus on offense and strive for rosters that focus on home runs. The findings here in this study can provide information that is valuable to baseball executives and the Commissioner's Office. The hope is that this information is effectively incorporated into future decisions about the attendance problem in baseball and that baseball retains the title of America's game for now and for the future.

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