Beyond the Arc: Investigating the Impact of 3-Point Shots on NBA Revenue: An Empirical Analysis

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Abstract:

This paper investigates the impact of Stephen Curry's revolution of the three-point shot and its impact on NBA's revenues. The study will incorporate the five years prior to Stephen Curry's back-to-back MVP's and the five years after those MVP's. The model will examine three-point makes and percentage per game, along with a player's effective field goal percentage, as well as playoff wins and attendance in home games. The study's results showed that in the five years after Stephen Curry changed the game and won his MVPs, the three-point shot was a big driver in a team's revenue. These results do not align with previous paper's work and should encourage further studies on the topic. The results in this study indicate that the play style of a player must include the three-point shot as the NBA is a business at the end of the day, and being able to shoot threes gives a team more chances of success, along with more money.

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1.0 INTRODUCTION

Stephen Curry changed the way that the game of basketball has been played because of his ability to shoot three-point shots better than arguably any other player in NBA history. Throughout different eras, the game of basketball has seen different players revolutionize and bring about new fans to the game because of their play style. Two easy examples of this are Michael Jordan and Allen Iverson. Jordan was a name known across the world, and his skillset was so great that he was the main driver behind the surge of NBA basketball. Prior to Jordan being drafted in 1984, the league was trending downwards, but afterwards, the TV viewership for the NBA reached levels previously unknown. Alongside that, rather than teams being disbanded as was planned prior, teams were added to the league (Reynolds, 2022). As far as Allen Iverson, his idol was none other than Michael Jordan. He led a cultural revolution in the NBA as he did not change his persona at any point to please anybody (Gordon, 2016). Not only that, but he was also a player that many shorter basketball players with professional aspirations looked up to, as despite being only six feet, he managed to win a Most Valuable Player Award (MVP).

I will investigate what the impact Stephen Curry had on the NBA is by looking at the five years prior to his back-to-back MVPs, otherwise known as his first five seasons in the NBA, and the five seasons after those MVPs. This study is important because while other studies have looked at the determinants of NBA revenue, none have considered whether Stephen Curry is another example of a player that has revolutionized basketball in the way that a Michael Jordan or Allen Iverson have. I was someone who grew up during this period and played in many different basketball leagues. In doing this, I was a part of the revolution to shoot more three-pointers and witnessed many of my friends or other players purchase Stephen Curry jerseys, shoes, etc. Another aspect to consider is that often in my early childhood, when someone would throw a piece of trash into the garbage, they may have yelled, “Kobe!”. As I began to grow up, I started hearing a shift from, “Kobe!”, into “Curry!”. As seen in Figure 2, since Stephen Curry was drafted in 2009, the three-point shot has become more and more utilized, aside from years pointed out where it makes sense that a decrease in three-pointers was seen.

Over this same period, the NBA has seen increases in revenue (see Figure 1) in all, but the same seasons as previously mentioned. Prior studies have examined the increases in NBA revenue, but neglected to focus on the value that Stephen Curry may have brought to the NBA. Another area that shows that Curry was extremely valuable to generating revenue for the league is the fact that he is consistently near the top or at the top of NBA jersey sales. Since 2001, Stephen Curry has been the leader in jersey sales three different seasons, behind only Kobe Bryant and LeBron James who have done it six and seven times, respectively (Pimentel, 2023). Curry is also trending towards being the number one jersey seller of the 2023-24 season (Release, 2024)

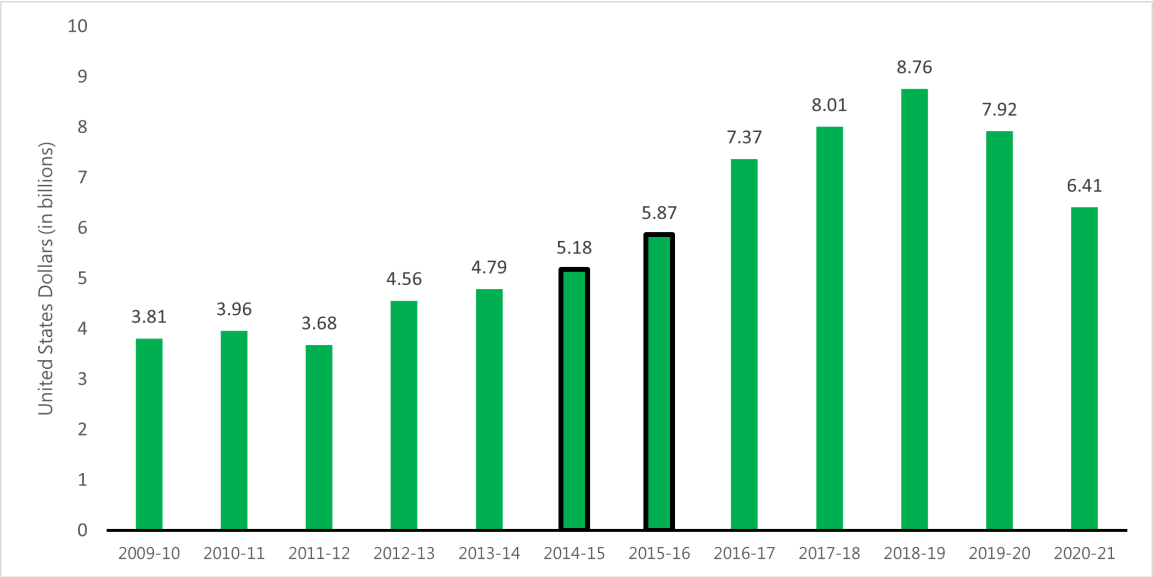
The rest of the paper is organized as follows: Section 2 explores the trend surrounding the topic. Section 3 dives into the literature review of previous studies in this general topic area. The data and empirical methodology of the study are shown and explained in Section 4. The results are shown and explained in Section 5. Lastly, there is a conclusion that wraps up the paper in Section 6.

2.0 3-POINTERS AND REVENUE, 2009 THROUGH 2021

Figure 1 shows that from 2009 to 2021, excluding the shortened season (2011-12) and the season where the Covid-19 pandemic arose (2019-20) and the following season (2020-21), the NBA's revenue increased. In 2011-12, the NBA season for each team was shortened from eighty-two games to sixty-six games (Beck, 2011). This was nearly a twenty percent decrease from the regular eighty-two game season. As for the 2019-20 season, the world was brought to a halt in March of 2020, and the season was again shortened, even after the NBA Bubble in Florida was played out. Not every team qualified for the NBA Bubble and the range of regular season games played ranged from sixty-four games to seventy-five games (2019-20 NBA Standings, 2020). With that, there were no full arenas for the last eight regular season games played for the teams invited to the bubble, nor with the playoff games. Lastly, the 2020-21 season was again shortened, and arenas were again not filled. The season was seventy-two games, ten less than a standard season and for the majority, if not the entire season, many teams were in limited capacity arenas (NBA.com Staff, 2021). The two years with black outlines are

the two years excluded from the study, being both of Stephen Curry's back-to-back Most Valuable Player seasons.

Figure 1: NBA Total Revenue by Season

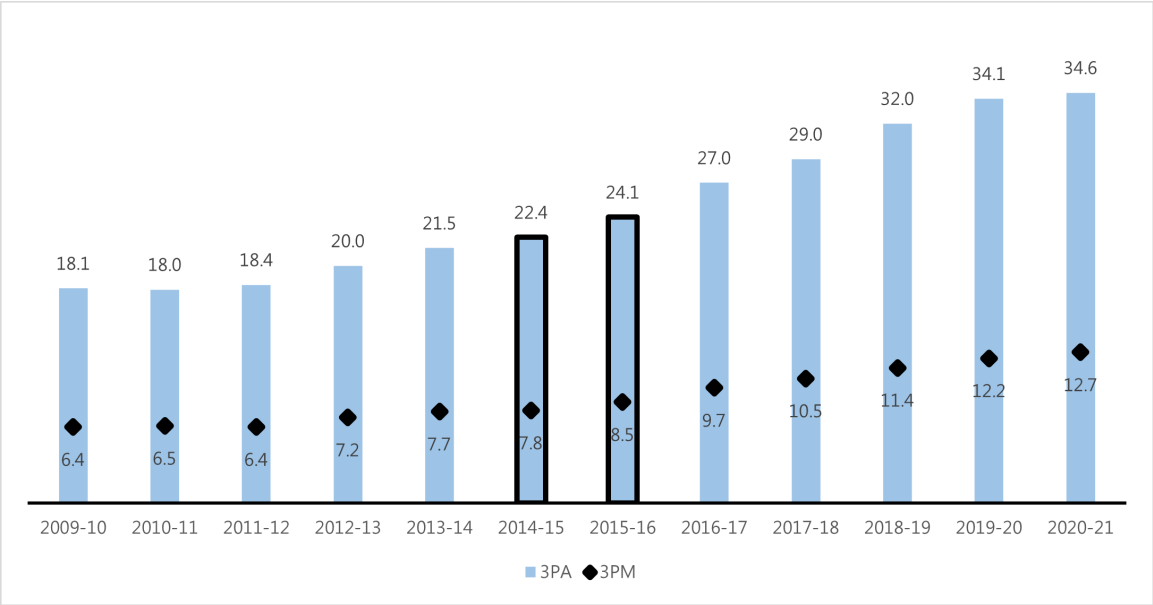


Source: Statista

Figure 2 depicts the yearly three-point attempts on average league wide, overlayed with the three-point makes each year meeting the same criteria. The number of three-point attempts in the NBA has increased every year since the 2010-11 season. The decrease from 2009-10 to 2010-11 was only by one tenth of an attempt per season, otherwise known as a fraction of a percent decrease. Similarly, the three-pointers made also increased in all but one season. The decrease in three-pointers made was from the 2010-11 season to the 2011-12 season, and it was again by one tenth of a shot, or a roughly one and a half percent decrease. Diving deeper into the numbers, the average percentage of these years was 35.7 percent (NBA League Averages – Per Game, 2024). Out of the twelve seasons in Figure 2, five of the seasons had three-point percentages that were less than the average (three-pointers made over three-pointers attempted). It is important to note, two of those seasons were the two seasons excluded from the study. The

largest negative difference however was in the 2011-12 lockout shortened season. On the flip side, the largest positive difference was in the Covid-19 shortened season of 2020-21.

Figure 2: NBA 3-Point Attempts vs 3-Point Makes



Source: Basketball Reference

3.0 LITERATURE REVIEW

In the 2009 NBA draft, Stephen Curry was drafted by the Golden State Warriors. Since then, the NBA's revenue has increased each season aside from the 2011-12, 2019-20, and 2020-21 seasons (National Basketball Association Total League Revenue from 2001/02 to 2022/03). All three can be deemed outliers as the former was the shortened season, and the latter two were the pandemic seasons. This is where the NBA finished its season in a bubble with no fans, and the following season saw zero to a fraction of the fans allowed in the arenas. There are many drivers behind the NBA revenue increases.

Reilly et al. (2023) attributed somewhere between $15 and $20 million lost each season because of star players missing games (load management), something that the league has worked to remove during this season (Reilly et al. 2023). Star players missing games obviously have an

impact on how many viewers the game gets, as people are more likely to tune in when the best players are playing. Likewise, when fans buy tickets for games and those star players decide to sit out for load management, those fans get upset, and would be less likely to then buy another ticket. Reilly et al. determined that stars would miss games for five reasons: letting injury heal sufficiently, in the second game of back-to-back days with a game, against the bottom-feeder teams, when the game is of lesser importance for their playoff hopes, and lastly, when the game is less likely to affect revenues such as an away game (Reilly et al. 2023).

The three-point shot was brought into the league in 1979, and Harrison (2019) examined the effects of many factors, including this, on NBA revenue increases. His study's purpose was to see how play style affects revenue in the league. As this study took place five years ago, Harrison found that the total number of three's attempted grew nearly seven percent on average from 2012-13 to 2017-18, while revenues grew over fifteen percent on average during that same period (Harrison, 2019). It is no secret that the three-point shot has become more popular in the past decade, but some other factors that Harrison looked at were arena age, all-star votes, playoff wins, and city population (Harrison, 2019). The study concluded that the three-point shot resulted in lower revenues at a statistically significant level. This occurred while playoff wins, all-star votes, and population were not statistically significant, but all showed positive impact on revenue.

In his assessment of different sports leagues, Bradbury contested that the better a team played (the more success that team had) the more revenue that individual team made. Not only did Bradbury find this in the NBA, but he found it in every league besides, surprisingly, the NFL (Bradbury, 2019). More specifically, how a team performs in the playoffs determines a difference of about seven million dollars in revenue. Another aspect of this revenue boost is when a new stadium gets erected. With a new stadium, teams saw an increase in attendance of fans, again, except for the NFL. Something else that Bradbury looked at was teams with another team in that same market. In the NBA, this meant the Los Angeles Clippers and Lakers, the New York Knicks and New Jersey, then Brooklyn Nets. There was no negative effect on either the Lakers or Knicks, which Bradbury attributed to the fact that these teams are top revenue

generating teams in the NBA (Bradbury, 2019). Lastly, Bradbury's study claimed that population increased a team's revenue.

Right around the time Stephen Curry began his seasons of three-point barrages, Gannaway et al. (2014) explored how the pivot of the NBA into being more concerned with scoring points impacted players and their productivity. Contrary to popular belief, the study found that introducing the three-point line increases productivity for taller players as opposed to smaller players. Likewise, taller players have been at a higher demand from NBA teams. After the three-point line was created, centers saw their shot attempts increase by over three and a half percent, while both forwards and guards saw their shot attempts decrease. This is interesting because with a three-point line, it is generally the smaller players that are better at shooting than centers. The researchers pinpoint this increase to the fact that the defenses became more spread out after the invention of the three-point line, making defense closer to the basket more difficult (Gannaway et al. 2014).

4.0 DATA AND EMPIRICAL METHODOLOGY

4.1 Data

The study examines time-series data from the years 2009-2014 and 2016-2021, looking at variables that determine the revenue in the NBA. The data comes from a variety of sources. The revenues for each team come from Statista.com and the attendance figures come from ESPN.com. The remainder of the variables: points per game, three pointers made, three pointer shooting percentage, efficient field goal percentage, regular season wins, and playoff wins, were found on basketballreference.com. The summary statistics for the variables listed above can be found in Table 1.

Table 1: Summary Statistics

Statistic	Team Revenue	PPG	3PM	3P%	eFG%	Reg. Season Wins	Playoff Wins	Home Attendance %
Mean	205660000	20.963	2.836	0.381	0.527	43.71	3.48	0.866
Median	201500000	19.6	2.75	0.381	0.522	43.5	2	0.959
Standard Deviation	83322207.742	5.603	0.732	0.0267	0.034	11.109	4.444	0.257
Minimum	78000000	11	1.8	0.316	0.462	20	0	0
Maximum	440000000	36.1	5.3	0.453	0.667	67	16	1.085
Count	100	100	100	100	100	100	100	100

4.2 Empirical Model

The model used in this study is a modified version of the model used in Harrison's (2019) study. The difference between Harrison's study to this study is that it examines more of how the three-point revolution and Stephen Curry impacted the revenue among the NBA. This differs from Harrison's study because he looked at five years including both years when Stephen Curry won MVP. While Harrison's study was evaluating the effect of play style on NBA revenue from the 2013-2014 season to the 2017-18 season, this study assesses the impact of the three-point shot. To do that, this study compares the seasons falling between 2009 and 2014 and then 2016-2021. Furthermore, Harrison included more variables regarding the teams' arenas and the cities where the arenas are located. I added the effective field goal percentage as well to the study, along with points per game.

The model used in this study is as follows:

$$\textit{Team Revenue} = \beta 0 + \beta 1(PPG) + \beta 2(3PM) + \beta 3(3P\%) + \beta 4(eFG\%) + \beta 5(\textit{Reg. Season Wins}) + \beta 6(\textit{Playoff Wins}) + \beta 7(\textit{Home Attendance \%}) + \varepsilon$$

The dependent variable being team revenue is being studied to determine how the change in play style of the NBA impacted the revenue versus other factors. Next, the independent variables include four offensive metrics and three team-based metrics. The four offensive metrics were found by taking the top ten players from each of the season studied in terms of three-pointers attempted. Upon doing that, the same player's points per game, three-pointers made per game, three-point shooting percentage, and effective field goal percentage. The first two of those are self-explanatory as to what they are, with three-pointers being from behind the three-point line. The three-point shooting percentage is the percentage of three-pointers made of the attempts. The effective field goal percentage is an adjusted field goal percentage that considers that three-pointers are greater than two-pointers. Next, regular season wins, and playoff wins can be a direct indicator of a team's revenue as a more successful team is likely to bring in more fans than a team that is not successful. The more successful a team is, the more tickets they will sell,

and those tickets may also be priced higher than a team struggling to fill its arena. Similarly, home attendance percentage is along those same lines, and can drive a team's revenue. As not every team has the same capacity in their arena, percentage is a better indicator of how they are filling the stadium.

5.0 EMPIRICAL RESULTS

The three tables below depict the regression results for the data, and then a comparison amongst the 2009-14 and 2016-21 datasets. This comparison will demonstrate the effectiveness of Stephen Curry in changing the game via the three-point shot and how much of an effect it truly had on revenue. Table 4 accounted for the variation in revenue the best, explaining seventy-two and a half percent, while Table 2 accounted for roughly sixty-four percent. The same cannot be said for Table 3, which used the data from 2009-14, which can only account for a third of the variation in the dependent variable of team revenue. The r-square value mentioned above is highlighted in each of the three tables, as well as any variable that is significant at the one, five, or ten percent levels.

Table 2: Regression results for years 2009-14 and 2016-21

Regression Statistics	Value
R Square	0.643807109
Standard Error	51585432.46
Observations	100

Variable	Coefficients	Standard Error	t Stat	P-value
Team Revenue (intercept)	8192651.595	118117870	0.069359967	0.94485363
PPG	-1363700.064	1165446.154	-1.170109883	0.244979022
3PM	81325130.21	11683309.47	6.960795688	4.89164E-10
3P%	-879890808.9	287392843.9	-3.061630892	0.002885932
eFG%	417087660.8	273322246.4	1.525992363	0.130442375
Regular Season Wins	805229.2311	687740.2813	1.170833312	0.244689524
Playoff Wins	3874091.302	1797797.277	2.154909985	0.033780245
Home Attendance %	71547172.38	22962509.75	3.115825455	0.002446836

The overall empirical estimation results are presented in Table 2. This regression used the data from every year in the study to capture the effect that the three-point shot, and other variables had in total. This model showed that four variables were statistically significant in

being a determinant of the team's revenue. The number of three pointers made (3PM), three-point percentage (3P%), and home attendance percentage were all found to be statistically significant at the one percent level. A team's number of playoff wins was also found to be statistically significant, but at the five percent level. While three pointers made were found to have a positive effect of over eighty-one million dollars, it is important and interesting to note that an increase in a player's three-point percentage decreases a team's revenue according to this model. Not surprisingly, the playoff wins of a team and home attendance percentage had a positive effect on a team's revenue. The former coincides with Harrison's 2019 findings that playoff wins have a positive impact on revenue in the NBA at a significant level. The other three variables were not statistically significant at any level.

Table 3: Regression results for 2009-14

Regression Statistics	Value
R Square	0.327555565
Standard Error	40269290.6
Observations	50

Variable	Coefficients	Standard Error	t Stat	P-value
Team Revenue (intercept)	-158649195.3	142586739	-1.112650422	0.272186609
PPG	2381570.322	1504463.873	1.583002666	0.120922926
3PM	5360830.498	25117634.41	0.213428956	0.832025071
3P%	309938111.3	394158919.1	0.786327789	0.436089767
eFG%	-285158009	383534373.4	-0.743500528	0.461317831
Regular Season Wins	546184.5285	764822.9669	0.714131965	0.479095813
Playoff Wins	-4027606.144	2275487.36	-1.769997151	0.083986887
Home Attendance %	276515788.5	79628694.52	3.472564635	0.001208011

The above regression in table 3 suggests that the model and variables I selected were not at all a great representation of the drivers of revenue in the NBA during the 2009-14 seasons. Of the three regressions, the variables were able to explain the smallest amount of variation in NBA revenue with this model, at just near thirty-three percent. Playoff wins and home attendance as a percentage of the stadium's capacity were the only two statistically significant variables in this model. Home attendance has a massive coefficient, meaning that on average, a one percent increase in home attendance while holding other variables constant will increase revenue by roughly two-hundred and sixty million dollars. It is interesting to note that playoff wins had a

negative impact on revenue in this model, but it was only statistically significant at the ten percent level. This fact is what I attribute to the high coefficient for home attendance percentage, that the only other statistically significant variable (playoff wins) was negative. It is also interesting to note that the intercept was a negative number unlike the other two models.

Table 4: Regression results for 2016-21

Regression Statistics	Value
R Square	0.725375067
Standard Error	34380483.14
Observations	50

Variable	Coefficients	Standard Error	t Stat	P-value
Team Revenue (intercept)	204174939.7	110524371.5	1.847329571	0.071751386
PPG	-1321819.622	1075739.329	-1.228754575	0.226004384
3PM	33427865.15	12051969.64	2.773643325	0.008234111
3P%	-236595436.2	295376877.3	-0.800995116	0.427642676
eFG%	-81565925.8	242211791.6	-0.336754562	0.737978882
Regular Season Wins	930628.75	701987.7249	1.325705161	0.192103114
Playoff Wins	6109064.708	1736348.615	3.518339954	0.001058041
Home Attendance %	60680062.26	16882525.39	3.594252688	0.000847865

In Table 4, the model explains more of the variance in a team's revenue than either of the models. This means that the variables I chose better explain the 2016-21 seasons as opposed to the 2009-14 seasons, as expected. This is a demonstration of how Stephen Curry impacted the game as variables related to his play style better determined revenue after his back-to-back MVPs. Unlike the 2009-14 regression, three pointers made were a large positive driver in revenue at a statistically significant level of one percent. The coefficient for 3PM means that on average, holding other variables constant, one more three-pointer made will increase a team's revenue by over thirty-three million dollars. Something of importance is that this is a much smaller figure than the model in Table 2 suggests. However, like Table 2, which tested the data for all the years, playoff wins, and home attendance were statistically significant variables. In this case, both variables were statistically significant at the one percent level. From 2016-21, home attendance was a much larger driver than playoff wins. On average, a one percent increase in home attendance, ceteris paribus, increases revenue by over sixty-million dollars, while one playoff win, ceteris paribus, increases revenue by over six million dollars.

6.0 CONCLUSION

This paper examined the effect that Stephen Curry had on NBA revenue with his change around how the game of basketball was played because of his usage of the three-point shot. As it turns out, the three-point shot, and Curry did have a great effect on being a determinant of a team's revenue in the NBA. There are, however, limitations in this study. In the first set of five years, there was a lockout meaning that the season was shortened, thus revenues went down. Similarly, in the second set of five years, after Curry won back-to-back MVPs, there was the COVID-19 pandemic which halted the entire world, never mind just the game of basketball. The effect on the NBA was that the season where the pandemic first hit was shortened and then finished without fans, in a bubble. The following season, states had differing policies on the Coronavirus, and some teams were able to fill their stands more than others, but it did not come close to pre-pandemic levels. Seeing as home attendance percentage was an independent variable in this study, the results may have been skewed.

Two key drivers of an NBA team's revenue are playoff wins and fan attendance. It is important to consider that the three-point shot plays a large role in both playoff wins and fan attendance. Stephen Curry, the all-time leader in three-pointers made in the NBA has won four NBA championships, the first of which was in his first MVP season, the 2014-15 season. If a team is looking to generate higher revenue, a great way of winning games and getting fans to come watch is to utilize the three-point shot. This would mean that the traditional power forward and center positions must adapt to survive. This is already being shown because many of the taller players in the NBA have developed three-point shots. The players that have not adapted this feature to their skill set are often not as valued as they were prior to the Stephen Curry revolution.

Appendix A: Variable Description and Data Source

Acronym	Description	Data source
Team Revenue	Revenue of the team in the NBA	Statista
PPG	Points Per Game: the total number of a player's points divided by number of games played	Basketball Reference
3PM	3-Pointers Made: the total number of a player's made three-pointers divided by number of games played	Basketball Reference
3P%	3-Point Percentage: the total number of three-pointers made divided by number of three-pointers attempted	Basketball Reference
eFG%	Effective Field Goal Percentage: an adjusted statistical measure of a player's field goal percentage accounting for three-pointers being worth more	Basketball Reference
Reg. Season Wins	Regular Season Wins: a team's number of wins in the regular season	Basketball Reference
Playoff Wins	Playoff Wins: a team's number of wins in the postseason tournament	Basketball Reference
Home Attendance %	Home Attendance Percentage: a calculated figure using the number of average attendees over the stadium's capacity	Computed using ESPN data

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