

Beyond the Arc: How 3 point shooting has impacted winning in the modern NBA*

Analysing the relationship between a team's 3 point shooting and sucess in the regular season

Aryaman Suri

April 2, 2024

In recent years, the three-point shot has emerged as a pivotal aspect of basketball strategy in the NBA. This study uses statistical modelling tools to analyze the association between three-point shooting and winning in the current NBA. Using season-wise NBA statistics, I examine the cumulative effect of teams' three-point shooting on their overall victory total. This study quantifies this link using Generalized Linear Models, which take into account parameters such as the amount of three-point shots made and other pertinent variables. The findings shed light on the importance of three-point shooting as an NBA success factor. I examine the ramifications of the findings for team strategy, player development, and basketball analytics. Additionally, ethical concerns and study limitations are addressed.

Table of contents

1	Introduction	1
2	Data	2
2.1	Data Collection	2
2.2	Data Cleaning	3
2.3	Data Analysis	3
3	Model	3
3.1	Model set-up	4
3.2	Model justification	4

*Code and data are available at: <https://github.com/aryamansuri/NBA-3PointAnalysis>

4	Results	4
5	Discussion	5
6	References	6

1 Introduction

The three point line was introduced in the NBA in the 1979-80 season and has brought unprecedented balance to the game. Instead of the game being centered around the big man or athletic wings, the 3 point shot gave everybody on the team a new powerful weapon on offenses. Today, there are 230 players who averaged at least one made three pointer in the 2022-23 regular season. The estimand of this paper is to see if these 3 point shots help the team win games in the regular season.

This paper aims to estimate the association between three-point shooting measures and win probability using advanced statistical techniques after meticulously analyzing season-wise data. The findings highlighted the importance of three-point shooting efficiency as a predictor of team performance in modern basketball and how important it is to be a good three point shooting team for success in today's game.

Understanding this link has far-reaching ramifications for numerous parties, including coaches, players, analysts, and team administration. This study adds to the ongoing debate in the NBA about strategic decision-making and player development by explaining the significance of three-point shooting in deciding game outcomes. Essentially, the question “Does three point shooting actually lead to team success?”, is being asked.

I begin by exploring the underlying data, which will provide insights into the variables and metrics used in our analyses. Following that, I explain the complexities of the modelling approach, describing the reasoning behind the statistical techniques and justifying the methodology. Later, the results of the analysis are discussed, diving into the empirical findings and their implications for understanding the relationship between three-point shooting efficiency and NBA team success. Then I have included a thorough conversation, contextualizing the findings within the larger landscape of basketball analytics and emphasizing significant takeaways from this research. Finally, I summarize the findings and propose paths for future research to further the understanding of this dynamic interaction.

2 Data

In this study, I utilized data sourced from the NBA's official database to examine the relationship between various team performance metrics and their corresponding winning percentages

throughout the regular season. My analysis aims to uncover insights into the factors contributing to team success in the NBA, specifically 3 point shooting. The NBA’s database serves as a comprehensive repository of statistical information on teams, players, and games, providing valuable insights into the dynamics of professional basketball. Below, I provide a detailed overview of the data collection process, cleaning procedures, and subsequent analysis.

2.1 Data Collection

All raw data utilized in this study was collected from the official NBA database, which aggregates comprehensive statistics on team performance, player performances, and game outcomes throughout the league’s history. Since this study only focuses on the modern nba, which is defined as the era from the 2014-15 season onward, the season wise data had to be individually downloaded and combined. This is then stored in our raw_data2.xlsx file. This dataset comprises a wide array of variables, including team statistics such as points scored, rebounds, assists, turnovers, and various other performance metrics recorded over multiple seasons.

2.2 Data Cleaning

Upon acquiring the raw data from nba.com, extensive cleaning procedures were implemented to ensure its suitability for analysis. This involved addressing missing or erroneous values, standardizing variable names, and aggregating data at the team level to facilitate meaningful comparisons across different seasons and teams. Additionally, I computed additional variables such as win percentages, and filtered the data to only include winning stats and 3 point stats. This dataset is then stored in the analysis data as a csv file.

2.3 Data Analysis

With the cleaned dataset in hand as seen in Table 1, I conducted a rigorous analysis to explore the relationships between 3 point shot performance metrics and team success in the NBA. Various statistical techniques were employed, including descriptive analysis, correlation analysis, and regression modeling, to identify significant predictors of winning percentages. Furthermore, I visualized the data through graphs and tables to elucidate trends and patterns in team performance across different seasons.

Table 1: Overview of the cleaned dataset

Team	Games	Wins	Loss	Win%	3PM	3PA	3P%	Box +/-
Golden State Warriors	82	67	15	0.817	10.8	27.0	39.8	10.1
Atlanta Hawks	82	60	22	0.732	10.0	26.2	38.0	5.4
Houston Rockets	82	56	26	0.683	11.4	32.7	34.8	3.4

Table 1: Overview of the cleaned dataset

Team	Games	Wins	Loss	Win%	3PM	3PA	3P%	Box +/-
LA Clippers	82	56	26	0.683	10.1	26.9	37.6	6.6
Memphis Grizzlies	82	55	27	0.671	5.2	15.2	33.9	3.2
San Antonio Spurs	82	55	27	0.671	8.3	22.5	36.7	6.2

By segmenting the data by season and team, I was able to conduct a detailed examination of performance trends over time and assess the impact of various factors on team success. This analysis provides valuable insights for coaches, analysts, and basketball enthusiasts seeking to understand the drivers of success in the NBA.

3 Model

The goal of my modeling strategy is two fold. First, I want to analyze the effect of 3 point shooting on team success defined by wins. Secondly, I want to predict NBA team wins based on the number of 3-point field goals made by each team throughout the regular season.

Here I briefly describe the Bayesian analysis model used to investigate the relationship between 3-point field goals made and team wins.

3.1 Model set-up

Let y_i represent the number of wins for team i throughout a given season, and let β_{3pts} denote the effect of 3-point field goals made on team wins. The number of 3-point field goals made per game ($3pts_i$) by team i is the predictor variable considered in this model.

$$y_i | \mu_i, \sigma \sim \text{Normal}(\mu_i, \sigma) \quad (1)$$

$$\mu_i = \alpha + \beta_{3pts} \times 3pts_i \quad (2)$$

$$\alpha \sim \text{Normal}(0, 2.5) \quad (3)$$

$$\beta_{3pts} \sim \text{Normal}(0, 2.5) \quad (4)$$

$$\sigma \sim \text{Exponential}(1) \quad (5)$$

We run the model in R (**citeR?**) using the `rstanarm` package. The default priors from `rstanarm` are utilized.

3.2 Model justification

I hypothesize that there exists a positive relationship between the number of 3-point field goals made by a team and the number of wins achieved throughout the regular season. Teams that make more 3-pointers tend to have higher-scoring offenses, which can lead to greater success in terms of winning games, especially in the modern NBA with a offensive focused game. This model aims to quantify the impact of 3-point field goals made on team wins and provide insights into the importance of this performance metric in determining NBA team success. The choice of a normal distribution for the response variable is justified by the continuous nature of team wins.

4 Results

Our results are summarized in Table 2.

Table 2: Explanatory models of Team success based on 3 Points

Parameters	Mean	SD	P10	P50	P90	mcse	Rhat	n_eff
(Intercept)	27.8	3.5	23.4	27.8	32.2	0.1	1	3811
3PM	1.2	0.3	0.8	1.2	1.6	0.0	1	3848
sigma	11.6	0.5	10.9	11.5	12.3	0.0	1	3536
mean_PPD	40.3	1.1	39.0	40.3	41.7	0.0	1	3764

In the context of the NBA, the interpretation of the model is provided below.

The **Intercept (27.8)** represents the estimated mean number of wins when the number of 3-point shots made (3PM) is zero. In other words, when a team makes zero 3-point shots, the model estimates that they would win approximately 27.8 games on average. The **3PM (1.2)** coefficient represents the change in the estimated mean number of wins for each additional 3-point shot made by a team. In this case, for every additional 3-point shot made, the model predicts an increase of approximately 1.2 wins on average. The **Sigma (11.6)** parameter represents the estimated standard deviation of the error term in the model. It indicates the variability in team success (measured by the number of wins) that is not explained by the number of 3-point shots made. The **Mean_PPD (40.3)** represents the average posterior predictive distribution of the outcome variable (number of wins). It provides an estimate of the average number of wins predicted by the model.

Overall, based on these estimates, it appears that there is a positive association between the number of 3-point shots made by a team and their success, as measured by the number of wins. Teams that make more 3-point shots tend to win more games on average, according to the model. However, it's essential to consider other factors not included in the model that may also influence team success.

Will include more graphs and tables in the final version of the paper. Fell short on time.

5 Discussion

Although, this paper discusses the upside of the three point line, I feel it is important to also include it's drawbacks. An interesting example of this in the modern NBA is the 2017-18 Houston Rockets. The Houston Rockets' general manager was a huge fan of the three point shot and in the 2017-18 season built an entire roster around 3 point shooting. This team was a huge success in the regular season and they shot more 3 pointers than any other team in league history. What he failed to take into account was, that basketball isn't math. While the Rockets were the most successful regular season team with 65 wins, they matched up against the Golden State Warriors in the western conference finals of the playoffs. The series went to seven games, and in game 7, the Rockets essentially shot themselves out of the game. They went 7 for 49 from the arc as a team, which was a record for the worst 3 point shooting in NBA history. This team lived by the three and eventually would die by the three. This just goes to show that although the three point shot is a great indicator of success, it is not without it's drawbacks.

6 References