

NBA Shot Selection Analysis

Context and Research Question

In this report, our team will explore and analyze the performance of NBA teams based on their shot selection. For background, the NBA consists of thirty different teams all with different coaches and playing styles. There are so many different ways to score points efficiently in the NBA, and that is what we want to explore in our report. Over the past few years, teams have placed a higher emphasis on the three point shot and have grown away from shots in the other zones of the court such as the midrange area. Our team wants to find out whether a concentration of certain shots from different distances on the court, specifically three pointers, have an impact on a team's success. The main research question of interest is: Does attempting more three pointers generally lead to a better win percentage for NBA teams? While exploring this research question, we will be investigating how the proportion of shots from each zone on the court can lead to an increase in a team's points per game, win percentage, and offensive rating. By determining which areas of the court the top teams shoot from the most, we can identify which zones correlate to team success. Our motivation for investigating this question is due to the recent success of the Boston Celtics during the 2023-2024 NBA season. The Celtics took an unusually high number of three pointers per game and dominated the league as a result. This question is relevant because it could impact how different teams may focus on their shot selection or how they make plays in the future, which is discussed in detail in the practical application section of our report. We are exploring this problem mainly to benefit coaches. The goal is for coaches to look at our report and conclude whether they should focus on getting more shots in certain areas of the court. Looking through some sources online, this problem has been tackled and explored before, but we want to simplify it through our regression model and research.

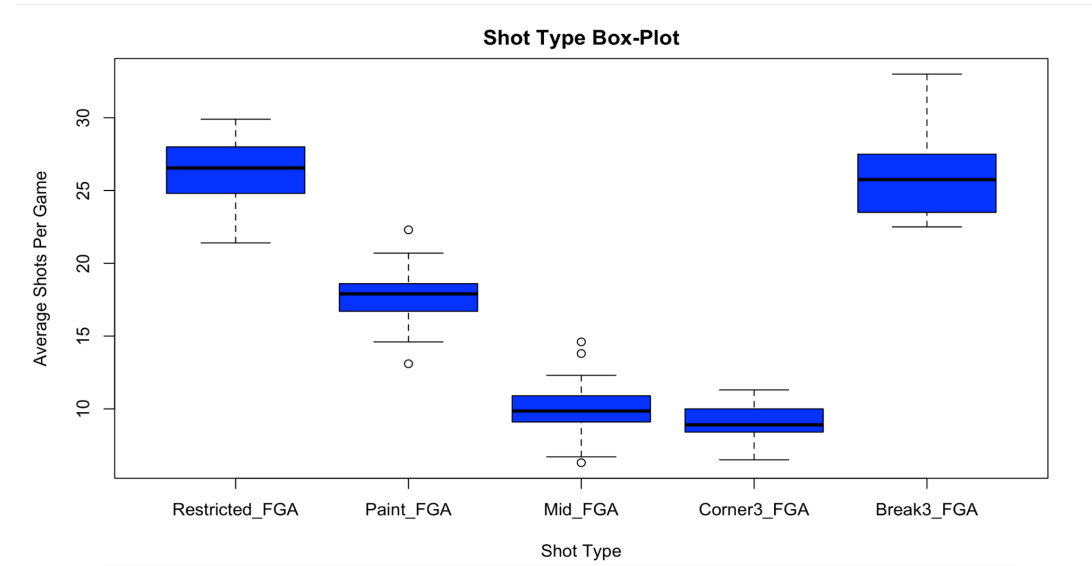
Dataset

We collected our data from the NBA website for the 2023-2024 regular season. We found two different datasets, which we integrated together to conduct our analysis. The first dataset contains information on each NBA team's field goal percentage, field goals made, and field goals attempted per game from various distances (Teams Shooting | Stats | NBA.com.). The data can also be filtered by zone, which was helpful in determining more specific locations of the court. The second dataset contains information on the team's performance such as their win percentage, points per game, offensive rating, and other key statistics (Teams Traditional | Stats | NBA.com.). We combined both of these datasets into a csv file by including the statistics based on zones from the first dataset in addition to the three main statistics from the second dataset. This made it easier to conduct our analysis and effectively create various visuals. In addition, we quantified the data from the second dataset to display the distances from the basket rather than just the zone name. We have only one explanatory variable, which is the distance from the basket or the different zones on the court. This is a continuous numerical variable ranging from 0 feet to 94 feet. The response variable is the team's performance throughout the season. We used the team's win percentage, offensive rating, or points per game to measure the team's performance. These are all continuous numerical variables where the win percentage is the proportion of games the team wins out of all 82 games, offensive rating is the number of points a team scores per 100

possessions, and the points per game is the average number of points scored a game. The range for the win percentage is from 0 to 100, offensive rating is from 0 to 300, and points per game is from 0 to 200. There are 30 observations representing each NBA team. The Boston Celtics could be a possible outlier because they had a historical season and led the league in win percentage and offensive rating.

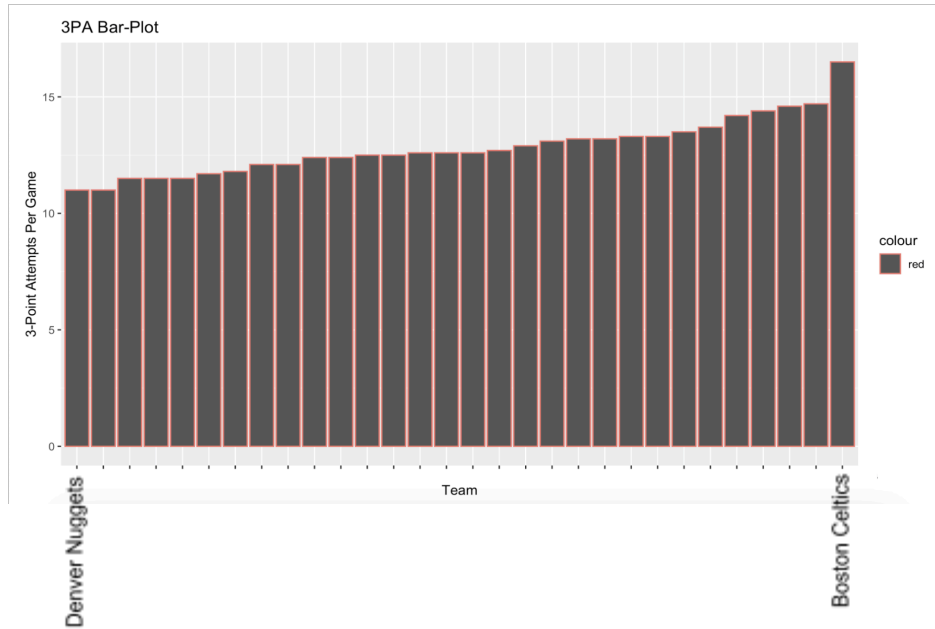
Analysis and Interpretation

Prior to any analysis or model creation in R-Studio, we first wanted to create some visuals to get a general overview of our data. We are interested in shot types, so we created a box-plot which shows the distribution of league-wide average shot attempts per game from different key zones on the court for last season.



Box plot of shot attempts per game from key zones on the court (Figure 1)

Restricted zone shots and paint field goal attempts are shots that are taken close to the rim, and break 3-point attempts are three pointers taken straight on facing the basket (not in the corners). These three shooting zones were clearly the most popular in the NBA last season. Meanwhile, mid-range and corner 3-point shots were not nearly as popular. Understanding these trends in NBA teams' shot selection will be important for further analysis. Next, we wanted an overview of team-by-team three point attempts. More specifically, we wanted to see which teams shot the most threes, and if those teams were successful. To do so, we created a bar plot of each team's average 3-point attempts per game for last season.



Bar-plot of three point attempts per game among all 30 NBA teams (Figure 2)

From the bar-plot, we can see that the Boston Celtics attempt the most threes per game at 42.3 and the Denver Nuggets attempt the least at 30.9 (Figure 2). This is very interesting because these were the top two teams in win percentage with the Celtics being first. Furthermore, the Celtics also won the NBA finals this season, largely due to their success behind the three-point line. However, when analyzing the data in more depth and using information from the boxplot as well, we noticed that the Denver Nuggets were third in field goal attempts in the restricted area attempting 28.6 per game while the Celtics were near the bottom in restricted area field goal attempts attempting 24.1 per game (Figure 1). It is also important to note that the Nuggets led the league in paint field goal percentage and the Celtics were second in three point percentage being only 0.1% behind first. Although many of the top teams attempt the most three pointers per game, this demonstrates that taking a lot of threes doesn't necessarily always lead to a higher win percentage as teams can also be successful taking more shots in the paint. For instance, the Celtics and Nuggets are two teams that have vastly different playstyles, which is probably centered around their players and how the team is structured. As a result, it is important to understand that teams must take their players into consideration when deciding what proportion of shots to take from each area of the court.

Now, to determine which shooting zone is the most efficient we created some models to determine which variables (shot zones) are significant predictors of points scored. Using a filtered dataset of each team's points per game and shot attempts from each shooting zone per game, we created a model using AIC selection to identify which statistical model is the best. The best model to predict points scored involved using only above the break three-point and mid-range shot attempts. The model was as follows:

$$Points = 91.0308 + 0.6277(Mid\ Range\ Attempts) + 0.6525(Break\ 3\ Attempts)$$

However, the adjusted R-squared value is 0.1222, showing the model is weak. Also, the mid-range attempts variable did not pass the individual t-test, so above the break three-point attempts is our only significant predictor for points in this model. After this model was found to be weak, we transitioned to using percentages as predictor variables. Knowing which spots on the floor it is most important to be efficient and effective scoring in can help coaches emphasize to players which shots to practice the most. Moreover, we changed to use offensive rating as a dependent variable. Offensive rating is simply the number of points a team scores per 100 possessions. This is more telling of efficient offense because it takes into account pace of play. AIC was used again to determine which model was the best for predicting offensive rating using shot zone percentages. Our model was:

$$ORtg = 26.07421 + 0.27221(Restricted\ Zone\ \%) + 0.37074(Paint\ \%) + 0.26298(Mid-Range\ \%) + 0.71628(Corner\ 3\ \%) + 0.42376(Break\ 3\ \%)$$

This model has an adjusted R-squared value of 0.804. Every predictor variable passed the individual t-test as well, other than break three-point attempts. Therefore, restricted zone, paint, mid-range, and corner three-point percentage are all significant predictors of offensive rating. Corner three-point attempts are the strongest predictor of offensive rating because it has the largest coefficient value, and also has the lowest p-value compared to all other individual t-tests. Therefore, coaches should prioritize shooting corner threes efficiently over any other shot type. Practicing corner threes more in practice and trying to sign or draft players who shoot corner threes efficiently could be an effective strategy for coaches.

Practical Application

Our analysis can be applied by coaches when creating future plays and offensive gameplans regarding shot selection. Based on our analysis, we aim to provide insights that can help coaches make decisions about the plays they run and overall game strategies to give them a better chance of winning. We examined the relationship between a team's shot selection, mainly focusing on three pointers, and their success metrics such as offensive rating and points per game. Interpreting our results will help coaches optimize their teams shot selection giving them a better chance to win more games.

One of the main takeaways from our analysis is that taking more three pointers and shots in the paint are the most optimal for increasing success metrics such as offensive rating and points per game. This makes sense as usually the shots in the paint are the highest percentage shots in basketball so having a high volume of high percentage shots will lead to more points. Attempting more shots in the paint will also lead to more free throws on average, as most shooting fouls happen around the rim. So even if they miss the shot, there is still a good chance they come away with points from the possession. On the other hand, a three pointer is on average a more difficult shot than a shot in the paint because it is so much further from the hoop, which is why it is worth the extra point. Taking more threes also makes sense because if you can't get a high percentage look around the rim, going for that extra point is worth it. Prioritizing these two types of shots will increase offensive rating and points per game on average which is strongly correlated with win percentage.

There are many different ways a coach can actually apply plays and strategies that our analysis suggests. The first example could be after a timeout, the coach usually draws up an inbounds play for his team to get a good shot. Knowing our results, the coach could draw up more of these plays to get an open 3 point shot rather than any sort of midrange or iso play. These results could also help the coach in making his lineups and substitutions, knowing how important 3 pointers and paint shots are to winning, giving players who are good at these types of shots more minutes would help the team. One final example could just be adjusting their overall offensive strategy during practice. The coach could establish a 5 out offense leaving more room for the slashers to drive into the paint, or run off ball screen sets to free up shooters for open threes. Really just anything to ensure the team is prepared to execute optimal shot selection. The coach could even use the results on his scouting report of the opponent and try to limit these types of shots from the other team. Overall, these results can help coaches make better decisions on their teams shot selection, improving their offensive efficiency and winning more games.

In general, our results align with modern trends in the NBA. We have seen this sort of shift away from the mid range to mainly just threes and layups in recent years. With the rise of analytics, teams have started to adopt these new strategies in order to increase efficiency. Successful teams in recent years like the Warriors and Rockets have led this shift and embraced the strategy of taking lots of threes and lots of layups very effectively. The analytics are proven to be successful over and over as even just last year the Celtics took the most threes in the league, and they won the championship. Players in today's NBA are trained to space the floor for open threes and attack the rim aggressively. Scouts are prioritizing players with these strengths for the draft and teams are creating rosters to support this type of play. The most obvious effect of this shift to prioritizing the three so much is the fact that even most centers shoot the three in today's NBA. This season, Nikola Jokic, a center, is leading the league in three point percentage. This would never have happened in Shaq's era. Our results support this evolution of basketball that prioritizing these high value shot types leads to greater efficiency and more wins.

Citations

Teams Shooting | Stats | NBA.com.

www.nba.com/stats/teams/shooting?SeasonType=Regular+Season&Season=2023-24&DistanceRange=By+Zone.

Teams Traditional | Stats | NBA.com.

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