SCHOLARLY REVIEW ONLINE

Scholarly Review Online - Summer 2025

Finding the right balance: How floor spacing and 3-point shooting affect NBA offensive ratings

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AUTHOR BIO

Jonah Tan is a junior at Alameda and Science Technology Institute located in Alameda, California. This paper combines Jonah's interests in basketball and coding. Jonah aspires to enter an economics field, and hopes to continue to develop his passion for analytics as well as basketball through future projects similar to this paper.

ABSTRACT

With the rise of the 3 point shot and perimeter shooting in the NBA, I wanted to find out how shooting a large number of 3 pointers and the spacing of efficient shooters affects a team's offensive rating. Within this research project, I look at how spacing the floor out with players who can shoot at a high efficiency would affect a team's offense rating. As opposed to the previous trend of having tall men score high percentage shots close to the basket, the most common playstyle from the past, around the years 2000-2010, my research shows that as the number of good 3 point shooters in a lineup increases, a team's offense rating generally increases. However, there is a need for balance in basketball lineups, to maximize offensive efficiency. This research paper found that lineups with 2-4 shooters were the most commonly played, while lineups with 1 shooter or 5 shooters wouldn't be seen as often. This result is statistically significant, but does not explain all aspects of offense efficiency.

***Keywords**: 3 Point Shooting, Offensive Rating, Lineup Efficiency, Shooters, Spacing, Balance, Basketball Analytics, Modern NBA Offense, Shot Selection.*

INTRODUCTION

The game of basketball has evolved and changed over the past few decades. According to ESPN, there has been an increase of over 50% in 3 point attempts per game over the last decade, where the 3 point shot has become a crucial factor in shaping team strategy. The 3 point shot is a much harder shot as it is much farther from the basket, while any shot inside the 3 point arc counts as 2 points, which is a much easier shot, explaining why teams weren't willing to shoot a lot of 3 pointers until recently. The 3 point shot currently defines the modern offensive play style, allowing teams to space the floor with shooters and create better and more efficient scoring opportunities, as opposed to traditional post play through a very tall man, who would use his size as an advantage in the post for high quality 2 pointers close to the basket. This shift to perimeter shooting is a significant change and I wanted to examine how the rise of the 3-pointer and spacing out the shooters on the floor would impact a team's offensive rating, the term offensive rating meaning how successful a team is on offense.

I decided to research how having defenders stay close to shooters will open up cuts, drives, and inside scoring. Cuts are when offensive players will be standing on the outside, then suddenly sprint towards the basket when the defenders may be distracted, which can lead to easy points around the basket. Offensive players who prefer to drive to the basket will also be benefited as defenders won't be able to help as they must stay glued to their man, otherwise the driver can easily pass to the shooter who will be able to shoot a wide open 3 pointer. Having these shooters outside will lead to more spacing inside and it allows for scorers to drive more efficiently. These qualities can be beneficial to scorers who prefer to drive to the rim instead of score outside the 3-point line, thinking that more shooters would lead to a higher offensive rating for a team. I found that there was a clear positive relationship between the amount of good shooters in the lineup and the offensive rating of that lineup. Teams with more shooters, especially in the range 2-4, would tend to be the most common and would see the most minutes within that lineup being played. This suggests that spacing with shooters improves offensive efficiency, but there is also a balance that teams must consider when building their lineups with shooters. The tradeoffs with skilled shooters would be that their defense wouldn't be as adequate compared to teams who include other players who might be better at defense, but who wouldn't be as skilled at shooting. Through this analysis, we aim to understand how the right balance of shooting and spacing can raise a team's offensive rating in today's game.

LITERATURE REVIEW

There were a few existing studies on this topic, but there wasn't much success looking for similar tests; An article titled *Effect of Increased Three-point Shot Attempts on Probability of Winning in High School Basketball* by Samantha Kostacos explains that taking more 3 point attempts does not actually help a team win more games or score more points and the better strategy would be to just focus on high quality 3 point attempts and a lot more efficient 2 point attempts. It does relate to measuring offensive efficiency, but as this was at the high school level, professional players have different skill sets so different strategies would make more sense there. A paper online entitled *Offensive Lineup Analysis in Basketball with Clustering Players Based on Shooting Style and Offensive Role* by Kazuhiro Yamada, talked about what combinations of 5 players and 2 players tended to be the most effective towards offensive efficiency. This paper attempts to study which kind of players go well together, and while my study appears to be similar to theirs as we are both studying lineup efficiency, I am adding to this by focusing specifically on shooting on the perimeter, and seeing how shooters affect a lineup and their respective offensive rating.

METHODS

Within this study, I used the NBA stat API, which is essentially the NBA's statistical database, to gather all the lineup data for every

lineup in the NBA during the 2023-2024 season. This data included the names of each player and the overall offensive rating for that lineup. Using the player names, I then retrieved their individual 3 point shooting stats for that season, and calculated a team's offensive rating, as well as the amount of elite 3 point shooters on the team, and compared how many shooters on the floor impact the team's offense. This allowed me to pinpoint the most efficient amount of shooters on the floor. The logic behind this method is that having too few shooters would lead to inefficient offense and no threat behind the perimeter, leading to less spacing, but placing too many shooters would lead to no driving options and not having that traditional post big man play. It would also affect their defensive capability without a big man, also known as a shot blocker, on the defensive side. A big man would stand near the rim and use his size to protect the rim from slashers, and this would impact a team's defense a lot. I aim to find the most efficient balance between having a big man and having elite shooters to find out the most efficient way to place shooters in a lineup. To do this, I analyzed 4 graphs representing key aspects of NBA team data. The first 2 graphs compare offensive rating with good 3 point shooters, the third graph measures how often lineups with 1-5 shooters are played, and the fourth graph displays the amount of minutes lineups would receive. These graphs helped me visually represent correlations in my data and determine the most effective way to place shooters in a lineup to maximize offensive efficiency.

Figure 1

Offensive Rating vs. Good 3PT Shooters

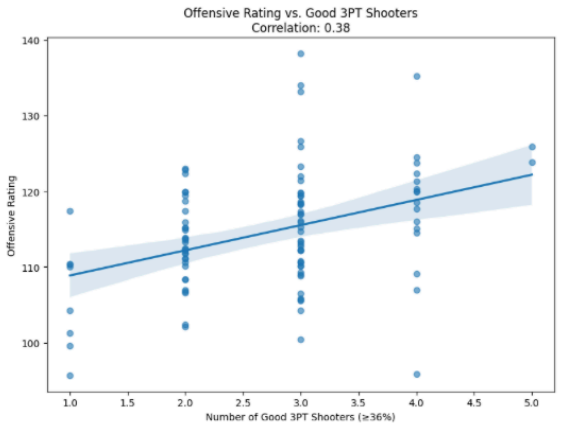
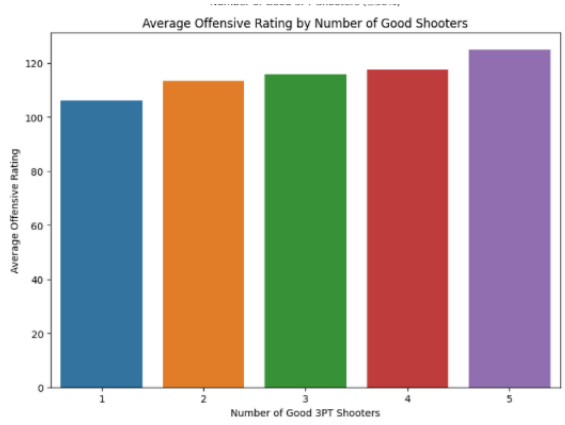


Figure 2

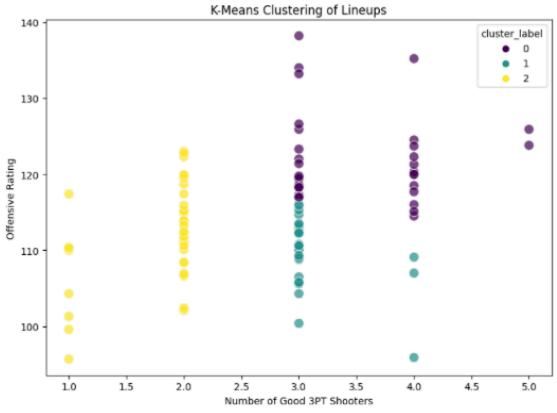
Average Offensive Rating by Number of Good Shooters



The graphs above compare the number of good 3 point shooters to a team's offensive rating. The graph on the top shows that having 3 shooters in a team is the most common number with many teams having good 3 point shooters. However, when we look at the second graph, 5 shooters in a lineup leads to the highest offensive rating. If we compare teams with 1 shooter, we can clearly see that as a team adds more shooters, their team's offensive rating goes up. Having 1 good shooter has a low offensive rating, but making the switch to at least 2 shooters boosts the offensive rating significantly, 2-4 raises the offensive rating even more, and having 5 shooters leads to another big jump.

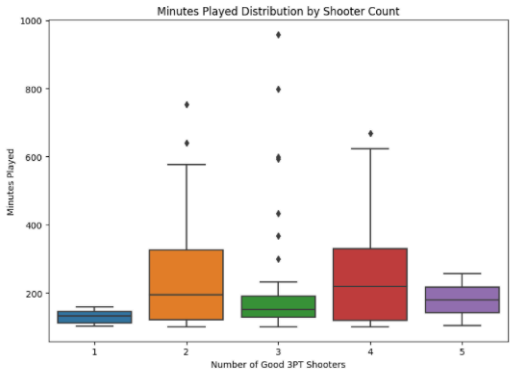
These graphs directly compare the team's offensive rating and the amount of shooters. We can also look at the correlation and determine how closely related they are and how much the shooters impact the rating. There is clearly a positive relationship between adding more good 3 point shooters to a lineup as the offensive rating goes up with it. The article *How many good 3-pointers shooters you really need to win an NCAA title* by Andy Wittry mentions that, "a national title contender probably needs at least three players who average at least one made three per game," as well as, "National championship hopefuls should probably have at least three players who make at least 35 percent of their 3 point attempts." It may seem optimal to have 5 good 3 point shooters, but before arriving at this conclusion we should consider other aspects of NBA teams such as how often a lineup is being played.

Figure 3
Clustering of Lineups



The third graph represents certain lineups with varying amounts of shooters. The most clusters or dots are in the lineups with 3 shooters. These clusters of dots each represent a team. There are many teams with 2 and 4 good 3 point shooters as well, but the graph clearly shows that having 1 shooter or 5 shooters isn't commonly played and probably isn't efficient for the defensive side. The 1st graph determined that the more shooters in a lineup, the better their offensive rating. Looking at this graph, why is the 5 shooter lineup not being played, and why are lineups that consist of 2-4 shooters more common? The most probable reason for this is defense. In a 5 shooter lineup, there most likely isn't a big man; Of course, cases like Karl Anthony Towns or Brook Lopez exist – players who can protect the rim as well as shoot the ball accurately due to today's changed game, but having a defensive big man who can protect the rim efficiently and be able to shoot well is rare, to the point where these players are valued by teams for their versatility. There are certain roles within a team and having only shooters might lead to an impressive offense, but we must also consider defense. Having 2-4 shooters would balance out the lineup with shooting efficiency with the shooters, but also have flexibility for big men who may not be able to shoot the ball well, but have the ability to protect the rim on defense and grab rebounds. We can see from the graph above that having 3 shooters seems to be the most frequent lineup, providing the best balance of offensive and defense versatility. The amount of dots and clusters in the graph seem to be placed most commonly in the 3 man shooter lineup.

Figure 4
Minutes Played Distribution by Shooter Count



The final graph displays the amount of minutes a lineup will be played, with 2 shooters and 4 shooters being the most common lineup that receives the most minutes. Lineups with 3 shooters receive less minutes, and while 5 shooters in a lineup gets a little more visibility, lineups with 1 shooter clearly aren't effective. This shows that on the floor, the lineups that play the most minutes consist of 2 or 4 shooters.

Lineups with 3 or 5 shooters can sometimes occur, but we know that 1 shooter isn't optimal at all. This can help us determine what lineups are most efficient and how many shooters on lineups are most common.

What we've done up until now is analyze all the graphs to decide the most efficient balance of shooters within a lineup. However, other factors could have an impact, such as the total number of 3 point attempts of a team, and how effective that data would be in measuring out an effective balance for the strongest possible lineup. Did having more good shooters matter or more players who took threes matter? After running the same notebook with a couple of changes in the code, replacing 3 point shooters with the total number of 3 point attempts and comparing which one of the 2 models explained more, the data that I received from how many 3 point attempts a team took wasn't really effective and relevant. It didn't seem related to my hypothesis, which explored the right balance of shooters in a lineup.

CONCLUSION

After analyzing all the lineup data and looking at the number of efficient 3 point shooters on a team compared to the offensive rating that lineup would produce, there was a clear positive trend: lineups with 1 shooter produced the lowest offensive rating, and as the amount of shooters increased, the offensive rating increased as well. Lineups with 2-4 shooters showed a steady increase in efficiency, while lineups with 5 shooters correlated to the highest offensive rating. However, a 5 shooter lineup was rare and not commonly played due to the difficulty in having 5 good shooters without compromising defense. This led to lineups with 2 or 4 shooters being the most commonly played, spending the most minutes on the floor. An additional study I tried detailing 3 point attempts, which I hoped would provide more data related to my hypothesis, proved not to be strongly correlated to better offensive performance, emphasizing the importance of shot quality and spacing over volume. In conclusion, these results proved that as the number of accurate shooters in a lineup increases, the offensive rating will increase as well, but there is a strategic balance of shooting and defense to build an effective lineup that can optimize performance on both sides of the ball.

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