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Consequences of NBA Shift to Three-Pointers

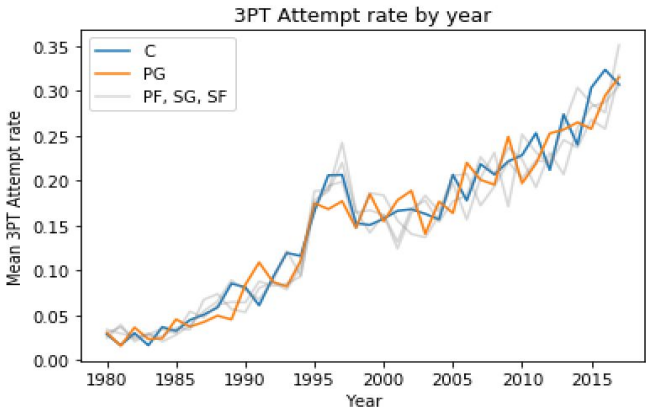
Abstract:

As the NBA evolves the game has shifted in many ways to fit the current time. Currently, we are in the age of the three-point shooter, thanks to Steph Curry, James Harden, Lebron James and many of the top performing players in the league who consistently shooting high-volume, high-percentage threes. As this shift changes the league, it raises a fundamental question: What will happen to the role of traditional centers and how will they adapt to maintain relevance in a three-happy league? Through my analysis, I have found that while the role of traditional centers in the modern NBA is shrinking, they continue to be an integral part of the game of basketball.

Introduction:

I hope to work in the sports analytics field for my career, so I enjoyed having this project be the first step in that direction. Ever since the introduction of the three-point line in the NBA in 1979, players/coaches have focused increasingly on taking three-pointers as opposed to two-pointers (Cohen).

As we can see, the three-point attempt rate has increased over time and has been increasing significantly in the past few years ($p<0.00$; `finalfinal.py, lines 107-116`). This is a result of sharp-shooters showing how much more valuable a high



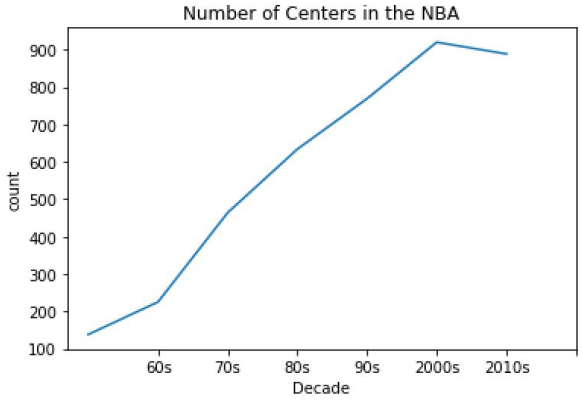
percentage three-pointer is than a high percentage two-pointer, as you get 50% more points per made basket.

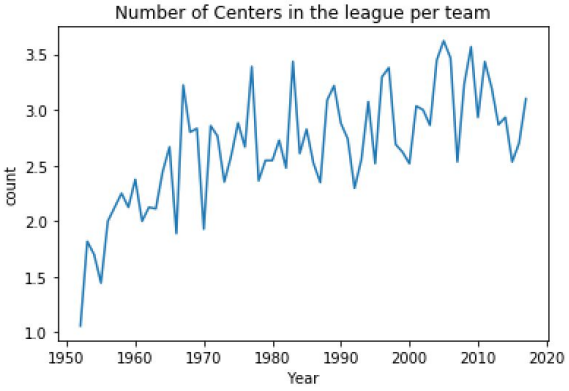
Data:

The dataset I used is publicly posted on Kaggle. It contains 50 columns including categorical variables like team and position in addition to quantitative variables like assists, points, blocks etc. While these basic statistics have been tracked since the ’50s, the dataset also includes advanced statistics for the years in which they were recorded, like value over replacement, player efficiency rating, usage percentage and more. To clean the data I decided to only include players who recorded over 200 minutes in a season, to try to avoid a skewed data set containing many players who did not see much game action. In addition, as many columns of data were totals per season, I wanted to convert those observations to totals per 36 minutes as that is a more understandable unit of measure. I chose 36 as opposed to 48 because players tend to max out around 36 minutes per game as opposed to playing a full game. Lastly, as I intended to look at distributions by player positions I reduced the number of positions in the data from 13 to the five traditional positions.

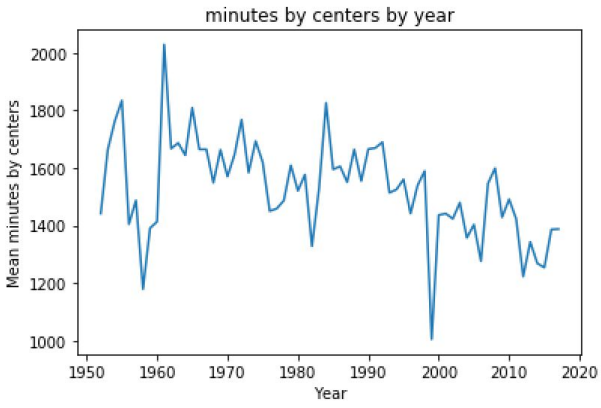
Results:

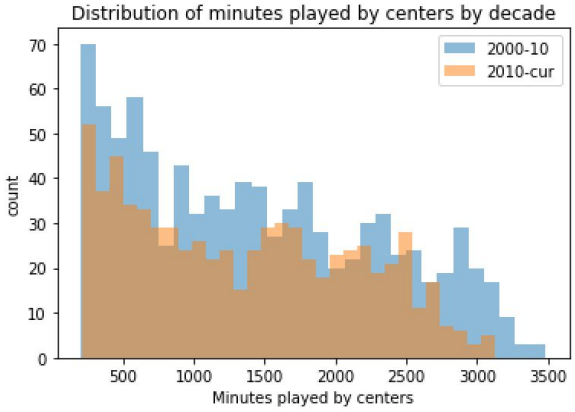
I started my research by looking at the Pearson correlation coefficients between all the variables and 3PAr. The most highly correlated variables were; FTr: -0.447116, ORB%: -0.612838, 3P: 0.935051, 3PA: 0.952234, 2P: -0.555586, 2PA: -0.546590, ORB: -0.61434,TRB: -0.511913, BLK: -0.389530 and PF: -0.387689 (`finalfinal.py, line 124`). Given these correlations, I looked further into the trends over time. Next, I was interested in how many centers have been in the league through the years (`finalfinal.py, lines 138-150`).





As we can see from the first trendline, the NBA consistently added players at the center position every decade, until the slight dropoff in recent years. I attribute this mainly to the expansion of the league from the late 1960s through the late 1980s (List). By 1990 there were 27 teams in the NBA, and through 2018 only three more teams have been added. Next, I looked at the distribution of minutes played by centers over the years and found that there was a significant difference in the mean minutes played by centers between the 2000s and the 2010s (p=0.0404, `finalfinal.py, line 152-162`). From the following histogram, we can see that there are fewer centers playing fewer minutes per season this decade compared to last.

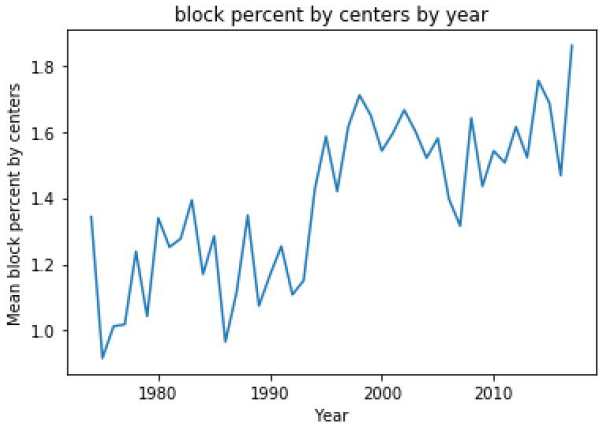


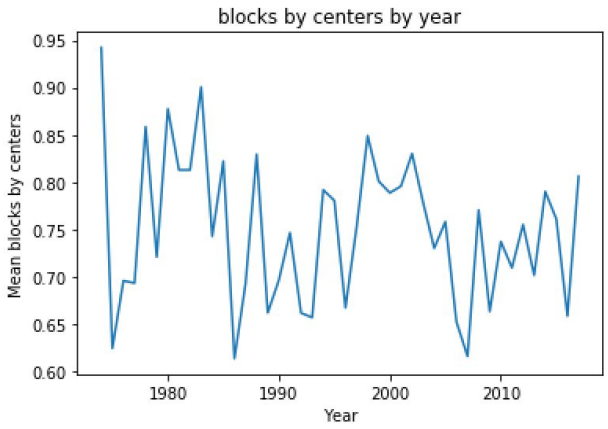


I attribute most of this shift to the faster pace and higher levels of athleticism needed to compete in the fast-paced, three-heavy modern NBA. Coaches are simply playing centers less, as they struggle to switch onto smaller players who can shoot a three over their head or breeze

past them for an uncontested layup. This has lead to the dominance of players like Giannis Antetokounmpo, Kristaps Porzingus and Nikola Jokić, who can defend smaller players by being incredibly athletic. Centers are no longer able to compete in the NBA at a high level simply because they are tall.

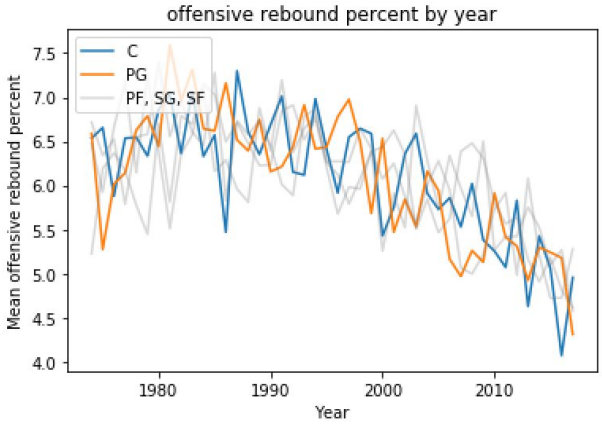
As more players take more threes, there have been fewer two pointers taken (if you are taking a three, you are passing on a chance to take a two), which means fewer shots defended by players closer to the basket, who tend to be centers. In this case, we would expect the total number of blocks made by centers to be decreasing over time. While I did find a significant difference in the block percentages over time (p=0.0115, `finalfinal.py, line 167`), the difference in total blocks was not significant (p=0.935, `finalfinal.py, line 182`). It appears that the centers who do continue to get minutes have been able to block a higher percentage of the shots they are defending. These trends are shown in the following figures.

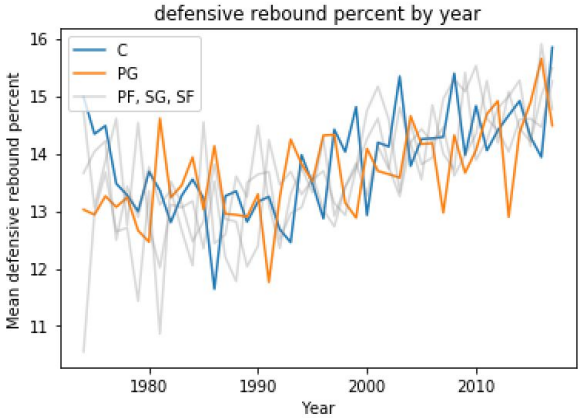


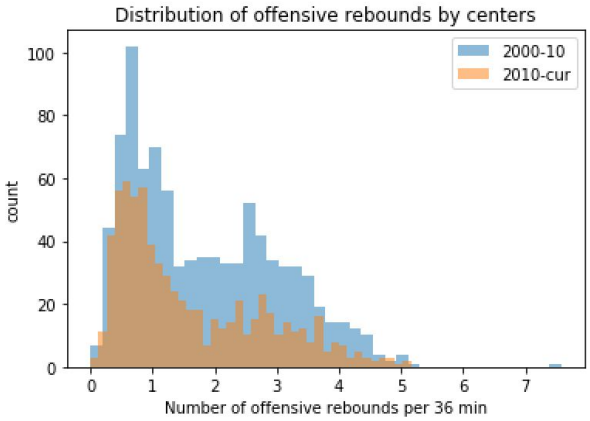


In addition to blocks, centers have the majority role in team rebounding. As more threes have been shot, we can expect there to be a higher number of rebound opportunities, as the effective field goal shooting percentage of the league decreases. In addition to this trend, the variability of the direction and force of rebounds has increased, given more variable input direction and force. This makes it harder to predict where the rebound will end up, reducing the

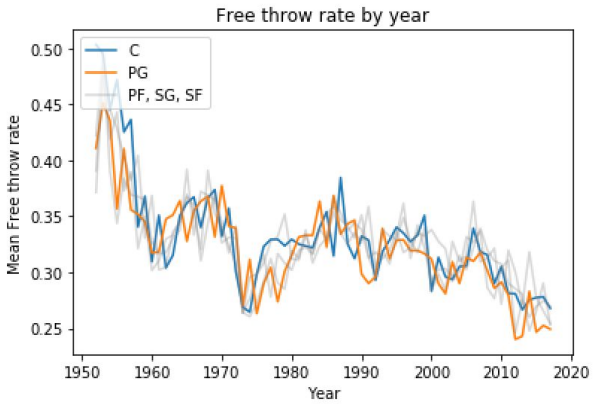
ability of centers to get good positioning for offensive rebounds. In addition, as offenses increasingly space the floor, there is a higher density of defensive players with better positioning ready for a defensive rebound. I found there to be a significant difference in total offensive rebounds by centers between the 2000s and 2010s (p<0.00, `finalfinal.py, line 198`).

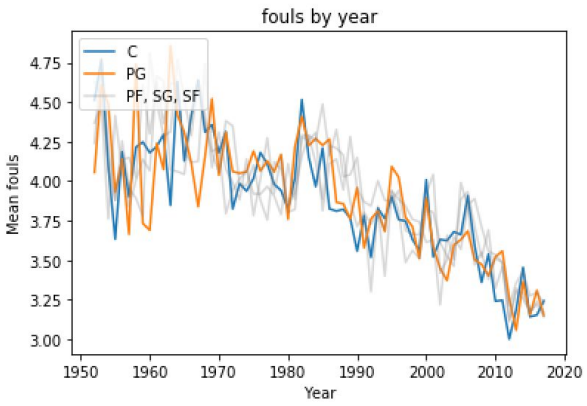




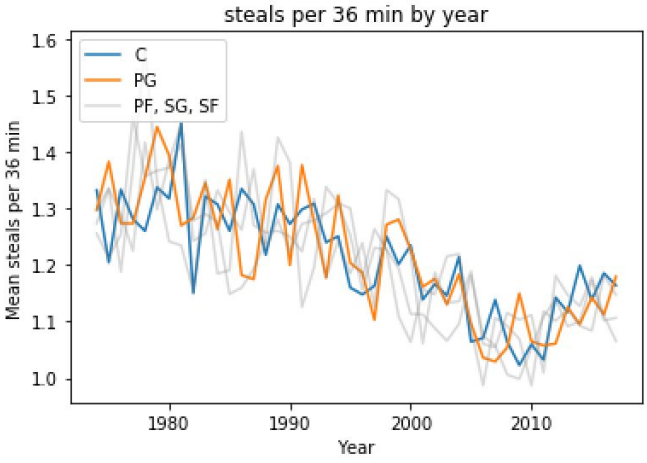


As players take more outside shots I would also expect the number of fouls committed to decrease. This outcome would be due to the fact that there is less contact on a jump shot than a drive or layup, putting referees in fewer positions to make close calls. This prediction was confirmed as I found a significant difference in free throw rate (p<0.00, `finalfinal.py, line 203`) and personal fouls (p<0.00, `finalfinal.py, line 206`) in the past two decades.





Finally, I looked at the trend in steals over time. I predicted that as more threes are being taken, more passes would be thrown per possession, resulting in more chances for steals and an increase in total steals. This was not entirely the case, as shown by the following figure. While steals trended downward for most of recorded league history we see a slight uptick in the graph right before 2010, but not enough to be statistically significant just yet (p=0.997, `finalfinal.py, line 211`). After the three-point line was invented, defenses may have been unsure about how much pressure to put on outside shooters, therefore defensive schemes were taken advantage of. As coaches develop schemes to put pressure on the three-point line and players become better at predicting the passing lanes and more athletic, I would expect the total number of steals to continue rising.



Conclusion:

In summary, I have shown that as the three-point attempt rate in the NBA has increased, centers have seen less time on the floor and had less impact on the game. While they have maintained consistent block totals they have had to refine their skills and block a higher

percentage of the fewer shot attempts against them. Their offensive rebounding totals and percentages have both continually decreased, reducing one of their traditional benefits to a team, while their defensive rebounding percentage has stayed mostly consistent. Traditional centers are being put in fewer positions on the floor to make a meaningful impact on the game and will be replaced by a new generation of longer, more athletic big men, who can dunk and shoot and defend three-pointers at a high rate.

Citations:

Cohen, B. (2018, April 12). The First Shots of the NBA's 3-Point Revolution. Retrieved December 6, 2018, from https://www.wsj.com/articles/the-first-shots-of-the-nbas-3-point-revolution-1523542076

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List of National Basketball Association seasons. (2018, June 29). Retrieved December 6, 2018, from https://en.wikipedia.org/wiki/List_of_National_Basketball_Association_seasons

Data retrieved from:

https://www.kaggle.com/drgilermo/nba-players-stats#Seasons_Stats.csv