

The Evolution of Points Scored in the NBA*

A Breakdown on How NBA Offense has Changed since 2000

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Using the basketball statistics provided by basketball-reference.com, this paper investigates the rise of scoring in the NBA by analyzing the difference in statistics from the years 2000 to 2024. By making use of league-wide statistics as well as highlighting significant individual analytics from certain teams and players, we aim to showcase the main contributing factors to the rise in scoring as well as any possible consequences. This paper covers the significant factors from quantitative numbers, like, the rise in three-point shooting and increased shooting efficiency, as well as, qualitative measurements, such as team pace and overall physicality. With the help of running these findings in a model, we intend to predict how NBA scoring may look in the future and whether there is another level of scoring or if it is nearing its peak.

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*Code and data are available at: https://github.com/foreverwoods/evolution_of_NBA_scoring.

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1 Introduction

The evolution of scoring in basketball throughout its tenure has brought about various discussions between the older generation of fans and the newer generation. A main topic of debate is in regards to the scoring of the game. Throughout this paper, we will be looking into the statistical data from the 2000-2001 NBA season up to the current 2023-2024 season. By analyzing the data and considering the changes, we aim to deduce the significant factors that have impacted scoring in the NBA. There are also other factors that may not be as obvious in the statistics, such as the change in pace of the game, how defenses have changed, and how the playstyles have evolved. This shows that what most would have as the ‘conclusive main argument’ for the ‘rise of NBA scoring’ in three-point shooting, may not be as significant on its own as it was originally perceived. There are many more factors that come into play that may co-align with the rise of three-point shooting, but have not been properly considered. All of these understandings are vital in predicting the possible future of NBA scoring. Suppose an NBA team replaced every single NBA shot with a three-point shot, since it is worth more points, then the entire game plan would change. Opposing teams would not consider that team a threat when they are closer to the basket, so they could overload the three point line and work to lower their opponents’ three-point shooting percentage beyond the league average. This hypothetical scenario could end up with that three-point shooting team scoring signifi-

cantly less than the average NBA team. ‘Live by the three, die by the tree’, as they would call it.

The estimand is what were investigating as we look for the main factors, both offensive and defensive that contribute to the rise in NBA points scored.

These are all factors that we will be looking into throughout this paper. This paper aims to make use of R Core Team (2023) to provide an analysis of the main factors that have contributed to the rise in scoring in the NBA and how it may affect the future of the sport, from statistics, to the player archetypes sought after, to whether or not the current NBA records will be broken. After introducing the chosen statistical data ranging from individual teams and players, to cumulative, league-wide stats, we will incorporate this data into a model to predict whether or not scoring will continue to rise, or if it has reached its peak.

2 Data

The information used in the development of this paper is from basketball-reference, which is a reputable database that tracks NBA statistics as far as the first ever game in 1946 (*Basketball-Reference.com - Basketball Statistics and History* 2024). It is endorsed by professional sports writers and major sports media outlets, like ESPN, which proves its reliability for the analysis in this paper. With the now completed 2023-2024 NBA season, the paper aims to analyze the increase in the ‘average points per game’ for each NBA season from 2000 to 2024 to find trends that affected the league as a whole as opposed to a subset of outlier teams.

The data was cleaned using **arrow** (Richardson et al. 2024), then parsed, analyzed, and visualized using **R** (R Core Team 2023) utilizing the packages **tidyverse** (Wickham et al. 2019), which made use of the following packages:

- **ggplot2** (Wickham 2016)
- **dplyr** (Wickham et al. 2023)
- **readr** (Wickham, Hester, and Bryan 2023)
- **tibble** (Müller and Wickham 2023)

as well as:

- **knitr** (Xie 2023) for table visualization.

2.1 Basketball Context

To give a brief context into the sport, in basketball, scoring points is done by shooting the ball through a hoop that is 10 feet off the ground. You can score two points by shooting the ball from within a marked line, called the three-point line, and three points by shooting the ball from beyond that line. The game is played in four 12 minute quarters and the team with the most points at the end of the game wins.

For a statistical breakdown on the significance of NBA offense and defense, in the 2000-2001 season, the average points per game by an NBA team was 94.8. In the current 2023-2024 season, the average points per game by an NBA team is 114.4, with approximately 90% of the games played (82 games per team) in the season. This is an increase of 19.6 points per game, which is overall a ~20.7% increase in scoring.

The biggest telltale sign of this increase, and the main topic of concern in the rise of three-point shooting. In the 2000-2001 season, the average three-point attempts per game by an NBA team was 13.7, with an average of 4.8 made to give a 35.4% shooting percentage. In the current 2023-2024 season, the average three-point attempts per game by an NBA team is 35.1 with an average of 12.8 made to give a 36.6% shooting percentage.

So in this time period, the average three-point attempts per game nearly tripled while also increasing the shooting percentage by 1.2%. While this information is very helpful in discovering the underlying causes of the rise in NBA scoring, there were also some consequences to this change. Like how the number of fouls has decreased from 22.3 to 18.9 which affects the number of free throws decreasing from 24.9 to 21.9 taken a game.

2.2 Variables

The basketball analytics used for this paper’s analysis specifically look at the average team’s stats across an entire NBA season. These statistics are official NBA data provided by the NBA’s official statistics tracking partner, Sportradar. Thus, this data is legitimate and unbiased as a viewer from home can track each statistics live and achieve the exact same stat sheet as basketball-reference. I have divided the analytics between offensive-based stats and defensive-based stats due to the impact defense has in stopping an offensive team from scoring, which can be seen on Table 1.

Table 1: NBA Average Team Statistics For Each Season

NBA Season	FGA	3PA	FTA	ORB	DRB	AST	STL	BLK	TOV	PF	PTS	FG%	3P%	FT%	Pace
2023-24	88.9	35.1	21.7	10.6	33.0	26.7	7.5	5.1	13.6	18.7	114.2	0.474	0.366	0.784	98.5
2022-23	88.3	34.2	23.5	10.4	33.0	25.3	7.3	4.7	14.1	20.0	114.7	0.475	0.361	0.782	99.2

Table 1: NBA Average Team Statistics For Each Season

NBA Season	FGA	3PA	FTA	ORB	DRB	AST	STL	BLK	TOV	PF	PTS	FG%	3P%	FT%	Pace
2021-22	88.1	35.2	21.9	10.3	34.1	24.6	7.6	4.7	13.8	19.6	110.6	0.461	0.354	0.775	98.2
2020-21	88.4	34.6	21.8	9.8	34.5	24.8	7.6	4.9	13.8	19.3	112.1	0.466	0.367	0.778	99.2
2019-20	88.8	34.1	23.1	10.1	34.8	24.4	7.6	4.9	14.5	20.8	111.8	0.460	0.358	0.773	100.3
2018-19	89.2	32.0	23.1	10.3	34.8	24.6	7.6	5.0	14.1	20.9	111.2	0.461	0.355	0.766	100.0

These analytics include:

- **Season**
 - Represents the NBA season, ex: 2000-01 signifies the NBA season between 2000 to 2001.

Offensive Analytics:

- **PTS**
 - The average points per game a team scored during a given NBA season.
- **FGA**
 - The average number of field goals (shots) attempted per game by a team during a given NBA season. This includes three point field goals, but not free throws.
- **FG%**
 - The average field goals percentage (shots made / shots missed) by a team during a given NBA season. This includes three point field goals, but not free throws.
- **3PA**
 - The average number of three-point field goals (shots) attempted per game by a team during a given NBA season.
- **3P%**
 - The average three-point field goals percentage (threes made / threes missed) by a team during a given NBA season.
- **FTA,**

- The average number of free throws attempted per game by a team during a given NBA season.
- FT%
 - The average free throw percentage (free throws made / free throws missed) by a team during a given NBA season.
- AST
 - The average number of assists (player scores off a teammate's pass) per game by a team during a given NBA season.
- TOV
 - The average number of turnovers (the team loses possession of the ball without attempting a shot) per game by a team during a given NBA season.
- ORB
 - The average number of offensive rebounds (offensive team rebounds the ball after a missed shot) per game by a team during a given NBA season.
- Pace
 - The average number of possessions a team has in a full game during a given NBA season.

Defensive Analytics:

- DRB
 - The average number of defensive rebounds (defensive team retrieves the ball off the offensive team's missed shot) per game by a team during a given NBA season.
- STL
 - The average number of steals (defensive team takes the ball away from offensive team) per game by a team during a given NBA season.
- BLK
 - The average number of blocks (defensive player deflects a shot attempt from the offensive player) per game by a team during a given NBA season.
- PF
 - The average number of fouls (player deflects makes illegal contact with a player on the opposing team) per game by a team during a given NBA season.
 - * If the offensive player is fouled during a field goal attempt and make the shot, then the field goal is counted and they are awarded 1 free throw. If they miss the shot, then they are given a proportional amount of free throws as their attempt (2 for a field goal within the arc and 3 for three-point attempts).

2.3 Justification

The reason why these variables were chosen is because they are the basic and fundamental aspects of basketball. These represent both offense and defense in an understandable manner, as opposed to advanced analytics, such as: Offensive Rating which calculates how many points a team can score within 100 possessions. This is a metric that, while valuable on its own, loses its value in the context of trying to calculate the average points per game since it is utilized in said formula.

Season and **PTS** are necessary since we would like to see the change in points scored as the years go by. The figure, Figure 1 showcases the increase in scoring over the years. In this figure, you are able to see specific seasons where NBA scoring took a significant leap as opposed to previous years, i.e. 2018-19.

FGA, **FG%**, **3PA**, **3P%**, **'FTA'**, **FT%**, are the variables that track every possible way to score a point. While three point shooting is still considered a 'field-goal' it is essential that we highlight it since it is a main contributing factor to the increase in scoring. Taking a look at the two figures in Figure 2, Figure 2a clearly shows how the increase in three pointers attempted correlates to the increase in points per game, regardless of the year it took place. Figure 2b shows how the three point shooting percentages relatively stayed the same (accounting for slight disparities from time to time), and that it is the volume of threes taken that made a difference.

AST is another offensive stat that has shown a correlation to points per game. Taking a look at Figure 3, you can see how the an increase in assists per game, correlates to an increase in points per game. This can possibly signify a change in offensive system, where teams are passing the ball more often as opposed to isolation play in order to generate better, higher-percentage, shot attempts.

TOV, **ORB**, **Pace**, are the last offensive statistics. They are possibly outliers in comparison to the other, more direct statistics, but they do show significant changes over the years. In the later years between 2000-2024, it is clear that both turnovers per game and offensive rebounds per game lessened, while the pace of the game increased.

DRB, **STL**, **BLK**, **PF**, are the main defensive statistics that have direct impact on offensive output. By securing a defensive rebound, steal, or block, the defending team can shut down the offensive team's possession and prevent them from scoring. **PF**, or personal fouls, impact the offense in various ways as it generally dictates how aggressive a team is playing defense. This can be seen in Figure 4, where it shows the less fouls committed, generally outputs to an increase in points per game.

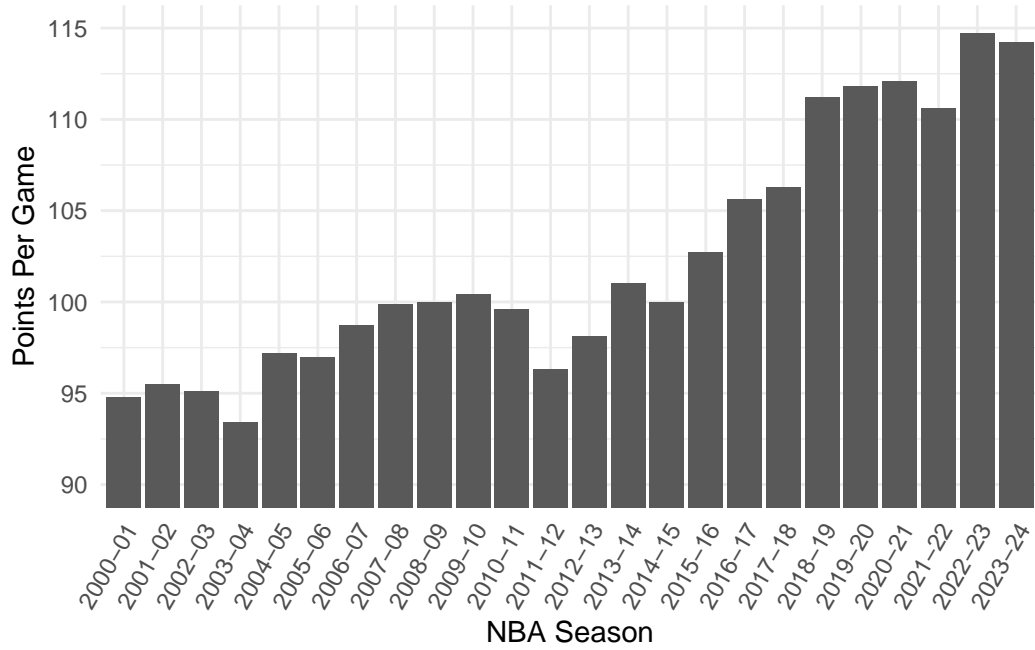


Figure 1: NBA Average Points per Game For Each Season

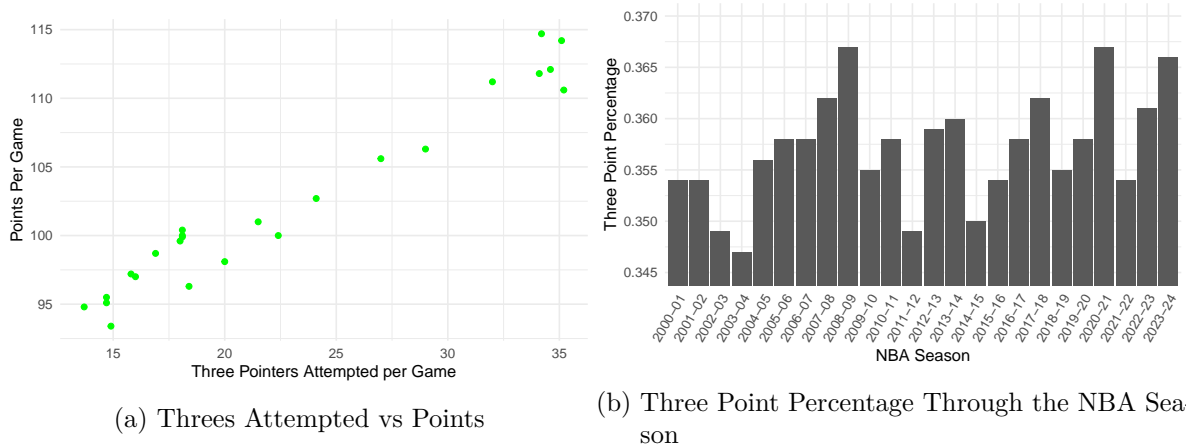


Figure 2: Impact of Three Point Shooting in the NBA

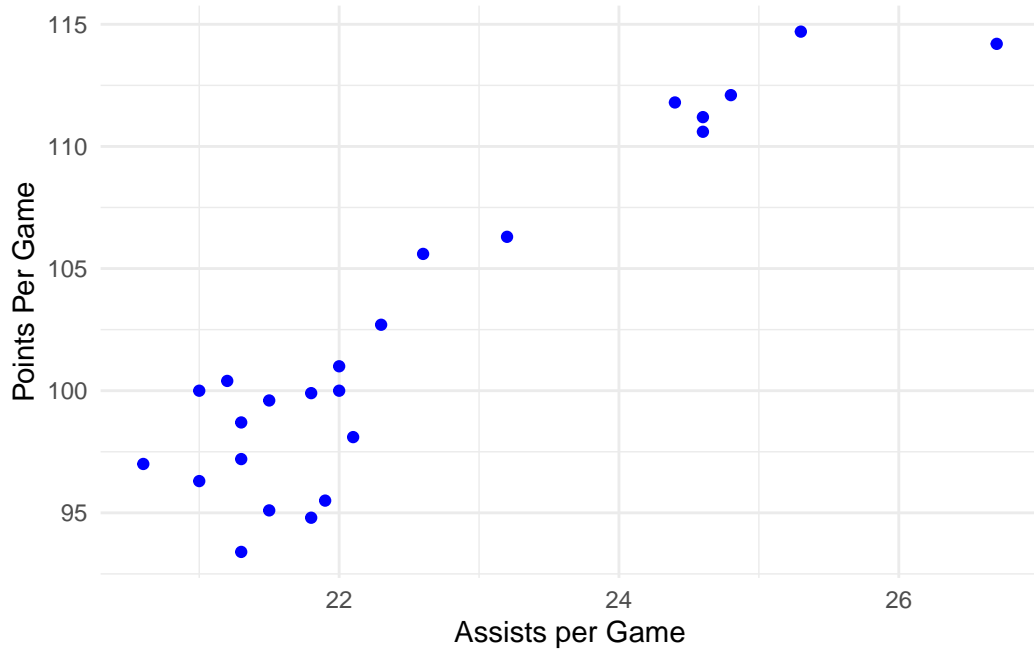


Figure 3: NBA Assists vs. Points

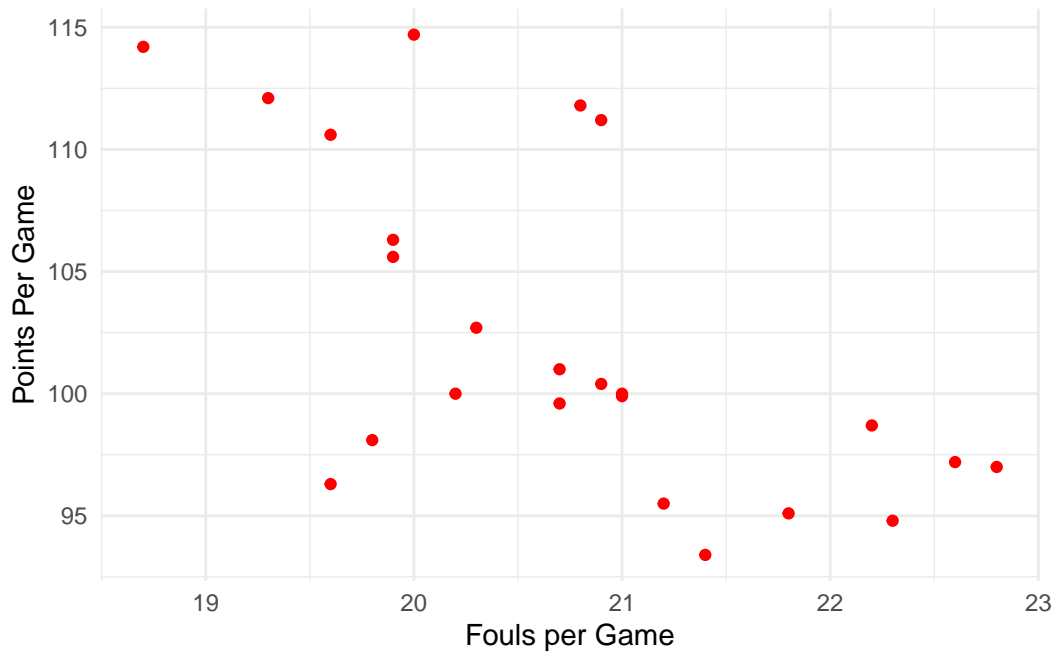


Figure 4: NBA Fouls vs. Points

3 Models

The production of the generalized linear model was created with the **rstanarm** (Goodrich et al. 2024) package. This is then followed up using **modelsummary** (Arel-Bundock 2022). There are a total of four models created that aim to predict the average points per game. We hope to highlight the most important factors that contribute to scoring points in the NBA. These models are:

1. Three Point Scoring and Efficiency
2. All Forms of Scoring and Their Respective Efficiencies
3. Offensive Intangibles
4. Defensive Importance in Scoring

3.1 Three Point Scoring and Efficiency

3.1.1 Model set-up

The model we are interested in is:

$$\begin{aligned}y_i | \mu_i, \sigma &\sim \text{Normal}(\mu_i, \sigma) \\ \mu_i &= \beta_0 + \beta_1 \text{3PA}_i + \beta_2 \text{3P-percentage}_i \\ \beta_0 &\sim \text{Normal}(0, 2.5) \\ \beta_1 &\sim \text{Normal}(0, 2.5) \\ \beta_2 &\sim \text{Normal}(0, 2.5) \\ \sigma &\sim \text{Exponential}(1)\end{aligned}$$

where y_i is average points per game in an NBA season, 3PA_i is the three pointers attempted per game and 3P-percentage_i is the average three point percentage.

Table 2 shows a model summary for this model, this will be discussed further in the [results](#) section.

3.1.2 Model justification

This first model is exclusive to three point shooting. This is what many people believe to be the sole factor in the increase in NBA scoring. There has been instances in the NBA where teams have elected to shoot only high percentage shots, which are three pointers and layups, eliminating the mid range almost entirely. This was seen in the 2017-2018 NBA season with the Houston Rockets, where they took the top seed in the Western Conference while leading the league with 41.5 threes a game Schwartz (2018). If you compare that to the league average

stats in that season, this would be an increase of 12.5 three pointers a game. As such, it would be a wise decision to solely dedicate a model to these statistics.

3.2 All Forms of Scoring and Their Respective Efficiencies

3.2.1 Model set-up

The model we are interested in is:

$$\begin{aligned}
y_i | \mu_i, \sigma &\sim \text{Normal}(\mu_i, \sigma) \\
\mu_i &= \beta_0 + \beta_1 3PA_i + \beta_2 3P\text{-percentage}_i + \beta_3 FGA_i + \beta_4 FG\text{-percentage}_i + \beta_5 FTA_i + \beta_6 FT\text{-percentage}_i \\
\beta_0 &\sim \text{Normal}(0, 2.5) \\
\beta_1 &\sim \text{Normal}(0, 2.5) \\
\beta_2 &\sim \text{Normal}(0, 2.5) \\
\beta_3 &\sim \text{Normal}(0, 2.5) \\
\beta_4 &\sim \text{Normal}(0, 2.5) \\
\beta_5 &\sim \text{Normal}(0, 2.5) \\
\beta_6 &\sim \text{Normal}(0, 2.5) \\
\sigma &\sim \text{Exponential}(1)
\end{aligned}$$

where y_i is average points per game in an NBA season, $3PA_i$ is the three pointers attempted per game, $3P\text{-percentage}_i$ is the average three point percentage, FGA_i is the field goals attempted per game, $FG\text{-percentage}_i$ is the average field goal percentage, FTA_i is the free throws attempted per game, $FT\text{-percentage}_i$ is the average free throw percentage.

Table 3 shows a model summary for this model, this will be discussed further in the [results](#) section.

3.2.2 Model justification

This second model is all forms of scoring. While an increase in scoring is generally attributed to better shooting, having a model to resemble that can allow you to check it and compare with defensive metrics whether the change was affected more by offense or defense. This includes the attempts for each scoring shot as well as the efficiencies over the years.

3.3 Offensive Intangibles

3.3.1 Model set-up

The model we are interested in is: $\text{ORB} + \text{AST} + \text{Pace} + \text{TOV}$,

$$\begin{aligned} y_i | \mu_i, \sigma &\sim \text{Normal}(\mu_i, \sigma) \\ \mu_i &= \beta_0 + \beta_1 \text{ORB}_i + \beta_2 \text{AST}_i + \beta_3 \text{Pace}_i + \beta_4 \text{TOV}_i \\ \beta_0 &\sim \text{Normal}(0, 2.5) \\ \beta_1 &\sim \text{Normal}(0, 2.5) \\ \beta_2 &\sim \text{Normal}(0, 2.5) \\ \beta_3 &\sim \text{Normal}(0, 2.5) \\ \beta_4 &\sim \text{Normal}(0, 2.5) \\ \sigma &\sim \text{Exponential}(1) \end{aligned}$$

where y_i is average points per game in an NBA season, ORB_i is the average number of offensive rebounds per game, AST_i is the average assists per game, Pace_i is the average number of possessions per game, TOV_i is the average number of turnovers per game.

Table 4 shows a model summary for this model, this will be discussed further in the [results](#) section.

3.3.2 Model justification

This third model is exclusive to offensive intangibles that are not directly scoring, but can lead to a potential score. This could be from increased playmaking leading to better percentage shots (less contest from defenders), turning the ball over less, crashing the boards for offensive rebounds more, or just playing in a faster pace.

3.4 Defensive Importance in Scoring

3.4.1 Model set-up

The model we are interested in is:

$$\begin{aligned}
y_i | \mu_i, \sigma &\sim \text{Normal}(\mu_i, \sigma) \\
\mu_i &= \beta_0 + \beta_1 \text{STL}_i + \beta_2 \text{BLK}_i + \beta_3 \text{PF}_i + \beta_4 \text{DRB}_i \\
\beta_0 &\sim \text{Normal}(0, 2.5) \\
\beta_1 &\sim \text{Normal}(0, 2.5) \\
\beta_2 &\sim \text{Normal}(0, 2.5) \\
\beta_3 &\sim \text{Normal}(0, 2.5) \\
\beta_4 &\sim \text{Normal}(0, 2.5) \\
\sigma &\sim \text{Exponential}(1)
\end{aligned}$$

where y_i is average points per game in an NBA season, STL_i is the average number of steals per game, BLK_i is the average number of blocks per game, PF_i is the average number of fouls per game, DRB_i is the average number of defensive rebounds per game.

Table 5 shows a model summary for this model, this will be discussed further in the [results](#) section.

3.4.2 Model justification

This last model is exclusive to defensive attributes. This can help us see what defensive factors are most significant in the change in NBA scoring. Steals and Blocks could possibly lead to more fast-break opportunities where teams run down the floor, generally leading to a score on the other end because the other team is not set to play defense as they were not expecting their possession to be stolen or blocked. Personal fouls could also lead to more free throw opportunities for teams, and defensive rebounds ensure that your team gets the possession and the chance to score.

4 Results

4.1 Threes Model

The intercept (23.391) is the average points scored when you zero out the other factors. 3PA: 0.798 is the increase in average points associated with each additional 3-point attempt. 3P%: 170.222 is The increase in average points associated with a 1 percentage point increase in 3-point shooting percentage. Since the percentage points are set up to not add up to 100 percent, divide 170.222 by 100 to show what a 1% increase in shooting percentage would increase in points, which is 1.70 points per game.

Table 2: Three Point Scoring and Efficiency

	Avg Points Per Game
(Intercept)	23.391 (19.141)
‘3PA‘	0.798 (0.038)
‘3P%‘	170.222 (55.102)
Num.Obs.	24
R2	0.962
R2 Adj.	0.961
Log.Lik.	−39.185
ELPD	−42.2
ELPD s.e.	3.3
LOOIC	84.3
LOOIC s.e.	6.6
WAIC	84.1
RMSE	1.18

4.2 Scoring Model

The intercept (-110.27) can be disregarded as we have removed all forms of scoring, as such it is in the negatives. 3PA: 0.340 is the increase in average points associated with each additional 3-point attempt. 3P%: 18.512 is The increase in average points associated with a 1 percentage point increase in 3-point shooting percentage. Since the percentage points are set up to not add up to 100 percent, divide 18.512 by 100 to show what a 1% increase in shooting percentage would increase in points, which is ~0.19 points per game. FGA: 0.93 is the increase in average points associated with each additional field goal attempt. FG%: 1.67 increase in average points with each 1% increase in field goal percentage. FTA: 0.755 is the increase in average points associated with each additional free throw attempt. FT%: 0.3455 increase in average points with each 1% increase in free throw percentage.

Table 3: All Forms of Scoring and Their Respective Efficiencies

	Avg Points Per Game
(Intercept)	−110.270 (4.454)
‘3PA‘	0.340 (0.019)
‘3P%‘	18.512 (6.830)
FGA	0.930 (0.037)
‘FG%‘	167.422 (6.416)
FTA	0.755 (0.027)
‘FT%‘	34.550 (4.776)
Num.Obs.	24
R2	1.000
R2 Adj.	1.000
Log.Lik.	20.387
ELPD	12.5
ELPD s.e.	3.3
LOOIC	−25.0
LOOIC s.e.	6.6
WAIC	−27.1
RMSE	0.14

Table 4: Offensive Intangibles

	Avg Points Per Game
(Intercept)	37.794 (29.539)
ORB	-1.201 (0.968)
AST	1.386 (0.526)
Pace	0.881 (0.341)
TOV	-2.558 (0.991)
Num.Obs.	24
R2	0.965
R2 Adj.	0.960
Log.Lik.	-37.522
ELPD	-42.9
ELPD s.e.	4.1
LOOIC	85.8
LOOIC s.e.	8.2
WAIC	85.0
RMSE	1.08

4.3 Intangibles Model

The intercept (37.794) is the average points scored when you zero out the other factors. ORB: -1.201 is the decrease in average points associated with each additional offensive rebound. This makes sense because an offensive rebound will only come with missed shots, but is not something that should be considered a negative aspect to offense. AST: 1.386 is the increase in average points associated with each additional assist. Pace: 0.881 is the increase in average points associated with each additional team possession. TOV: -2.558 is the decrease in average points associated with each additional turnover. This makes sense because it means that your team would miss out on the entire possession meaning you score no points as well as it took time out of the clock which gives you less possessions overall to play the game.

4.4 Defense Model

The intercept (99.952) is the average points scored when you zero out the other factors. ORB: -1.201 is the decrease in average points associated with each additional offensive rebound. This makes sense because an offensive rebound will only come with missed shots, but is not something that should be considered a negative aspect to offense. AST: 1.386 is the increase in average points associated with each additional assist. Pace: 0.881 is the increase in average points associated with each additional team possession. TOV: -2.558 is the decrease in average points associated with each additional turnover. This makes sense because it means that your team would miss out on the entire possession meaning you score no points as well as it took time out of the clock which gives you less possessions overall to play the game.

Table 5: Defensive Importance in Scoring

	Avg Points Per Game
(Intercept)	92.952 (29.250)
STL	-12.497 (2.902)
BLK	3.372 (3.480)
PF	-0.913 (0.623)
DRB	3.321 (0.390)
Num.Obs.	24
R2	0.879
R2 Adj.	0.847
Log.Lik.	-53.320
ELPD	-58.7
ELPD s.e.	4.4
LOOIC	117.4
LOOIC s.e.	8.8
WAIC	116.3
RMSE	2.18

These statistics may work well together as an increase in pace means that teams have more possessions in the game, and since offensive rebounds lessened ()

5 Discussion

5.1 First discussion point

5.2 Second discussion point

5.3 Third discussion point

5.4 Weaknesses and next steps

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