Did Stephen Curry Revolutionize the Three-Point Shot in The NBA?

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For: Mr. Fox

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Introduction:

The NBA has seen many revolutions, such as taller players playing multiple positions, as seen through Magic Johnson, a 6ft 9 point guard who paved the way for taller players to play the guard position. One of the most recent revolutions basketball has seen is the shooting revolution and specifically the use of the three-point shot. To avid watchers of the NBA, it is generally known the offensive capabilities of players, especially shooting, has significantly increased as years have passed. In the 1900s and early 2000s, centers and power forwards would never think about attempting three-pointers, while in this generation of NBA, it is excepted that everyone can shoot (with exceptions) if they wish to have a spot on the team. The player who is mainly credited with starting this revolution is Stephen Curry (Verma, 2022). Curry is a 4x NBA champion, 2x NBA MVP, and 9x NBA All-Star (*NBA Players*, n.d.), known for his sharp three-point shooting. I want to determine if there is statistical evidence that Curry influenced basketball in the NBA, specifically referring to how three-point attempts, three-point field goal percentage, free-throw percentage, and average points per game have changed throughout the history of the NBA.

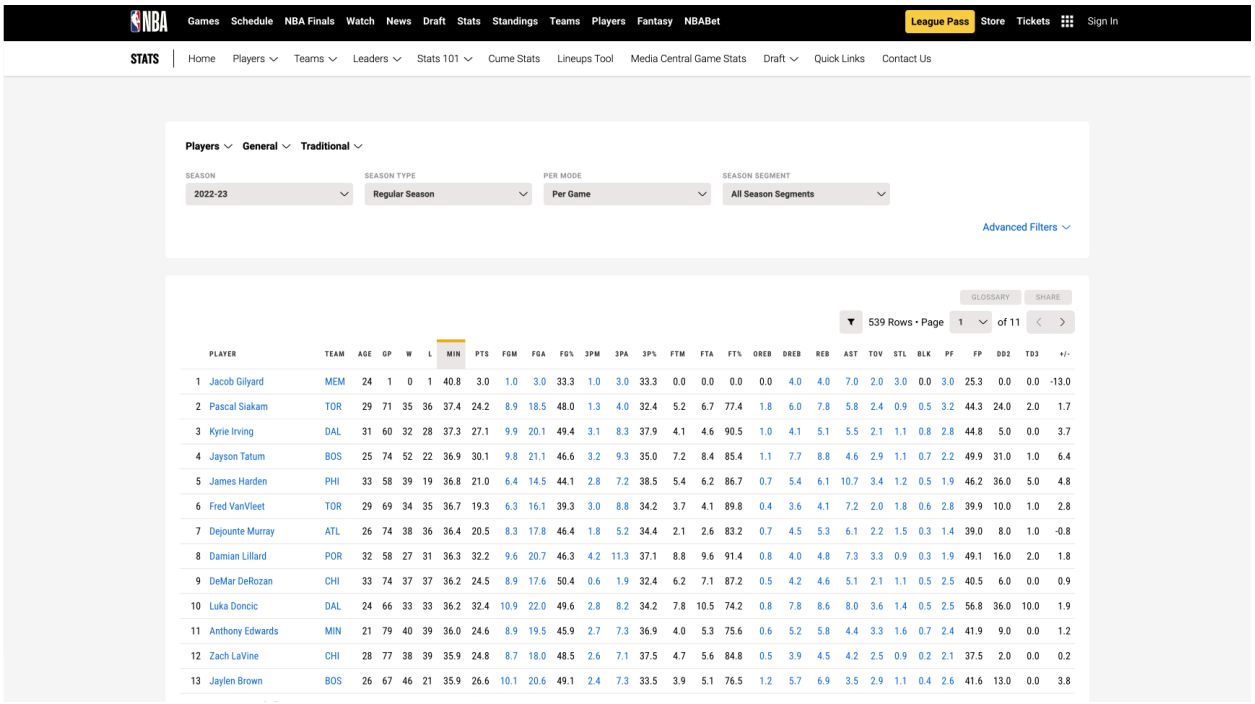
Data Collection:

For my samples, I took all of my data from nba.com/stats (*NBA Advanced*, n.d.). I took players throughout the NBA's history and recorded their average points per game, average three-point attempts per game, three-point field goal percentage per game, and

free-throw percentage. I decided to use stratified random sampling to select the players and stratified by year and by position. I chose to stratify by year to get an equal proportion of players each year to see the progression of the variables I decided on. I also chose to stratify by position (guard, forward, center) because, in basketball, the position you play often affects a player's shot tendency; for example, guards are more likely to shoot three-pointers while centers are less likely to shoot three-pointers, so I wanted an equal proportion of players at each position as if I selected a large number of centers the data would be skewed to fewer three-pointers. I only looked at regular season stats and averages per game for the actual data I took.

To select the players, I used a random number generator to reduce bias. I generated ten numbers between 1-100 for guards and forwards and five numbers between 1-50 for centers, then selected players corresponding to those numbers based on the average minutes played per game. I only generated five numbers/players for centers because in basketball, a "Guard" and "Forward" can be considered two positions (Point Guard, Shooting Guard, Small Forward, Power Forward, respectively), while there is only one center position. I also generated numbers between 1-100 and 1-50 because I wanted to select players that actually played, therefore having meaningful data; I did not want to choose a player with low minutes played per game average as it could skew the data. If I got the same player twice within the same year, I generated another random number and chose that player instead. I started this process in 1996-1997 and went up every other year (1998-1999, 2000-2001, etc.) till the current year (2022-23). I chose to do every other year because I did not have enough time to select players from every single year.

Raw Data



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Players General Traditional

SEASON: 2022-23 | SEASON TYPE: Regular Season | PER MODE: Per Game | SEASON SEGMENT: All Season Segments

Advanced Filters

GLOSSARY SHARE

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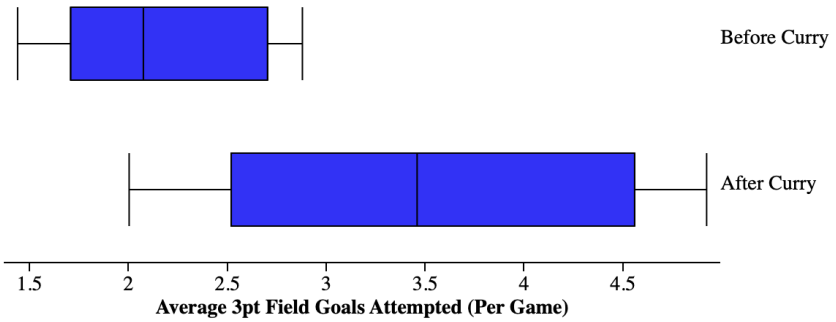
	PLAYER	TEAM	AGE	GP	W	L	MIN	PTS	FGM	FGA	FG%	3PM	3PA	3P%	FTM	FTA	FT%	OREB	DREB	REB	AST	TOV	STL	BLK	PF	FP	DD2	TD3	+/-
1	Jacob Gilyard	MEM	24	1	0	1	40.8	3.0	1.0	3.0	33.3	1.0	3.0	33.3	0.0	0.0	0.0	0.0	4.0	4.0	7.0	2.0	3.0	0.0	3.0	25.3	0.0	0.0	-13.0
2	Pascal Siakam	TOR	29	71	35	36	37.4	24.2	8.9	18.5	48.0	1.3	4.0	32.4	5.2	6.7	77.4	1.8	6.0	7.8	5.8	2.4	0.9	0.5	3.2	44.3	24.0	2.0	1.7
3	Kyrie Irving	DAL	31	60	32	28	37.3	27.1	9.9	20.1	49.4	3.1	8.3	37.9	4.1	4.6	90.5	1.0	4.1	5.1	5.5	2.1	1.1	0.8	2.8	44.8	5.0	0.0	3.7
4	Jayson Tatum	BOS	25	74	52	22	36.9	30.1	9.8	21.1	46.6	3.2	9.3	35.0	7.2	8.4	85.4	1.1	7.7	8.8	4.6	2.9	1.1	0.7	2.2	49.9	31.0	1.0	6.4
5	James Harden	PHI	33	58	39	19	36.8	21.0	6.4	14.5	44.1	2.8	7.2	38.5	5.4	6.2	86.7	0.7	5.4	6.1	10.7	3.4	1.2	0.5	1.9	46.2	36.0	5.0	4.8
6	Fred VanVleet	TOR	29	69	34	35	36.7	19.3	6.3	16.1	39.3	3.0	8.8	34.2	3.7	4.1	89.8	0.4	3.6	4.1	7.2	2.0	1.8	0.6	2.8	39.9	10.0	1.0	2.8
7	Dejounte Murray	ATL	26	74	38	36	36.4	20.5	8.3	17.8	46.4	1.8	5.2	34.4	2.1	2.6	83.2	0.7	4.5	5.3	6.1	2.2	1.5	0.3	1.4	39.0	8.0	1.0	-0.8
8	Damian Lillard	POR	32	58	27	31	36.3	32.2	9.6	20.7	46.3	4.2	11.3	37.1	8.8	9.6	91.4	0.8	4.0	4.8	7.3	3.3	0.9	0.3	1.9	49.1	16.0	2.0	1.8
9	DeMar DeRozan	CHI	33	74	37	37	36.2	24.5	8.9	17.6	50.4	0.6	1.9	32.4	6.2	7.1	87.2	0.5	4.2	4.6	5.1	2.1	1.1	0.5	2.5	40.5	6.0	0.0	0.9
10	Luka Doncic	DAL	24	66	33	33	36.2	32.4	10.9	22.0	49.6	2.8	8.2	34.2	7.8	10.5	74.2	0.8	7.8	8.6	8.0	3.6	1.4	0.5	2.5	56.8	36.0	10.0	1.9
11	Anthony Edwards	MIN	21	79	40	39	36.0	24.6	8.9	19.5	45.9	2.7	7.3	36.9	4.0	5.3	75.6	0.6	5.2	5.8	4.4	3.3	1.6	0.7	2.4	41.9	9.0	0.0	1.2
12	Zach LaVine	CHI	28	77	38	39	35.9	24.8	8.7	18.0	48.5	2.6	7.1	37.5	4.7	5.6	84.8	0.5	3.9	4.5	4.2	2.5	0.9	0.2	2.1	37.5	2.0	0.0	0.2
13	Jaylen Brown	BOS	26	67	46	21	35.9	26.6	10.1	20.6	49.1	2.4	7.3	33.5	3.9	5.1	76.5	1.2	5.7	6.9	3.5	2.9	1.1	0.4	2.6	41.6	13.0	0.0	3.8

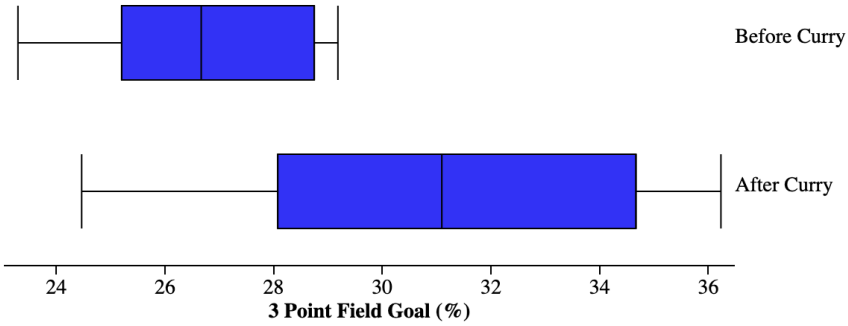
Data Display/Data Analysis



Summary Statistics

Group Name	n	mean	SD	min	Q_1	med	Q_3	max
1: Before Curry	7	2.178	0.547	1.44	1.708	2.076	2.704	2.88
2: After Curry	7	3.458	1.113	2.004	2.52	3.46	4.56	4.924

Looking at the boxplots for average three-point field goals attempted and three-point field goal percentage, there is a clear difference between the years before (before 2009) and after Curry (after 2009). The median 3pt attempts after Curry (3.458) are greater than the

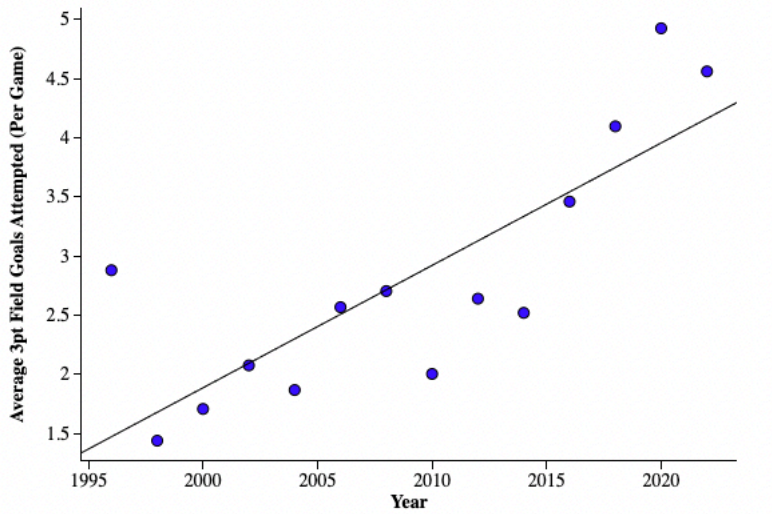


Summary Statistics

Group Name	n	mean	SD	min	Q_1	med	Q_3	max
1: Before Curry	7	26.742	2.03	23.296	25.204	26.668	28.748	29.184
2: After Curry	7	30.618	4.044	24.468	28.076	31.096	34.668	36.232

median three-point attempts before Curry (2.178), and the median three-point field goal percentage after Curry (31.096%) is also greater than the median three-point attempts before Curry (26.668%). In fact, the median for both variables after Curry is greater than the max for both variables before Curry. Both boxplots for after Curry also have a greater range, and IQR shows a large variability, indicating that after Curry was drafted, the tendency to shoot 3-pointers and the average player's ability to shoot three-pointers increased drastically. In addition, every value in the 5-number summary for both boxplots after Curry exceeds their respective value before Curry.

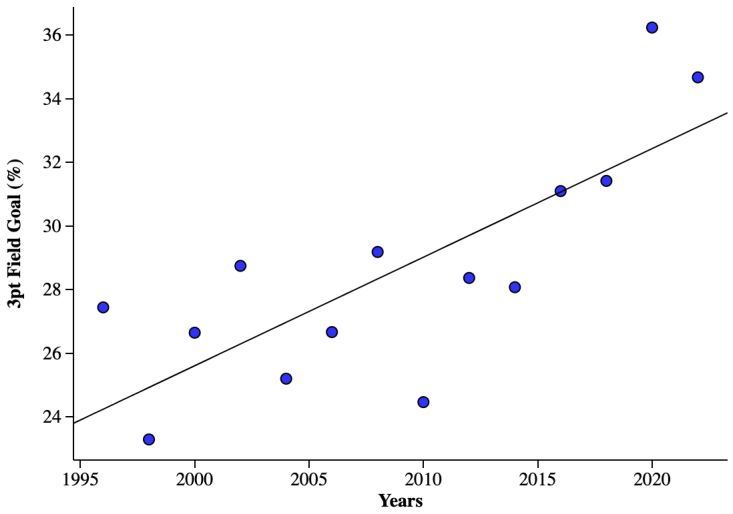
Scatterplot



Equation	n	s	r^2
$\hat{y}$ = -204.9703 + 0.1034x	14	0.66	0.651

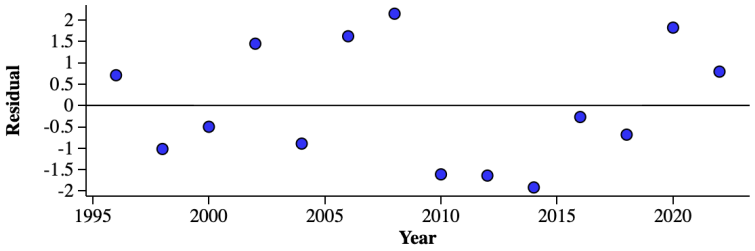
$r = 0.807$

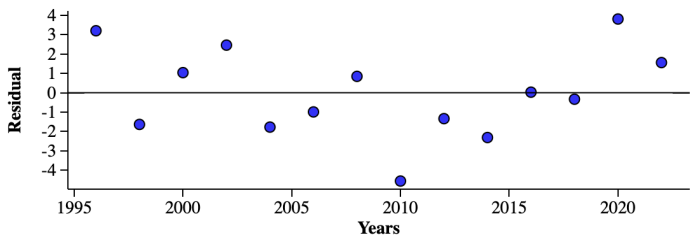
Scatterplot



Equation	n	s	r^2
$\hat{y}$ = -656.3672 + 0.34099x	14	2.409	0.603

$r = 0.777$

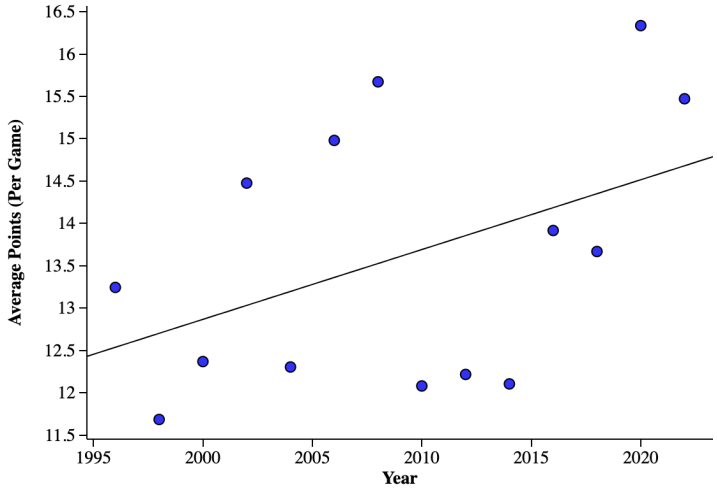




At first glance, the scatterplots for average three-point field goals attempted, three-point field goal percentage, free-throw percentage, and average points generally show a steady increase from 1996 - 2023. However, the story the graphs show is more complex upon a closer look. For the scatterplots for average three-point field goals attempted, three-point field goal percentage, and average points, it seems that from 1996-2010 they steadily increased, then they suddenly dropped, the largest drop being average points per game. In fact, the residual plots for three-pointers attempted and three-point field goal percentages show an up-down-up pattern, indicating that a curve would likely be a better fit for these graphs. You can see this effect on the graph, as after 2010 (around the time when Curry was drafted), the scatterplots show a sharp rebound, bouncing back up and increasing at a faster rate than previously seen, making those data points look similar to an exponential function. This evidence supports the conclusion that the rate of three-point attempts and three-point field goal percentage increased as soon as Curry entered the NBA and kept rising as his career continued.

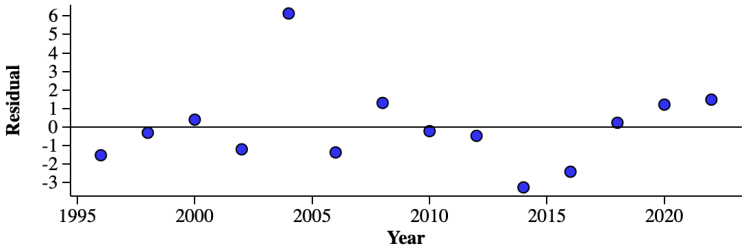
Similar to the three-point attempts and three-point field goal percentage graphs, the average points per game scatterplot shows that from 1996-2009 the average points increased, then after the 2009-2010 NBA season, the average number of

Scatterplot



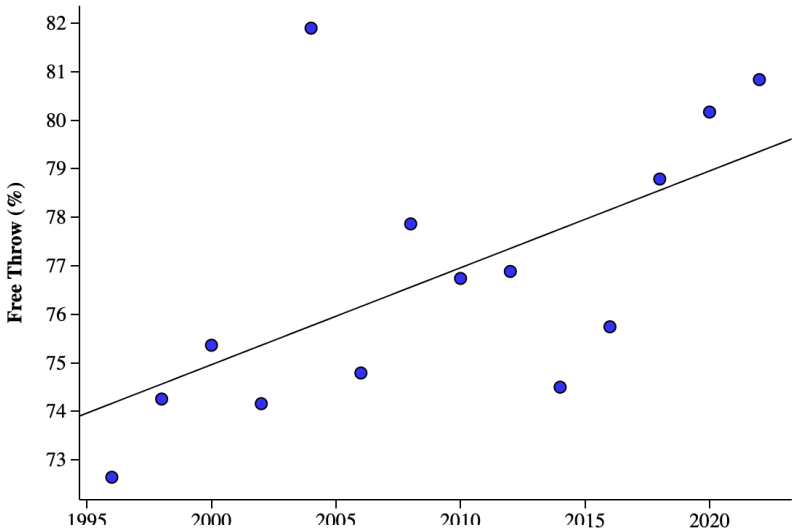
Equation	n	s	r^2
$\hat{y} = -152.038998 + 0.0825x$	14	1.453	0.196

$r = 0.443$



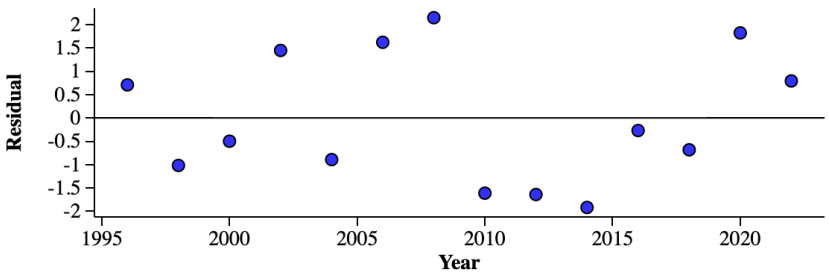
points dropped then increased sharply over the next couple of years similar to how the three-point shot attempts and three-point field goal percentage scatterplots. The residual plot also shows a random scatter conveying that a line is more appropriate than a curve. This evidence can support the conclusion that maybe Steph Curry also influenced the average number of points to increase during his time at the NBA.

Scatterplot



Equation	n	s	r^2
$\hat{y}$ = -324.16604 + 0.1996x	14	2.339	0.356

$r = 0.596$



The free throw percentage scatterplot shows that apart from the upwards spike in 2004-2005, the free throw percentage has generally been steadily increasing from 1996 - 2023. If we also look at the residual plot, there is a random scatter of data around 0, conveying that a linear line is more appropriate for this graph rather than a curve. This could be an indication that shooting, in general, has consistently been getting better and that since a line is not appropriate for this graph, Curry has not

affected how good players are at shooting in general, but rather only three-point shots attempts and three-point field goal percentage.

Inference Procedure

Let μ_b be the true mean three-point shots attempted per game before Stephen Curry was drafted.

Let μ_a be the true mean three-point shots attempted per game after Stephen Curry was drafted.

$\alpha - level = 0.05$

$\bar{x}_a = 3.458 \ \bar{x}_b = 2.178$

$S_a = 1.113 \ S_b = 0.547$

Hypothesis:

H_o: $\mu_a - \mu_b = 0$

H_a: $\mu_a - \mu_b > 0$

Independence:

- Stratified Random Sampling: Divided players by year and position to get an equal proportion representative of the NBA's population, then randomly selected using a random number generator
- 175 players < 10% of NBA players after Steph Curry was drafted
- 175 players < 10% of NBA players before Steph Curry was drafted

Sample Size:

- $n_b = 175 \geq 30$
- $n_a = 175 \geq 30$

Sample size conditions are satisfied since both are large enough

We will perform a 1-tailed t-test for a difference in means with a model of

$\bar{x}_a - \bar{x}_b \sim t_{8.739}$

Test Statistic:

Test-Statistic $= (Statistic - Parameter) / Standard\ Error$

$= [(\bar{x}_a - \bar{x}_b) - 0] / \sqrt{(S_a^2/n_a) + (S_b^2/n_b)}$

$= [(3.458 - 2.178) - 0] / \sqrt{(1.113^2/7) + (0.547^2/7)}$

$= 2.731$

P-Value:

P-Value $= P(t_{8.739} > 2.731)$

$= 0.0119$

Conclusion

Since p = 0.0119 < α = 0.05, we reject the null and accept the alternative. The data collection results suggest that the true mean three-point shot attempts went up after Stephen Curry was drafted. However, since I did not do an experiment, I cannot definitively say that Stephen Curry was the cause of why the average field goal %,

three-point attempts, three-point field goal %, and average points increased after he was drafted; there could be other reasons as to why these variables increased. Nevertheless, we can speculate as to why these variables increased, as since the graphs of three-point attempts, three-point field goal percentage, and average points per game show a similar trend, they could be related to each other. We already concluded from the three-point field goal percentage and free-throw percentage graphs that more players are getting better at shooting, regardless of Stephen Curry. If more players are attempting more threes because of Curry (or not), three-pointers are worth more than two-pointers causing average points to increase or decrease based on three-pointers attempted per game.

I must also point out how strange three variables started to increase from 1996 - 2010, then suddenly dipped. In the year 2010, I do not think anything catastrophic would've caused this decrease, as I know the NBA lockout happened the year after, so I am not sure as to why the variables suddenly dipped; it could possibly be due to the natural progression (or regression) of NBA and basketball players (Thompson, 2011). However, I can suggest that Curry could possibly be the reason or one of why these variables increased at a drastic rate from 2010 - 2023.

Reflection

One thing I wish I had done better was getting more data. Ideally, if I had more time and resources, I could get data from every year of the NBA and select more players from each position in those years. Also, it is very possible I made mistakes when pasting over the variables from nba.com/stats to my spreadsheet, so maybe if I had more time, I

could have myself or another person double-check my data.

I would also tweak the way I got my data. Randomizing and taking the top 50 or 100 players based on minutes played per game was not the most optimal way to do it. Every year the minutes vary between the top 50 and 100. For example, for 2022-2023, the 100th player's average minutes played was 30.4, while for 1996-1997, the 100th player's average was 31.6. The difference between those two years is not significant, but I think it would have been more effective to have a hard stop at minutes, for example, taking every player above 20 minutes played and then using the random number generator to select a player. Also, while looking at the data, I noticed that some of the players had a high average of minutes played per game but only played one or a few games. This consequently doesn't give me the best data as it would be better if they played many games so their averages are more representative of the player. For example, in 2022-2023, Jacob Gilaryd had the highest average minutes played with 40.8, but he only played one game throughout the year. This typically happens in the NBA because the last couple of regular season games does not matter for some teams, so they play their bad players that don't see much playing time to give them experience while resting the good ones. To combat this, I would then add more restrictions to the data collection, such as if the player has played in less than 25 games, then generate another player.

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