Comparing Regular Season and Postseason Basketball

By: Nate Cull, Ben Siglow, Ben Reutelshofer

Abstract:

With how much the regular season has changed in the last 20 years and how Covid may affect the future of the NBA season, one may wonder if there is a difference between the play in the regular season and the postseason. To further explore this information, we look into many of the traditional box score stats for each team between 2000 and 2020. Using data visualization, box scores were reviewed against traditional tropes and other expectations to support further exploration. We review box score comparisons in the overall level, the individual statistic level, and team level comparison on individual statistics and overall team performance in further investigation.

Problem Statement:

The regular season of the NBA is long and diverse, and at times teams showing unbelievable performance in the regular season cannot perform to complete success in the postseason. We hope through data exploration, visualization, and hypothesis testing at multiple levels. We hope to determine if regular season performance is significantly different than the postseason.

Data Overview:

Data was scraped directly from Basketball-Reference from 2000 - 2020. This data includes four separate tables used in tandem with each other. The first set of data had the box scores of each team in the NBA during the regular season from the last 20 years. This included 625 rows of data and 22 statistics. The same variables were included in the scrape of the team's box scores in the postseason. The second data frame had 336 rows of team data. As expected, the number of teams involved in the modern NBA playoffs is almost half of all the teams, and therefore, we have nearly half the number of observations. Flipping to the defensive data, basketball reference was again scraped, looking specifically at the opponent's box score of how teams perform against our observed team. The regular season table resulted in 22 variables and 625 rows, while the postseason table had 336 rows with 22 variables. Two major takeaways from this data are the skew between postseason and regular season amount. The playoff data is nearly half and may skew some future findings. It is also reasonable to note the scraped data was already in averages of the season (82 games). As we plan to test this data specifically through t-tests and Hoteller's t-test, we find it acceptable to use these average scores rather than per game score because we are merely taking the average of averages to compare the aforementioned tests.

Exploratory Analysis:

When conducting some exploratory analysis, we wanted to compare the mean and standard deviations of some common box score statistics in the regular season and postseason. When analyzing basketball, we always hear common dialogue points about the differences between regular-season basketball and playoff basketball. Delving into some of these theories will be the root of our explanatory analysis. In Figure 1, we compare fouls per game in the regular season and postseason. A common idea is that playoff basketball is much more physical compared to the regular season, and we do see some semblance of that with a higher average number of fouls in the postseason. Figures 2 and 3 both look at the impact of defense in the playoffs. It is thought that in the playoffs scouting reports and familiarity is a lot stronger, leading to better defense. The two figures show very little difference in points per game and turnovers per game in the playoffs and regular season. Based on this exploration, further investigation is required to determine if we support the idea playoff basketball is significantly different from regular season basketball.

Comparison Model:

After reviewing exploratory visualizations and previous beliefs on the playoffs, it seems applicable to continue with our planned testing. In the following section, we will be using two specific methods: Hotelling's t-test to compare multiple stats and the traditional independent t-test to review the individual statistics. This will be performed on two separate levels. Our defined levels are the entire NBA's regular season and postseason and the individual team's performance in the regular and postseason. Please recall, we are doing all these analyses on both the team's box scores, but also the box score of the team's opponents. In reviewing the team's opponent, box score and value determinations will be inverted because we may want to see our team box score points increase but hope to see our opponents' points decrease.

Overall:

Hotelling:

In an effort to review the whole picture of NBA statistics, we plan to review three complete NBA-level Hotelling tests: stats we would hope to go up, stats we would expect to go down, and the whole stat group. This was to check for any issues in directional change and see how different stat groups may affect the test. Once completing these three stats groups' Hotelling's t-tests, we see p-values showing a significant difference between the regular season and the postseason. This process was repeated, including the three different stat group tests with the defensive box score data. This group of tests all showed p-values depicting significance as well.

T-test:

With multiple independent t-tests, we look further into the box score and review each individual statistic for both the offensive and defensive data set against their playoff counterparts. Once completing these separate t-tests, some interesting results did emerge, showing some of our stats did not show significant differences between each other. These are shown in the following bullets below.

- Offense: 3 points made, 3 points attempted, and free throw percentage
- Defense: 3-point percentage, 2-point percentage, free throw percentage, defensive rebounds, total rebounds

Some related statistics show no significant difference from the regular season to the postseason. These preliminary findings do somewhat fit in that we may not expect some of these stats to change. For example, free throw percentage not changing may be because the free throw is just the player, and players tend to perform consistently at their level.

Team:

Moving forward from the statistical relevance on the whole NBA level, the next area we plan to review will be that of the team level box scores compared to their postseason performance. We need to think about a few things when doing this, specifically how different the number of games played from the regular season to the postseason. For this reason, some constraints were made when using the following tests. Before making any comparison, a team's regular-season stats were matched with their postseason stats, and then the number of playoff appearances were checked. If in the last 20 years the team being compared had not made at least four playoff appearances, they were removed from the analysis due to having such a difference in overall data points. Once this specification was met, each team's stats were reviewed against their postseason stats using the t-tests. After t-testing, the statistics were grouped into eight major categories and then compared using Hotelling's t-test.

T-test:

Once completing the t-test, the results were placed in a chart reviewing the lower critical value and the upper critical value. Before any evaluation, the values that were results of t-tests that had a p-value that was not significant were removed. After this test, as a matter of quantification and determining the "best" teams in the playoffs, we determined an overall "score". The following parameters determined this score. If the lower critical value showed better performance in the postseason when completing the

test, the team was given 2 points. If the upper critical value shows better than regular-season statistics, the team is awarded 1 point. The final team score is the addition of all attribute values. This process was completed on both the offensive and defensive box scores. The resulting top teams will be depicted further in the results section, and a chart showing these teams are in the t-test table in the appendix.

Hotelling's:

Starting Hotelling's t-test, eight subcategories were chosen to group the box score statistics we plan to review as a whole between the regular season and playoffs. The following breakdown is what statistics were used in each specific category in the Hotelling comparison.

- Field goals: Field goals attempted, Field goals made, and Field goal percentage
- 3-point shooting: 3s attempted, 3s made, and 3 percentage
- 2-point shooting: 2s attempted, 2s made, and 2 percentage
- Free throws: Free throw attempted, Free throw made, and Free throw percentage
- Rebounds: Offensive rebounds, Defensive Rebounds, and Total rebounds
- Defense: Steals and Blocks
- Scoring: Assists and Points
- Mistakes: Turnovers and Personal fouls

After the subgroups were made, each team's regular season was matched with their postseason box scores. Each of the eight categories was tested in the Hotelling's t-test between the regular season and postseason. The results of the Hotelling's t-tests were determined to be significant by having a p-value below .05. For the results that show a p-value in the significant range, the mean differences were reviewed of each statistic used within the Hotelling test. The only exception to this is in the shooting statistics (free throws, 3 pointers, and 2 pointers) to not overly score them. The only mean differences reviewed were total field goals made and field goal percentage. The mean differences that showed better performance in the playoffs received a point, and the overall group value is a sum of these results. A breakdown is below.

- Better playoff performance in all attributes of the groups
- Overall group score: 2
- Better playoff performance in one attribute of the group
- Overall group score: 1
- Better playoff performance in none of the attributes of the group

- Overall group score: 0

Once the group values were produced, a final team score was the result of a sum of the group scores. The results of these will be shown further in the results section.

Results:

Hotelling's Overall:

Each of the statistical groups reviewed for both offense and defense show p-values that were negligible to zero. This supports a significant difference in the overall team's box scores between the regular season and the postseason on both the offensive and defensive sides.

T-test Overall:

Referring back to the t-tests section of the comparative models, only a particular group of box scores showed not to be significantly different. However, the majority of statistics when reviewing the regular season to the postseason showed a significant difference. This is shown as well on the defensive statistics. However, more statistics did show no significant difference when reviewing defense.

T-test Team:

Once only reviewing statistics that showed significant differences, some clear leaders in offensive and defensive playoff performance emerged, shown in the t-test comparison chart in our appendix. There is a further discussion on why these teams may have come to the top in the discussion. Based on our methodology, these leaders should have some further review based on this preliminary outcome.

Hotelling's Team:

Once only reviewing the significantly different group values, clear leaders were shown in both defense and offense depicted in the chart in the appendix. These rankings do differ, giving some credence that the resulting performances change when reviewing attributes in a group. As the two groups are different further exploration into why these teams may show as leaders is reviewed in the discussion.

Discussion:

Overall:

Seeing overall significant differences supports the idea there is a significant difference between regular-season performance and postseason performance. There are some concerns moving forward. The first being when comparing playoffs to the regular season, your number of reviewable games will always be vastly different. In future reviews, it may be a good idea to randomly sample the same number of regular-season games from the entire dataset to create matching data points between the regular season and postseason. In addition, the period did give a significant number of results but could be a problem with the extent the NBA has changed as a whole. It may be necessary for the future to constrict the date range when testing regular season and playoff performance.

T-test Team:

The T-test identified the Detroit Pistons, Indiana Pacers, Boston Celtics, Atlanta Hawks, and New York Knicks as the top five teams who performed better in the playoffs compared to the regular season offensively. Looking at the top five teams, one trend that appeared was that many of the teams had stars who were older. Due to their age, these stars tended to not play as many minutes in the regular season compared to the playoffs which could be why these teams tended to perform better offensively in the postseason. One prime example of this was the first ranked team, the Boston Celtics. From 2008 - 2013, three of their best players were Paul Pierce, Kevin Garnett, and Ray Allen who were all in their mid-thirties. Some other teams in the top five who had older stars included the Detroit Pistons and Indiana Pacers.

On the defensive side, the top five teams that performed better on the defensive side of the ball included the Dallas Mavericks, Portland Trail Blazers, San Antonio Spurs, Los Angeles Lakers, and New Orleans Pelicans. We found this interesting because many people consider these two teams as doing the best job at defending Lebron, so it makes sense that they were on the list. In 2011, the Dallas Mavericks were able to defeat the Miami Heat largely due to Shawn Marion’s defense on Lebron. Similarly, the San Antonio Spurs were able to defeat the Miami Heat in 2014 partly due to Kawhi Leonard’s defense on Lebron. Both of these teams are also really well coached by Rick Carlisle and Gregg Popovich so that could also be a reason why they were in the top 5.

Hotelling's Team:

Hotelling's t-test identified the Boston Celtics, Los Angeles Clippers, Sacramento Kings, Cleveland Cavaliers, and Chicago Bulls as performing better in the playoffs compared to the regular season. Looking at the top five teams, one trend between the teams was that they all had really good point guards handling the ball and running the offense. Looking at these five teams, some of these primary ball handlers include Chris Paul, Rajon Rondo, Lebron James, Mike Bibby, and Derrick Rose. When you have an elite point guard running the offense, your efficiency can improve, and your shot selection can improve in the postseason compared to the regular season where the primary ball handler is not playing as many minutes and bench players have the ball more frequently. One team that may be surprising to some people is the Sacramento Kings because they have not made the playoffs in fifteen years. However, the Kings had some good teams in the early 2000's with Chris Webber and Mike Bibby.

On the defensive side, the top five teams that performed better on the defensive side of the ball included the Cleveland Cavaliers, Atlanta Hawks, Indiana Pacers, Golden State Warriors, and Detroit Pistons. The Cleveland Cavaliers being the top team according to this test supports the claim that LeBron James picks up his defensive play in the postseason and might coast sometimes during the regular season. The other teams in this top 5 all have had elite defensive players at some point such as Roy Hibbert, Draymond Green, and Ben Wallace. When you have elite defensive players playing big minutes and guarding the other team's best player, it makes sense that the defensive performance may be better than the regular season where they might not be playing as many minutes or locking in for every game.

Conclusion:

In conclusion, there is outstanding support showing significant differences between regular-season and playoff performance. In the overall reviews of the statistics, the majority of the stat-level t-tests showed significant results, and all versions of the Hotelling's t-test showed significant differences. When reviewing team level data, the resulting rankings showed a massive number of results, many showing significantly different between the regular season and postseason. The ranking method was a cut-off in this project which may need to be tweaked further. In the future, it may be helpful to review player-level changes and determine if some stars perform better in the postseason. Further review and research of possible regressions or predictive models may be beneficial in weighting specific stats more heavily or quantifying how much better or worse play is instead of just significant differences. All and all, we would say there is a significant difference between the regular season and postseason performance.

Appendix:

Figure 1: Fouls Per Game (Regular Season vs. Postseason)

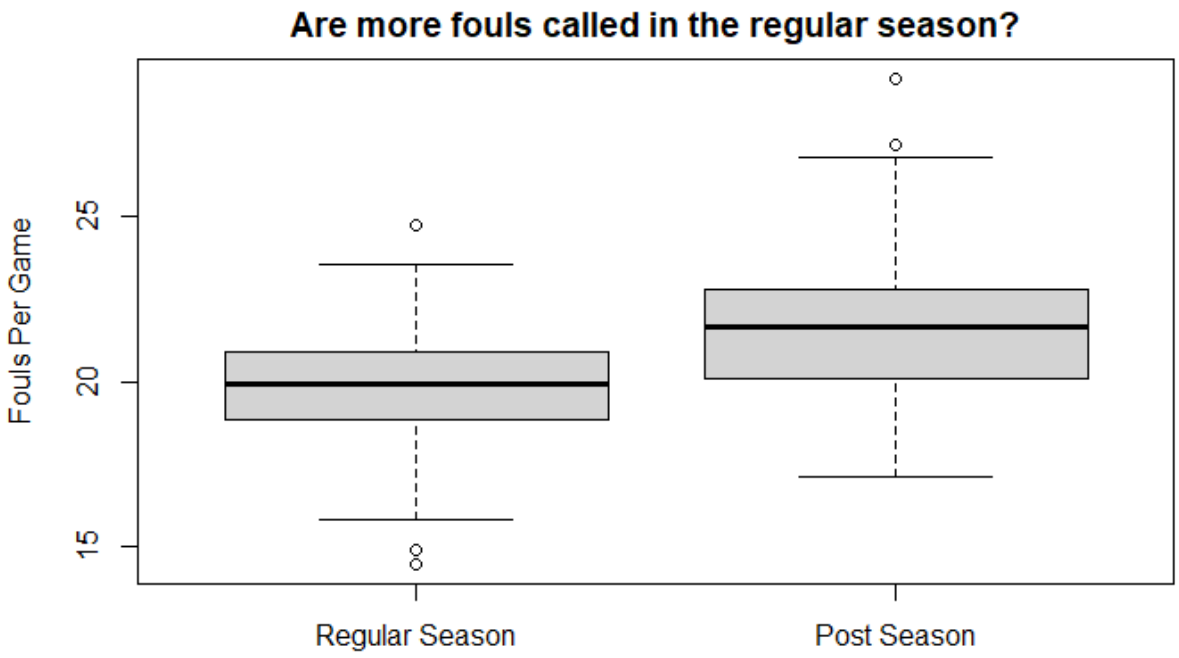


Figure 2: Points Per Game (Regular Season vs. Postseason)

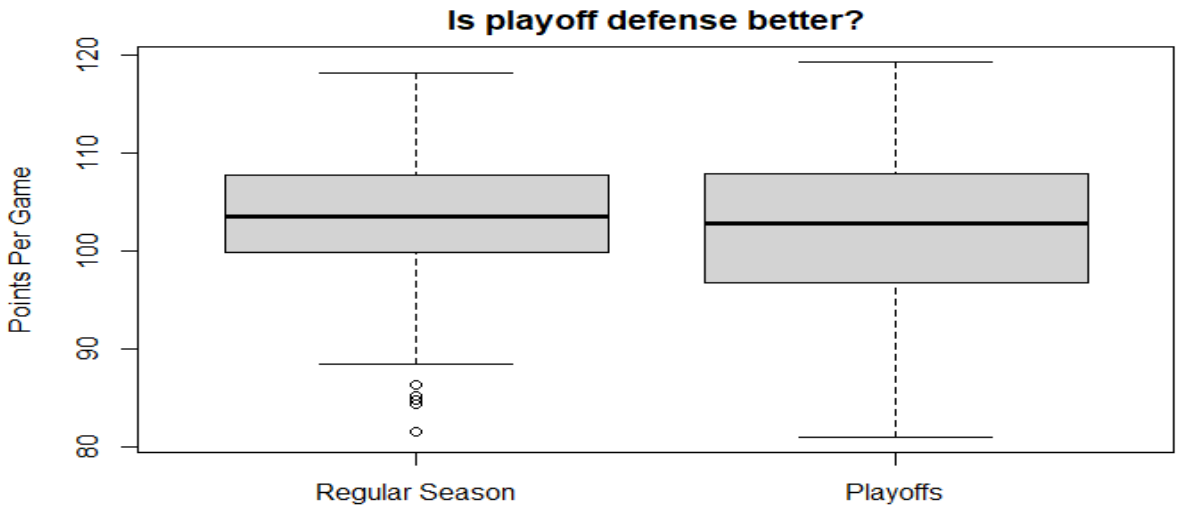
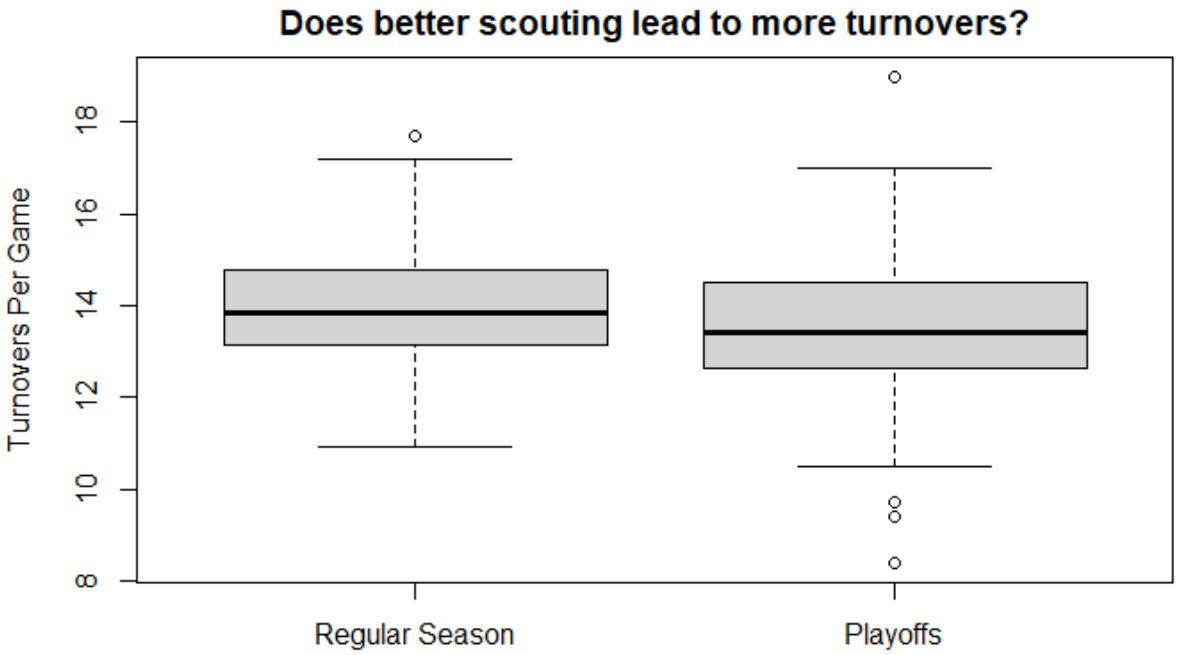


Figure 3: Turnovers Per Game (Regular Season vs. Postseason)



T-test Top Five Teams	
Offense	**Defense**
Detroit Pistons	Dallas Mavericks
Indiana Pacers	Portland Trailblazers
Boston Celtics	San Antonio Spurs
Atlanta Hawks	Los Angeles Lakers
New York Knicks	New Orleans Pelicans

Hotelling's Top Five Teams	
Offense	**Defense**
Boston Celtics	Cleveland Cavaliers
Los Angeles Clippers	Atlanta Hawks
Sacramento Kings	Indiana Pacers
Cleveland Cavaliers	Golden State Warriors
Chicago Bulls	Detroit Pistons