The Changing Dynamics of the NBA Since 1996

INTRODUCTION

The NBA seems to be changing every year as teams are discovering new ways to overcome the hurdle of being a below average team and not making the playoffs. To become a championship contending team, organizations are moving away from the traditional player type and developing teams and strategies focused on skills rather than physical attributes. One key tool organizations are beginning to utilize to become championship-contenders is Data Analytics. While in recent years there has been some controversy regarding the effectiveness of these new strategies as teams venture deeper into the playoffs, there's no doubt that Data Analytics in the NBA has proven to be an effective strategy to turn below average teams into playoff/championship contenders.

DATA

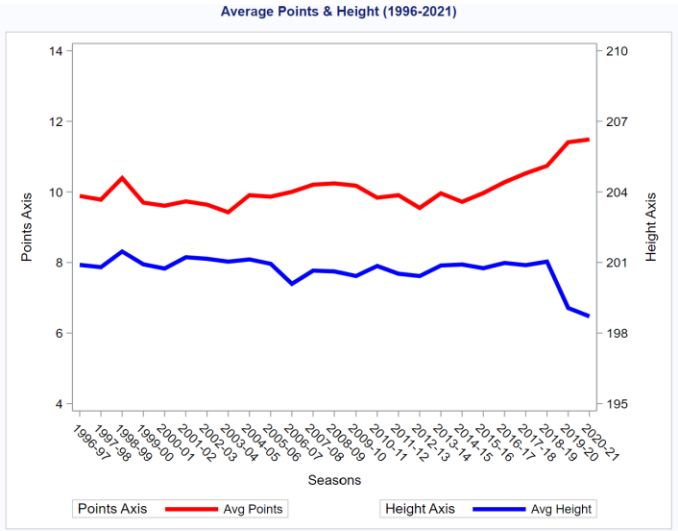
To conduct our analysis, we downloaded the NBA dataset from Kaggle.com as a csv file that contains all seasonal attributes of players dating back to the 1996-97 NBA season. Upon further analysis and confirmation, this Kaggle dataset directly pulls data from the official source of NBA stats: https://stats.nba.com/. Using this csv, we then utilized the "Import" task to open and transform the data within SAS Enterprise Guide. The entire NBA Dataset contains a total of 2,333 observations and 22 different variables. For the majority of the analysis, we incorporated a transformed dataset looking at seasonal averages only for those who played the majority of the regular season. This was done primarily through the use of the "SQL" procedure and the "Summary Statistics" task. Lastly, some of the most important variables used to perform our analysis include 'Player_Name', 'Net_Rating', 'Team', 'Season', 'Gp' (games played), 'Player_height', 'Player_weight', and other common basketball statistics.
Also, it should be worth noting for the purposes of this analysis that the definition for 'Net_rating' is a team's point differential per 100 possessions while the player is on the court, which can be inherently biased based on the makeup of the team.

ANALYSIS

Problem I – Changing Player Attributes Over Time

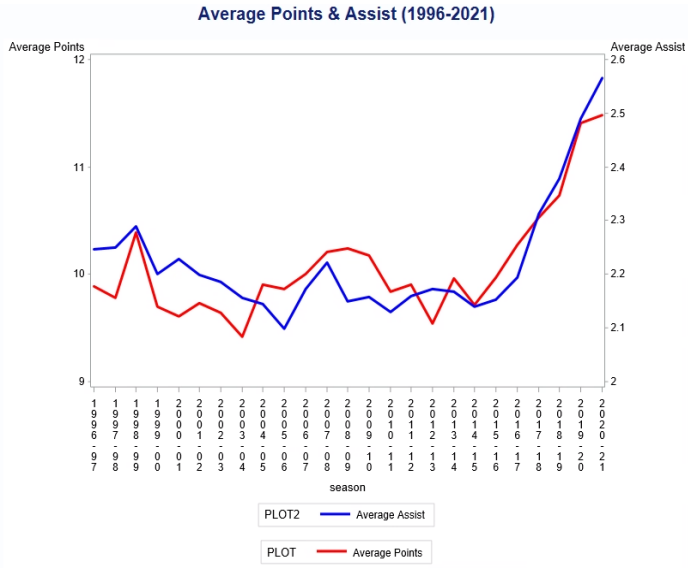
The first problem we wanted to analyze was how the player attributes, for those who played more than half the season, have changed since 1996. For this problem, we decided to view the players' changes with respect to both their physical characteristics as well as their game statistics.

Figure 1



From Figure 1, we can see that the relationship between both the average points and the average height remained relatively stable for much of the time period being reviewed. However, starting in the 2015-16 season we can see that while the average points began to increase the average height began to decrease. Both of these trends, once started, have accelerated into the present-day season. Furthermore, this inverse relationship highlights how organizations are shifting into a "new era" of player dynamics, with a focus on skill based players.

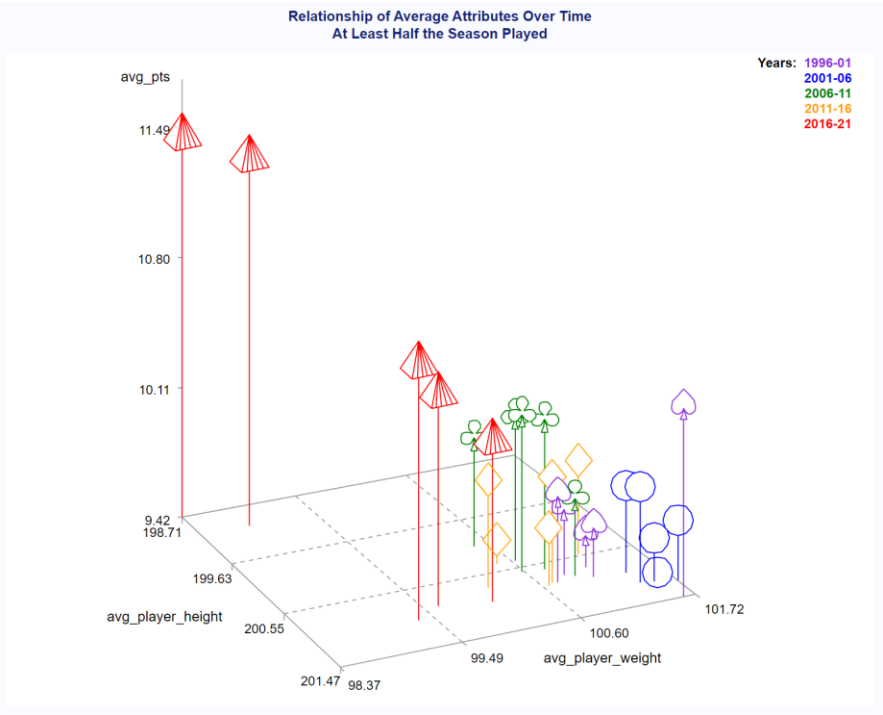
Figure 2



This can be seen in more detail from Figure 2 by looking at the relationship of average points and average assists for each season. Again, we see that from 1996 to the 2014-15 season the relationship between these two attributes remained relatively constant and did not fluctuate from each other. However, following the 2015-16 NBA season both the average assists and the average points begin to skyrocket. This trend, similar to that seen in Figure 1, continues to propel into the

present-day season, highlighting the new focus NBA organizations have around creating fast-paced, high-scoring teams.

Figure 3



Lastly, by looking at the relationship between average points with both average player height and weight we see the same relationships discussed in the previous figures. Focusing on the seasons, we can see that starting in 2016 the average points began to increase compared to prior years.This relationship first showed correlation with a decreasing average player weight, but was further accelerated by a combination of decreasing average player weight and decreasing average player height.

Problem II – Is There a Correlation Between Net Rating and Success?

The second problem we analyzed was the visualization of net rating over time. Comparing the graphs for each team over the years since 1996, the viewer can see the best team's net rating per year for a view into a potential competitive season and long playoff run. Hopefully, ending with a shiny Larry O'Brien championship trophy at the end of the season.

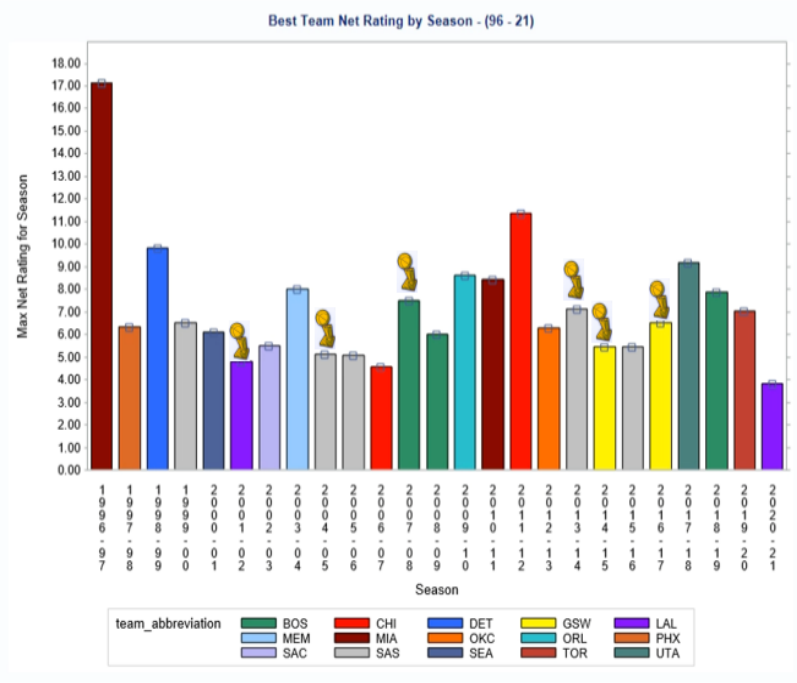


Figure 5 - Best Team Net Rating Per Season (Top)

In Figure 5, we decided to take a look at the net rating of each team and graph a bar chart showing the best Team Net Rating by Season from '96-'21. Also, we labeled any year with a season ending with a championship won, by including a Larry O'Brien trophy emblem above that particular season's team.

From the graph of 25 seasons, we can see a nearly one in four chance that carrying the best Net Rating for that season lands a franchise an opportunity to holster the 24 karat gold finished trophy. I did want to point out the first bar on the graph. This bar belongs to the '96-'97 Miami Heat that managed to carry a bolstering 17.14 net rating for the season. Although Miami managed to produce the best season net rating in the last 25 years, they were met by the statistical anomaly of Michael Jordan. In this particular year, Jordan and the Chicago Bulls beat the Miami Heat in the Eastern Conference finals four games to one, and eventually produced their third title in three years, completing one of few three-peats in NBA history.

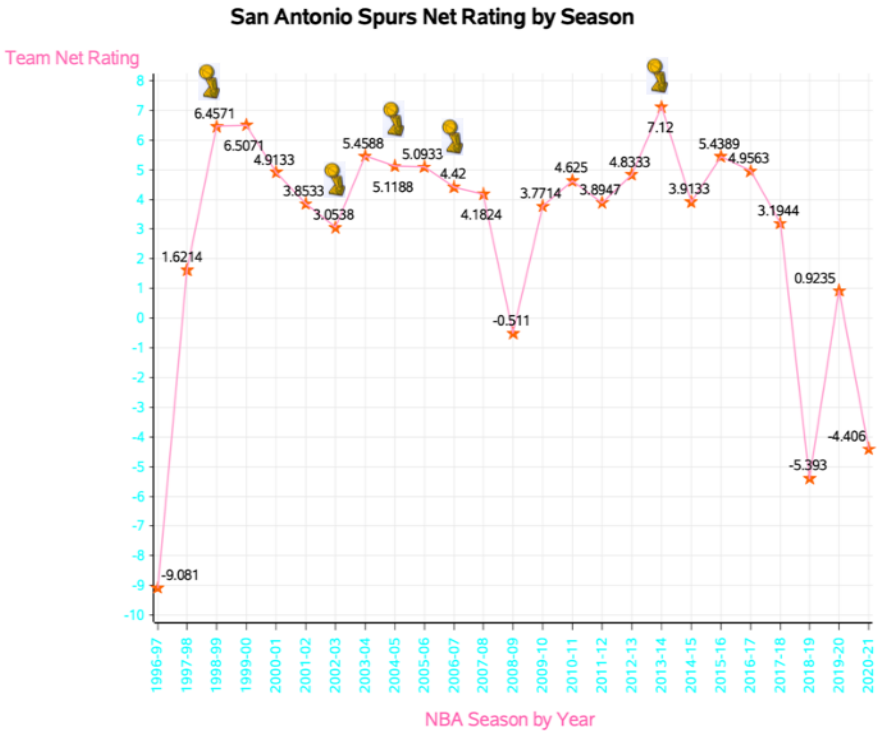
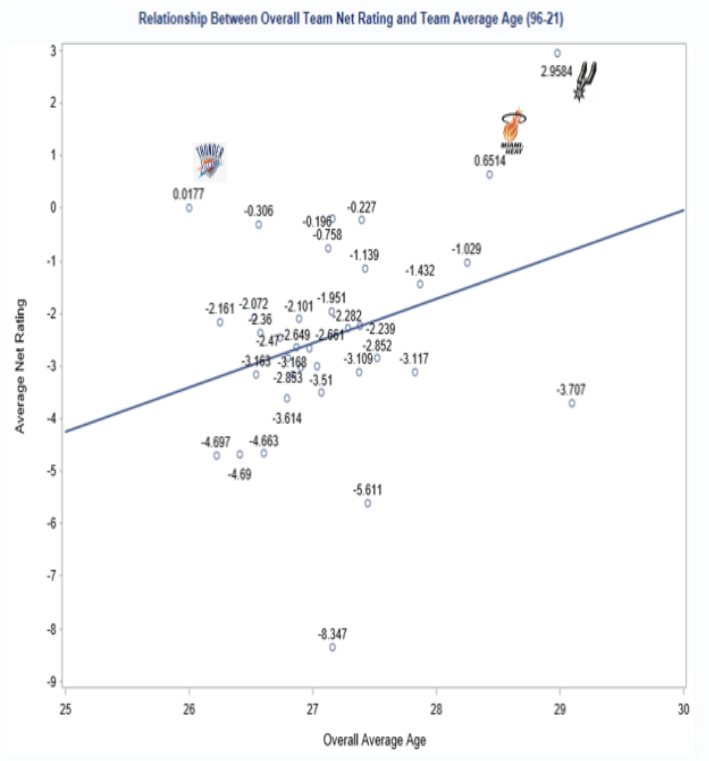


Figure 6 - Spurs Net Rating Over Time (Bottom)

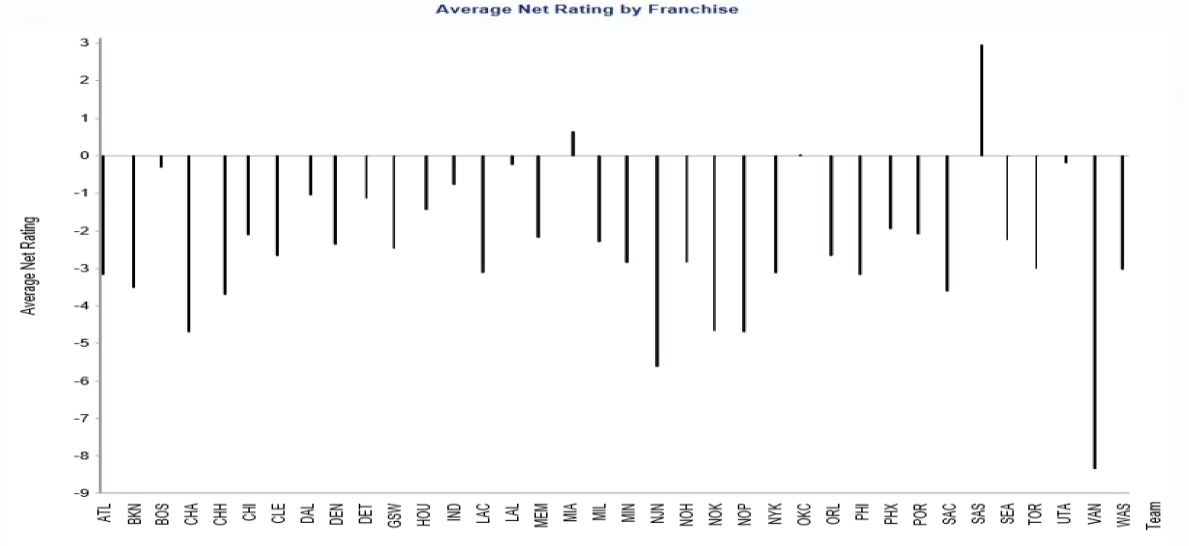
For those familiar with the San Antonio Spurs, in Figure 6, we can visually see the sustained greatness the Spurs have maintained since 1996. The significant dip in the middle of the graph shows a lower net rating for the Spurs' '08-'09 season. Nevertheless, they reached the playoffs each year from '97 to '19. The playoff data from NBA.com provides that any year the Spurs concluded with a net rating score > 1, despite their dip and lower net rating of -.511(2008-09), they qualified to compete in that year's playoffs. Furthermore, the Spurs ended their playoff run early that year, losing with a record of 1-4 and being eliminated by the Dallas Mavericks in the first round. The Spurs captured the record for most consecutive seasons ('98-'19), having reached the playoffs, garnering the small-market franchise a twenty-two-year record. The Spurs also managed to win five championship titles over three decades during this stretch.

Figure 7 - Linear Regression - Net Rating and Age (Below)



In Figure 7, we wanted to see if there was a correlation between overall player age and overall net rating by team.The linear regression scatter-plot identified a positive relationship between the two. Thus, age can have its advantages with veteran leadership and furthering skill sets through NBA Coaching, skill training, and becoming more comfortable with spacing, speed, along with other variables in making a transition from the NBA G League or collegiate play. As we can see from the graph there were only three teams with a positive net rating for each year that team was active in the NBA. Those were, in ascending order, OKC (0.01), MIA(0.65), and the San Antonio Spurs(2.96), holding the best overall net rating of any franchise.

Figure 8 - Average Net Rating by Franchise (Below)



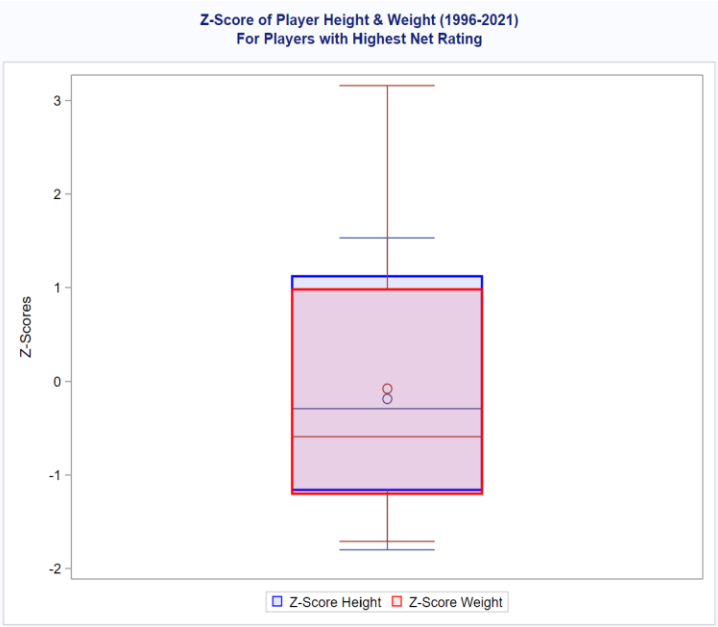
Problem III – The Relationship Between Net Rating and Player Attributes

Thus far we've discussed both the changing player attributes over time and how a player's or team's net rating affects their overall success. Logically, the last problem to analyze is the relationship between the previous two problems. For this analysis, we decided to take the Z-scores of the highest net rating player's attributes from each season (compared to the seasonal averages) as well as the Z-scores of the highest net rating team's attributes from each season. This was done to gain insight as to how net rating and player attributes could possibly be related.

Figure 9 (Left); Figure 10 (Right)

Highest Net Rating with Z-Score Attributes

Player	Team	Season	Rating	z_gp	z_pts	z_reb	z_ast	z_player_height	z_player_weight
Litterial Green	DET	1996-97	17	-1.88	-1.32	-1.36	-0.67	-1.61	-1.28
Shaquille O'Neal	LAL	1997-98	15.6	-0.75	3.33	2.72	0.08	1.53	3.16
Greg Anthony	POR	1998-99	12.7	0.85	-0.76	-1.29	-0.15	-1.8	-1.59
Derek Fisher	LAL	1999-00	13.4	0.69	-0.59	-1	0.31	-1.64	-0.79
Terry Porter	SAS	2000-01	13.3	0.92	-0.4	-0.71	0.45	-1.1	-0.62
Terry Porter	SAS	2001-02	14	0.29	-0.73	-0.85	0.31	-1.13	-0.66
Eduardo Najera	DAL	2002-03	13.9	-1.82	-0.49	0.15	-0.67	0.22	0.39
Jamaal Tinsley	IND	2003-04	13.5	-1.32	-0.2	-0.67	2.05	-1.13	-0.98
Tim Duncan	SAS	2004-05	16.7	-0.17	1.76	2.8	0.3	1.03	1.28
Manu Ginobili	SAS	2005-06	12.1	-0.28	0.83	-0.29	0.79	-0.29	-0.65
Devin Harris	DAL	2006-07	14.1	1.03	0.03	-0.65	0.8	-1.02	-1.28
Kevin Garnett	BOS	2007-08	17	0.13	1.43	1.92	0.61	1.12	-0.08
Ben Wallace	CLE	2008-09	17.9	-1.11	-1.23	0.94	-0.71	0.56	0.66
Anderson Varejao	CLE	2009-10	12.6	0.61	-0.28	1.36	-0.56	1.13	1.39
Omer Asik	CHI	2010-11	14	1.16	-1.25	-0.16	-0.88	1.37	1.21
Jimmy Butler	CHI	2011-12	18.8	-2.02	-1.38	-1.26	-0.96	0.02	-0.12
Mario Chalmers	MIA	2012-13	14.6	0.76	-0.18	-0.77	0.7	-1.41	-1.21
Andre Iguodala	GSW	2013-14	13.7	-0.39	-0.12	0.2	1.09	-0.31	-0.57
Stephen Curry	GSW	2014-15	17	1.12	2.77	0.04	3.12	-1.16	-1.2
Draymond Green	GSW	2015-16	18.9	1.12	0.74	2.19	2.9	-0.01	0.35
KJ McDaniels	HOU	2015-16	18.9	-2.7	-1.39	-1.28	-1.02	-0.29	-0.61
JaVale McGee	GSW	2016-17	18.7	0.8	-0.7	-0.42	-1.06	1.38	1.91
Nene	HOU	2017-18	17.1	-1.42	-0.7	-0.36	-0.77	1.15	1.24
Stephen Curry	GSW	2018-19	13.7	0.27	2.78	0.36	1.52	-1.26	-1.21
Giannis Antetokounmpo	MIL	2019-20	15.4	0.43	2.92	3.74	1.61	1.41	0.98
Mike Conley	UTA	2020-21	16.7	-0.72	0.74	-0.4	1.72	-1.59	-1.71

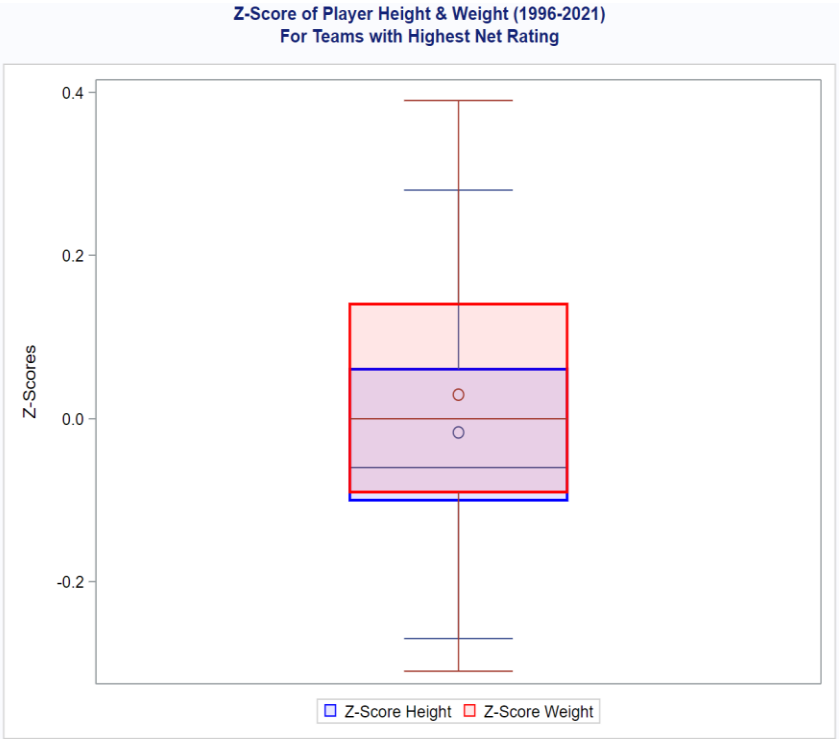


Looking at the distribution of the Z-scores of the weight and height from Figure 8, taken from the highest net rating players from each season in Figure 8, we notice some interesting relationships. First, focusing on Figure 8, notice how the majority of the players are widely considered by many to be prolific, game-changing players, which reinforces our findings in Problem II. However, there does appear to be some players who are less prolific and who may have inflated net rating scores due to the variable's bias towards the players' teammates. Interestingly enough, though, by looking at their

respective attributes' Z-score in Figure 9, we can see that both the median and mean of the highest net rating players' height and weight fall below the seasonal averages of these attributes (Z-score < 0). In other words, the majority of players who had the highest net rating for the season had average and median height and weight that was smaller than the rest of the NBA.

Figure 11 (Bottom)

Next, by looking at the seasonally-normalized average attributes taken from the teams who had the highest net rating from each season, we can see a slightly similar story. Focusing on the distributions of height Z-scores from Figure 10, there appears to be a relationship with higher team net rating and lower team height, as seen by the median and mean for Z-score height being below zero. However, the relationship between team weight and team net rating appears to follow a normal distribution that falls directly in line with the seasonally adjusted average weight of the whole association. While in both distributions (Figure 9 & 10) there's not a definitional statistical difference between the attributes of the highest net rating players and teams in comparison with the rest of the association, one could use these findings more as suggestive guidance moving forward into future seasons.



FURTHER ANALYSIS

Because the sport of basketball changes as the season progresses and changes even more so once the playoffs begin (when success is measured by multiple series wins rather than individual game wins) an additional layer that could potentially provide more context to the previously discussed problems would be the time aspect within each season. This would be especially useful when analyzing teams' performance during series play and how the teams' attributes contribute to series wins.

CONCLUSION

By utilizing the NBA's player attributes and team data through the use of data analytic techniques, organizations can now gain insights as to how the professional sport of basketball may continue to evolve and what potential attributes to look for in future prospects. From our analysis, one could conclude that the changing sport of basketball has made organizations more focused on skill-based, high-speed players, who ultimately create significant positive point differentials for their team.