

A Pareto Principle Analysis of the NBA: How Production Distribution Affects Team Success

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Abstract

The Pareto Principle, also known as the 80/20 rule, states that in general “80 percent of consequences stem from 20 percent of causes” (Bunkley, 2008, p. 1). This research examines the relationship between the 80/20 rule and the National Basketball Association (NBA) with respect to the distribution of individual player production through secondary data analysis and linear regression modeling. While there are only so many superstars to go around, this research examines the Pareto Principle as an analytic dashboard metric that league executives can look at to try to find success in the “Big Three Era.” Regression modeling from ten NBA seasons (2008/09 – 2017/18) shows a negative correlation between the 80/20 Principle and regular season wins, suggesting that NBA franchises be cautious of constructing top-heavy rosters. The equation and term “Simple Game Score” (SGS) is also introduced as a unique statistic.

Introduction

The purpose of this paper is to introduce a unique resource metric that both National Basketball Association (NBA) general managers and coaches can utilize longitudinally for roster construction within team analytic dashboard software (Athithya, 2019) where performance stats are represented in an interactive format. Additionally, the equation and term “Simple Game Score” (SGS) is also introduced as a unique statistic. This study continues the *Global Sport Business Journal* Pareto Principle discussion, brought forward in the article “A Pareto principle analysis of the NHL: Why ice hockey is the ultimate team game” (Lupinek, Chafin, & Arkell, 2017), by utilizing an 80/20 Principle theoretical framework to analyze whether NBA team success is influenced by the amount of production the top 20% of rostered players produce relative to the rest of the team. The 80/20 Principle states that in general “80 percent of consequences stem from 20 percent of causes” (Bunkley, 2008, p. 1). Contextually, the Pareto Principle is a framework baseline as the percentages are not always equal to 80% and 20%. The 80/20 rule illustrates the importance of the “vital few”, the small number of inputs that generally affect the outcome in any given situation.

Of the four major North American professional sports (basketball, football, baseball, & hockey), basketball is arguably the sport where star players have the largest impact on team success. There are only five players on the court at a single time, compared to 11 in football, nine in baseball, and six in hockey. Additionally, each player in a basketball game is free of positional constraints. A star basketball player can control the ball for an entire possession, plays both offense and defense, and can shoot an unlimited amount of times. The impact that stars in other sports have on their team’s success is limited by the mere structure of the sport. For example, a star baseball player cannot step up to bat more often when he is confident in his swing, and he must still be reliant on the other eight batters while he waits in the dugout, not to mention

pitching. In basketball, when a star player such as Stephen Curry is on a hot streak, he can theoretically shoot the ball on every offensive possession and play for the entirety of the game. On balance, it appears that the vital few on a modern NBA roster disproportionately impact their team's success when compared to the other major North American professional team sports.

Many NBA managers believe that the most likely road to success for NBA teams is to acquire as many star players as possible (Silver, 2017). "Super Teams", or teams that have a collection of high performing star players, have been a part of the NBA almost from its inception (Aschburner, 2017). However, in recent years, it has become more common for star players to join together as free agents or through forced trades. Modern star players are changing teams at a younger age and faster pace than ever before (Paine, 2018). The "Big Three" era, meaning teams having three star players, arguably started in 2007 when the Boston Celtics acquired Ray Allen and Kevin Garnett through trades to team up with Paul Pierce (Thompson, 2015). In response, in 2008, the Los Angeles Lakers acquired Pau Gasol to team with Kobe Bryant and Lamar Odom (Ganguli, 2020). Additionally, in 2010 the Miami Heat put three perennial all-stars together when they signed LeBron James and traded for Chris Bosh to team with Dwyane Wade (Chiang, 2019). These three teams played in all seven of the NBA finals from 2008 to 2015, winning five of them. This research team believes that it is no coincidence that 2015 was the year the run ended, as that was the year LeBron went back to Cleveland and Cleveland traded for all-star Kevin Love to join LeBron and fellow all-star Kyrie Irving. Cleveland played in the next four championships (2015 – 2018), winning one of them in 2016.

This success has led to teams trying to emulate the big three team composition. However, while it is evident that the clearest path to competing at a championship level is to acquire star players (Silver, 2017), pursuing a top-heavy roster does not guarantee regular season or playoff success. There are myriad reasons a team may not live up to expectations even with prominent players on the roster, including lack of chemistry, non-complimentary skill sets, aging star players, and injuries.

For example, the Los Angeles Lakers have had two star filled teams within recent decades that did not fully live up to expectations. In the 2003/04 NBA season, the Lakers paired Kobe Bryant and Shaquille O'Neal with former all-stars Gary Payton and Karl Malone. This team did make it to the NBA Finals, but was decisively defeated, winning only one game against the Detroit Pistons. Kamenetzky (2012) reported, "[The 2004] Lakers, beaten by the Detroit Pistons in five games during the Finals, are remembered as a failed experiment, the cautionary tale for front offices utilizing the formula of "instant championship: just add superstars" (p. 1). Derek Fisher, a point guard on the 2004 Lakers, said in 2015, "We weren't a team. We were a collection of very accomplished and high-achieving individuals. Even though we had a really good core and nucleus of guys who had been there for a few years already, we weren't a team" (Bucher, 2015, p. 1).

Nearly a decade later, during the 2012/13 season, the Lakers again combined four all-star caliber players in Kobe Bryant, Pau Gasol, Dwight Howard, and Steve Nash. This team came into the season with championship expectations, but ultimately lost in the first round of the playoffs. In a 2019 interview, Steve Nash stated:

[Kobe] was playing great, at a super high level. But just the pieces, you know. It was a lot of old dogs, new tricks. And you know, we already talked about how temperamental chemistry is on a basketball team in particular of all the sports in a sense. You know,

that balance [...] looking back at it now, I'm not sure if it would've ever worked. (Orense, 2019, p. 1)

More recently, the Oklahoma City Thunder paired all-stars Carmelo Anthony and Paul George with Russell Westbrook in 2017/18 only to lose in the first round of the playoffs to the Utah Jazz. This team struggled to fit its star players together in a complimentary fashion, and Royce Young (2018) reported for ESPN, "among the many issues they ended up with -- fit, focus, consistency -- some rested simply in hubris" (p. 1). In spite of "super teams" that did not fully live up to expectations, it is important to note that sports are inherently unpredictable. There are 30 NBA teams, and at the end of a season there can only be one champion. But for acquiring star players, an NBA team essentially has no chance at winning a championship (Silver, 2017), rendering the construction of a team with star players a necessitation. Statistically, success and the amalgamation of top performing players is proven out by the 80/20 rule. While there are only so many superstars to go around, this research examines the Pareto Principle as an analytic dashboard metric that league executives can look at to try to find success in the "Big Three Era."

An analytical approach to NBA roster size was used in this research to apply the Pareto Principle. With NBA rosters consisting of a maximum of 15 players at any given time, the top three players (20% of the roster) represent the vital few of the 80/20 model. The aim of this research is to determine how closely the NBA adheres to the 80/20 Principle, and more importantly, what effect this has on team success. Secondary data was gathered from 10 NBA seasons (2008/09 - 2017/18), to examine the following research questions:

RQ1: Does the top 20% of NBA players in combined points, rebounds, and assists account for 80% of the league's total points, rebounds, and assists during each of the 10 regular seasons?

RQ2: Does the top 20% of NBA players in combined points, rebounds, and assists account for 80% of the league's points, rebounds, and assists during the combined regular seasons since the three-point line was introduced (1980 – 2018)?

RQ3: Does each NBA team's top 20% of players in combined points, rebounds, and assists account for 80% of the team's total points, rebounds, and assists during each of the 10 regular seasons?

RQ4: What effect does an NBA team's 80/20 percentage have on its regular season win percentage during each of the 10 regular seasons?

To date, there has been a paucity of research on the distribution of production for individual NBA teams. Using the 80/20 rule as the underlying framework, the results of this longitudinal research, specifically *RQ4*, aim to serve as an additional resource that both NBA general managers and coaches can track to assist them in determining how to construct their roster and roster management style.

Literature Review

80/20 Principle Applications in Business

The Pareto Principle was first introduced by Italian economist Vilfredo Pareto, who noted that 80% of the wealth in Italy was controlled by only 20% of the population (McKeown, 2012). Management expert Joseph Juran pioneered the use of the Principle in business operations during the mid 20th century. The Economist (2009) reported that:

Juran extended the [80/20] Principle to quality control, stating, for instance, that most defects in production are the result of a small percentage of the causes of all defects—what he described as ‘the vital few and the trivial many’. (p. 1)

The 80/20 Principle was later applied to businesses in various sectors of the economy. IBM noted that its computers used about 20% of the processing code 80% of the time. As such, IBM improved the user experience by focusing on the most used 20% of code to make the computer faster and more efficient (Koch, 1998). The 80/20 Principle is often applied in contemporary management to focus on the most profitable aspects of a business. In 2014, Proctor & Gamble (P&G) consolidated its company by cutting over 100 brands out of its global brand portfolio. P&G maintained that only approximately 80 of its brands produced 95% of its profits (Schrage, 2014). In recent years, 80/20 analysis has been applied to industries apart from the traditional business context, including professional sport.

80/20 Principle Applications in Sport

The 80/20 rule has been applied to sports from various different perspectives. For example, the Baltimore Ravens National Football League (NFL) team uses the Pareto Principle as a player valuation metric. The team attempts to construct its roster within salary cap restraints by finding value in less expensive players. When a Ravens player is a free agent that commands too much money on the open market, the team attempts to find players that can provide 80% of the free agent's production at 20% of the cost (Garcia, 2014).

In baseball, the 80/20 Principle was found to be not valid when analyzed in a single season context. However, when analyzed throughout the history of Major League Baseball (MLB), many statistics followed “nearly perfect Pareto distributions” (Tzelepis, 2015, p. 1). For example Tzelepis (2015) found, as of 2015, 20% of all historical MLB players accounted for 78% of home runs.

The 80/20 rule has also been analyzed in professional ice hockey in both a team and league wide context. Lupinek et al. (2017) found that on average the top 20% of highest paid players on a team account for only 19% of team offensive production. However, from a league wide perspective, the top 20% of goal scorers accounted for 49.24% of total scoring over a five-year span. In addition to research applying the 80/20 rule to professional sports, there are studies regarding the optimal distribution of talent in organizational contexts.

Talent Distribution

There has been a significant amount of research conducted concerning optimal talent distribution within organizations, both in business and sport settings. Researchers at Columbia University studied the phenomenon of what they call the “Too-Much-Talent Effect” (Swaab, Schaerer, Anicich, Ronay, & Galinsky, 2014). Their findings showed that in contexts where task interdependence was low, i.e. individual performance was independent of other team members, talent and performance exhibited a linear relationship. However, when task interdependence was high, meaning organizational members relied on each other, “The linear relationship between talent and team performance was positive and significant [...] but only up to a point, after which the marginal benefit of talent decreased and the slope eventually turned negative” (Swaab et al., 2014, p. 1586).

In professional baseball, Papps, Bryson, and Gomez (2010) found that teams with either too

much or too little talent inequality within their rosters underperformed relative to teams that had an optimal talent distribution. “Teams with a healthy balance of stars and players on their way to becoming stars (and perhaps even players entering years of declining productivity but who provide experience) outperform teams at the extreme ends of the skill distribution” (Papps et al., 2010, p. 23). As the distribution of talent is important in any organizational context, it also plays an important role for NBA teams.

Talent Distribution in the NBA

Nate Silver (2017) of FiveThirtyEight analyzed the amount of star power needed to compete for an NBA championship. He broke down star players into three tiers based on a statistic called Consensus Plus-Minus. The three tiers are Alpha, Beta, and Gamma, with Alpha representing the absolute best players in the league, and the Beta along with Gamma categories being comprised of second and third tier stars, respectively. Star points are assigned based on the number of Alpha, Beta, or Gamma players a team has on its roster, with an Alpha being worth three, a Beta two, and a Gamma one. Most rostered players do not earn their team a star point, and historically teams need at least five star points to compete for a championship as teams that have fewer than five star points have accounted for only eight of the past 37 champions through 2018 (Silver, 2017).

Whitehead (2017) used team distribution of VORP (Value Over Replacement Player) to attempt to identify a team’s odds of winning an NBA championship. Findings suggest, “For a given level of overall team quality, an unbalanced roster was more likely to produce a championship than a balanced one. [...] Thus, sacrificing depth in favor of star power seems like a logical strategy for championship success” (Whitehead, 2017, p. 1). According to this VORP model, out of the NBA champions since the 1979/80 season, 12 were considered team efforts, while 26 championships were based on some variation of the star player model. However, there is an upper limit to success under the star player model as no champion was able to win as a “solo act.” As such, a Pareto Principle framework is utilized for this study in development of a unique longitudinally roster construction analytic team management dashboard metric for both NBA general manager and coach utilization.

Method

Secondary data was collected from Basketball Reference (2020) for each NBA team over 10 regular seasons (2008/09 – 2017/18), resulting in 300 total observations. Simple Game Score (SGS) is introduced as a unique statistical variable to serve as a proxy for a player’s overall raw production by combining points, rebounds, and assists. First, each team’s season statistical totals were used to calculate 80/20 percentages simply by dividing the top three players SGS by the team’s as a whole (See Figure 1). Each team’s top three players combined Player Efficiency Rating (PER) and combined minutes played were calculated and used as independent variables in the model estimating regular season wins.

Historical secondary data was collected starting with the 1979/80 season. This time period is statistically important for a few reasons. The NBA and American Basketball Association (ABA) merged in 1976, and the three-point

Figure 1: Simple Game Score (SGS) 80/20 Equation

$$80/20 = \frac{\sum pts, rebs, asts [top 0.2(N \text{ players})]}{\sum pts, rebs, asts (N \text{ players})}$$

line was introduced three years later in 1979. Also in 1979, Larry Bird and Magic Johnson were drafted to the Boston Celtics and Los Angeles Lakers, respectively. As such, the 1979/80 season is often considered the beginning of the modern era of the NBA (Ziller & Flannery, 2015). After establishing the historical timeframe, each NBA player's individual regular season statistical totals were compiled in spreadsheet format, totaling 16,084 observations. Next, regular season totals for individual players were merged, resulting in total statistics for 2,954 NBA players. Finally, the total points, rebounds, and assists of the top 20% of NBA players was divided by all players combined points, rebounds, and assists.

All secondary data collected from Basketball Reference (2020), a Sports Reference LLC holding, and was stored in Excel spreadsheets. Data was compiled and sorted in individual worksheets by team and year before being cleaned and aggregated into one master worksheet for analysis. SPSS Statistics 25 software was used to run descriptive statistics and regression analysis tests including ANOVA.

Results

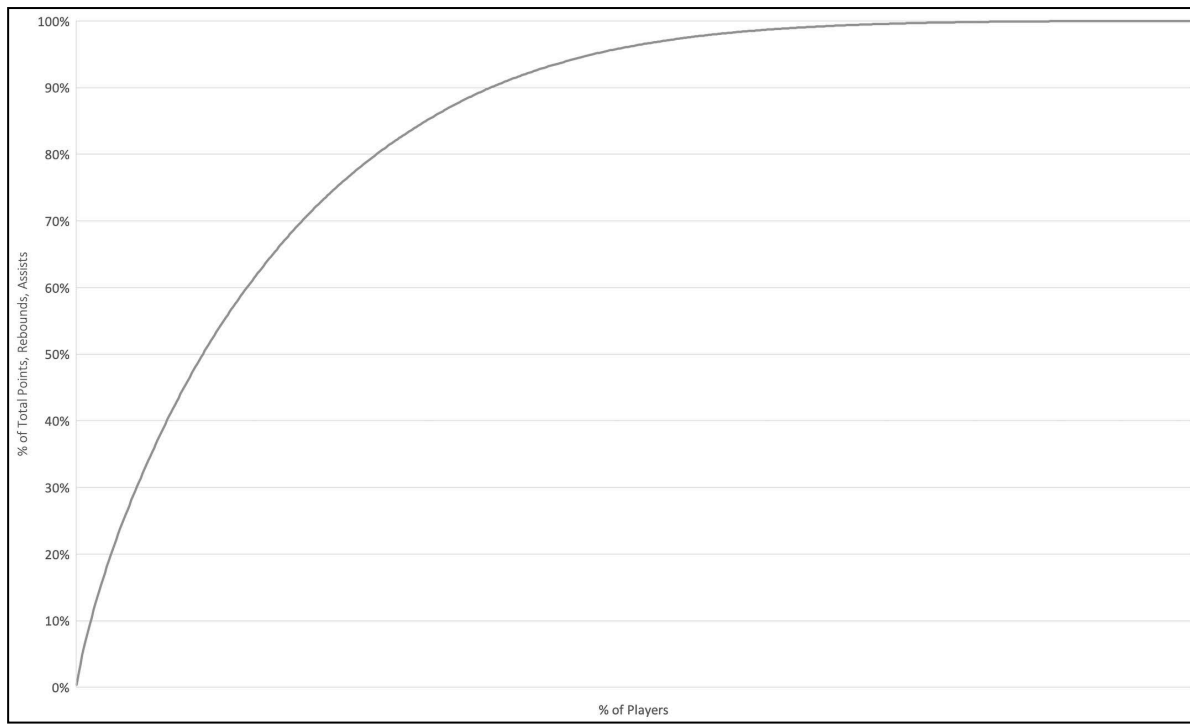
The 80/20 rule was found to not be valid with respect to *RQ1*. Over the 10 season (2008/09 to 2018/19) review period, the top 20% of players in the NBA consistently accounted for less than half of the league's SGS each year. The year-to-year averages stayed remarkably consistent, with a 10-year range of only 4.1%. The median 80/20 percentage was 46.2% with the highest year being 2017/18 at 48.8% and the lowest being 2014/15 at 44.7% (See Table 1). These results are similar to the findings of previous professional sport research pertaining to hockey and baseball (Lupinek et al., 2017; Tzelepis, 2015). Over a five-year span in the National Hockey League (NHL), "49.24% of the NHL league scoring [came] from the top 20% of the league's goal scorers" (Lupinek et al., 2017, p. 45). In the 2014/15 baseball season, the top 20% of home run hitters accounted for just over 50% of the league's total homeruns (Tzelepis, 2015).

Table 1: NBA SGS 80/20 Percentage 2008/09 – 2017/18 Regular Seasons

2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
46.2%	45.1%	46.1%	46.1%	46.2%	47.0%	44.7%	45.3%	47.0%	48.8%

The 80/20 rule is much closer to being valid when the distribution is viewed over a longer period of time. The Pareto Principle follows a pattern similar to a power law distribution (Bar-Yam, 2011), meaning the longer period of time that data is observed, the larger share of the whole the vital few will account for. With respect to *RQ2*, over 39 NBA seasons (1979/80 – 2017/18), the top 20% of players accounted for 69.6% of the league's SGS (See Figure 2). Star players often have long careers and consistently produce high statistics on a year-to-year basis, separating themselves from the rest of NBA players over time. As such the Pareto Principle is found to be valid for *RQ2* with SGS statistical calculation as it approaches the 80/20 range.

Figure 2: Historical Pareto Distribution: 1979/80 – 2017/18 NBA Regular Seasons



For RQ3, each team's 80/20 percentage was calculated on a yearly basis over the 10 regular seasons (See Figure 3). The average 80/20 percentage for individual teams was 43.42% (See

Figure 3: 10-Year NBA Average SGS 80/20 Percentage vs. Wins

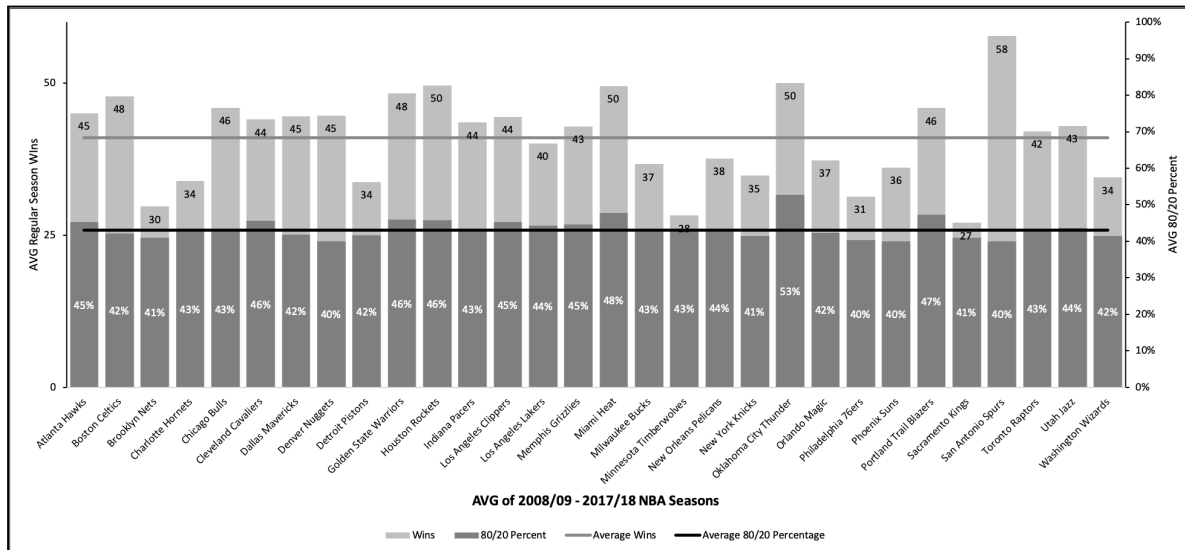


Table 2). The highest 80/20 percentage was the 2010/11 Miami Heat at 61.27%, the first year after LeBron James, Dwyane Wade, and Chris Bosh joined together. The lowest 80/20 percentage was the 2014/15 New York Knicks at 28.27%. As such, the Pareto Principle was found to be not valid with respect to *RQ3* as individual teams averaged a 43/20 distribution.

Table 2: NBA SGS 80/20 Rule 2008/09 – 2017/18 Data Set

Team	80/20 Avg	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Atlanta Hawks	45.2%	46.8%	50.1%	49.1%	47.5%	48.5%	41.0%	42.0%	45.9%	44.5%	36.8%
Boston Celtics	42.1%	46.8%	44.3%	45.1%	48.1%	42.5%	38.7%	32.4%	41.0%	43.0%	38.8%
Brooklyn Nets	41.0%	49.8%	43.7%	40.9%	44.3%	45.5%	36.7%	39.5%	40.0%	34.9%	34.7%
Charlotte Hornets	42.8%	46.7%	48.0%	42.3%	36.2%	39.6%	46.7%	37.0%	42.7%	43.6%	45.0%
Chicago Bulls	42.7%	43.5%	43.4%	50.7%	40.6%	45.5%	44.4%	42.8%	42.6%	40.7%	33.0%
Cleveland Cavaliers	45.6%	52.1%	47.1%	39.8%	40.7%	38.7%	40.8%	51.1%	47.1%	52.6%	45.5%
Dallas Mavericks	41.8%	49.8%	48.0%	42.9%	42.6%	37.6%	45.1%	40.8%	36.2%	36.8%	38.3%
Denver Nuggets	40.0%	44.2%	48.0%	36.3%	38.2%	38.5%	37.6%	39.9%	35.3%	37.4%	44.7%
Detroit Pistons	41.6%	41.7%	35.5%	37.0%	44.0%	40.6%	47.2%	41.7%	47.6%	42.2%	38.2%
Golden State Warriors	45.9%	35.6%	45.9%	50.6%	39.3%	51.4%	48.2%	45.9%	51.8%	47.5%	42.3%
Houston Rockets	45.8%	45.8%	45.5%	44.5%	38.3%	46.4%	48.0%	45.7%	49.5%	46.8%	47.8%
Indiana Pacers	42.9%	43.5%	41.2%	42.8%	42.6%	46.4%	48.6%	31.8%	43.6%	47.5%	40.5%
Los Angeles Clippers	45.3%	39.4%	43.0%	44.8%	50.2%	44.7%	49.7%	51.4%	43.9%	44.3%	41.2%
Los Angeles Lakers	44.4%	51.5%	49.8%	55.9%	56.2%	49.0%	34.5%	32.0%	40.2%	36.4%	38.3%
Memphis Grizzlies	44.7%	47.7%	51.5%	46.7%	47.2%	47.2%	43.9%	45.6%	33.9%	45.1%	37.7%
Miami Heat	47.7%	50.2%	48.1%	61.3%	53.8%	53.5%	49.2%	37.3%	42.2%	45.5%	36.2%
Milwaukee Bucks	42.8%	43.7%	40.6%	38.5%	41.4%	45.3%	36.7%	35.7%	48.1%	44.3%	53.5%
Minnesota Timberwolves	43.1%	39.3%	41.1%	45.4%	40.8%	34.1%	47.0%	35.5%	46.7%	53.7%	47.8%
New Orleans Pelicans	43.5%	53.1%	42.0%	45.9%	33.6%	42.8%	39.6%	45.3%	40.0%	42.4%	50.6%
New York Knicks	41.4%	44.9%	47.8%	42.6%	41.7%	47.0%	44.2%	28.3%	42.1%	41.0%	34.5%
Oklahoma City Thunder	52.6%	50.4%	55.9%	52.3%	58.2%	56.8%	51.9%	39.3%	54.0%	52.1%	55.5%
Orlando Magic	42.3%	51.9%	43.7%	45.1%	45.4%	38.3%	39.3%	46.2%	38.7%	41.2%	33.6%
Philadelphia 76ers	40.3%	48.4%	41.9%	43.1%	40.1%	47.5%	41.5%	31.5%	31.6%	32.3%	45.0%
Phoenix Suns	40.0%	41.0%	48.3%	39.0%	42.8%	38.4%	41.3%	41.3%	31.6%	40.6%	36.1%
Portland Trail Blazers	47.2%	46.9%	46.3%	48.7%	40.5%	51.1%	49.0%	46.7%	46.5%	45.8%	50.6%
Sacramento Kings	41.1%	36.4%	41.6%	40.1%	45.3%	40.2%	47.4%	42.9%	46.1%	36.2%	34.4%
San Antonio Spurs	40.0%	47.5%	42.7%	44.3%	38.5%	40.4%	36.0%	36.5%	40.3%	41.8%	39.5%
Toronto Raptors	43.1%	45.9%	44.9%	39.5%	35.1%	39.1%	48.1%	39.8%	46.9%	47.1%	44.3%
Utah Jazz	43.6%	43.0%	47.9%	48.1%	44.7%	42.1%	42.0%	43.1%	42.1%	42.5%	40.6%
Washington Wizards	41.6%	46.7%	33.4%	40.4%	40.0%	33.8%	46.9%	42.0%	42.5%	49.2%	40.7%

Lastly for *RQ4*, the 80/20 percentages calculated from *RQ3* analysis were used to examine the relationship between regular season wins and 80/20 percentage. Based on a surface level review of the data, it appeared that regular season wins and 80/20 percentage were positively correlated as teams that made the playoffs had an average 80/20 percentage of 45.85%, while teams that made the finals had an average 80/20 percentage of 48.83%. As such, teams with

high caliber players on their roster allocate a large number of minutes to their top players and run their offense through them, whereas teams with lower quality players do not rely on their top players nearly as much. However, this descriptive statistic lens did not fully address *RQ4*.

A deeper analytical approach was used to examine *RQ4* in more detail. A multiple regression analysis was performed to control for the quality of a team's top three players, the health/total playing time of the top three players, and the defensive quality of the team. Player efficiency rating (PER) was used to determine the quality of the top three players (Fromal, 2012). PER, according to John Hollinger, who invented the statistic, "Sums up all a player's positive accomplishments, subtracts the negative accomplishments, and returns a per-minute rating of a player's performance" (Fromal, 2012, p. 1). Total minutes played was used to control for the health and playing time of star players. Additionally, team defensive rating (points allowed per 100 possessions) was used to account for the defensive quality of the team. All of these factors produced the following z-scores through the linear regression model: wins = $-7.7703E-15$, 80/20 % = -0.6417 , PER = 0.8493 , minutes = 0.6660 , def. rating = -0.4556 (See Table 3). The research team interprets the results to suggest that after accounting for other factors that relate to team success, wins and 80/20 percentage have a considerable negative correlation, assuming a *ceteris paribus* relationship.

Table 3: Regression Results (z-scores)

	Coefficients	Standard Error	t-Stat	P-value
Intercept	$-7.7703E-15$	0.025473718	$-3.05032E-13$	1
80/20 Percentage	-0.641657936	0.07925735	-8.095879203	$1.50681E-14$
Top 3 PER	0.849272981	0.04946748	17.16830881	$2.76027E-46$
Top 3 Minutes	0.665933358	0.063528706	10.48240072	$4.61341E-22$
Defensive Rating	-0.45595047	0.027505182	-16.56397117	$5.03764E-44$

Discussion

The four research questions for this study were: *RQ1*) Does the top 20% of NBA players in combined points, rebounds, and assists account for 80% of the league's total points, rebounds, and assists during each of the 10 regular seasons?, *RQ2*) Does the top 20% of NBA players in combined points, rebounds, and assists account for 80% of the league's points, rebounds, and assists during the 39 combined regular seasons from 1980 through 2018? *RQ3*) Does each NBA team's top 20% of players in combined points, rebounds, and assists account for 80% of the team's total points, rebounds, and assists during each of the 10 regular seasons?, and *RQ4*) What effect does an NBA team's 80/20 percentage have on its regular season win percentage during each of the 10 regular seasons? The following discussion expounds on the implications of the results from each question.

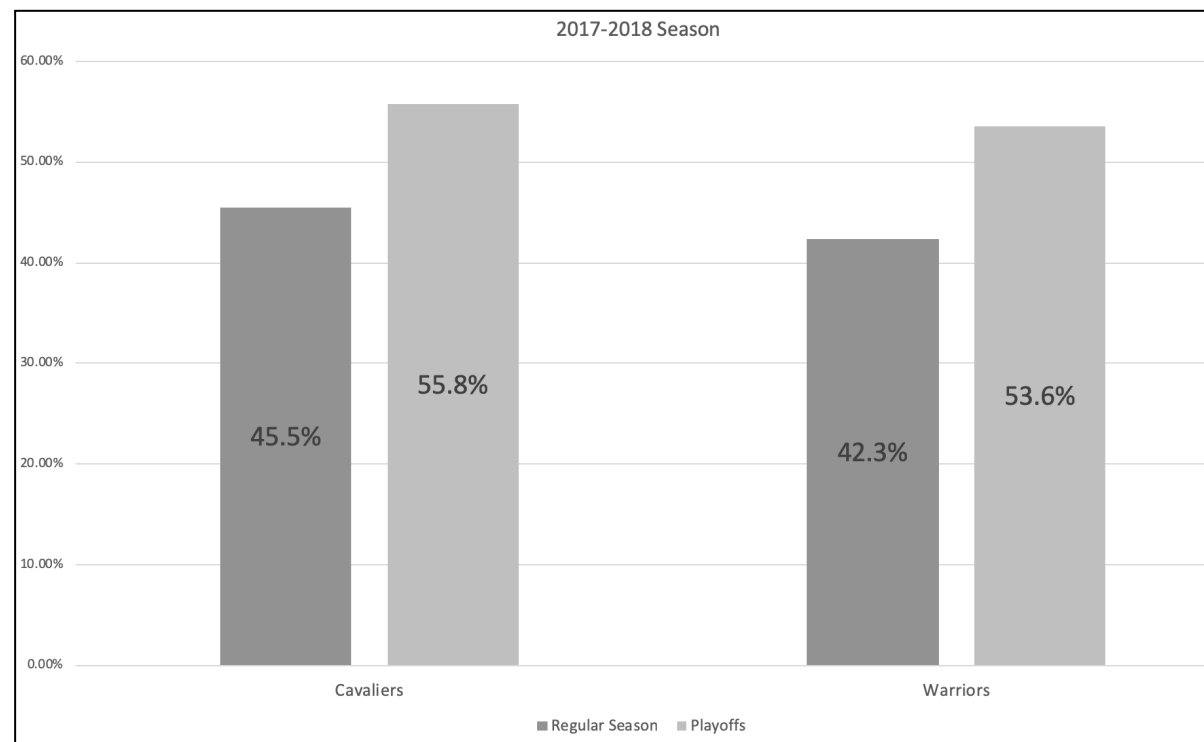
The introduction of a unique analytic team management dashboard metric is the aim of this

research for both NBA general manager and coach utilization toward longitudinal roster construction. Additionally, in this pursuit, the SGS equation was developed as a new basketball statistic. An important aspect of NBA team strategy is determining how top heavy its roster and playing style should be (Bontemps, 2018). In a league with a salary cap, it's essential that team executives construct their roster with an awareness of players value relative to their salary. In essence, roster construction boils down to the most fundamental definition of economics: the allocation of scarce resources (Robbins, 1932). There is a delicate balance between acquiring high-level players at an expensive salary and filling out the roster with affordable, quality rotation players. An NBA team with three highly paid players often cannot afford to have a deep roster with strong role players because such a high percentage of its salary cap is being allocated to a small percentage of the roster. Additionally, team strategy and reliance on its top players during games to play a high number of minutes or carry a significant offensive burden has a meaningful impact on team success (Aschburner, 2018).

There is no doubt that assembling a roster with legitimate star players is the clearest path to an NBA championship. Over the 10-year review period (2008/09 – 2017/18), NBA champions have had an average of 2.5 all-stars on their roster, according to data from Basketball Reference (2020). Teams simply don't win at the highest level without having at least two of the league's top players. Each of the four seasons from 2014/15 – 2017/18 ended with the Cleveland Cavaliers and the Golden State Warriors competing in the NBA Finals. Both franchises have several star players, leading to a concentrated production distribution in which the vital few carry the team throughout the regular season and into the playoffs. The Cavaliers and Warriors have had relatively high SGS 80/20 percentages over this time period, averaging 49.10% (5.68% above league average) and 46.89% (3.47% above league average), respectively.

According to a New York Times article, through game three of the 2018 NBA Finals, Cavaliers star LeBron James was producing a higher percentage of his team's playoff box score statistics (points, rebounds, assists, steals, and blocks) than any other player in history (Ward, 2018). As Warriors GM Bob Myers said in 2013, "What you see in the playoffs is the top six or seven guys basically determining the outcome of every game. You can spend a lot of time trying to fill out the rest of the roster in the perfect manner, but if you're top five guys can't get the job done, it almost doesn't matter" (Lowe, 2013, p. 1). During the 2017/18 season, the Cavaliers and Warriors 80/20 percentages significantly increased from the regular season to the playoffs by 10.3% and 11.3%, respectively (See Figure 4). As such, team depth is generally more important in the regular season than in the playoffs because of the two distinctly different contexts.

The 82-game regular season is a grueling ordeal, with cross country travel and back-to-back games. A deep roster is a major advantage in this format because it reduces the burden of top players. The playoffs, however, only consist of a maximum of 28 games (if a team was to make the finals and play a full seven game series all four rounds). There is also a minimum one day of rest between games and a less demanding travel schedule as the first three rounds are played within geographically separated conferences. Because of these structural differences, as well as the higher stakes of the playoff games, teams can play their star players a significantly higher number of minutes per game in the postseason. Therefore, the value of having a deep, balanced roster is minimized in the playoffs when star players ultimately play more and decide the outcome of games.

Figure 4: NBA Regular Season vs. Playoffs 80/20 Percentage

However, the players that constitute the remaining roster spots, the “trivial many”, still have a major impact on team success, especially when it pertains to long term roster construction (Aderhold, 2013). The San Antonio Spurs are the prototype for a franchise with a consistently low 80/20 percentage of 40.76% compared to the NBA average 43.42% and are the outlier when looking at the Pareto Principle and success in the NBA. The Spurs are widely regarded as one of the most well-run franchises of the past generation (Fox Sports, 2016). The Spurs have made the playoffs for the past 21 consecutive seasons through 2018, won over 50 games in 18 of those seasons, and collected five championships along the way. The primary reason is most likely head coach Gregg Popovich and GM R.C. Buford. While the team did have star players such as Tim Duncan, Tony Parker, and Manu Ginobili, those star players filled a specific role and played within a strict team first system. Additionally, each player was with the team from the inception of their NBA careers and stayed together for 13 years, winning more games than any other trio in NBA history. (Bontemps, 2018). Because of this system, the Spurs rely on their top players much less than other franchises. In the 10-year review period of this study, playoff teams have had an average 80/20 percentage of 45.85%, while the Spurs 80/20 percentage over the same time period was 40.76%.

The Spurs reliance on its role players is another of the reasons the franchise has been able to maintain a sustained level of excellence over a long period of time. Reducing the workload of star players during the regular season helps to prevent fatigue and injury (Holmes & Haberstroh, 2016). Additionally, through reduced star player workloads, empowering “non-star” role players

in the regular season by playing them a high number of minutes and involving them in the offense prepares those players to be successful in the playoffs and in future seasons. Rather than focusing a vast majority of resources on the top few players on the roster, San Antonio distributes its production more democratically than other franchises. San Antonio went so far as to be fined \$250,000 for sending their core players home prior to the last game of a six-game road trip. However, modeling a successful franchise after San Antonio requires a special kind of coach, GM, and special players who are willing to play a specific role and put the team first (Bontemps, 2018). An example of a team that has emulated the San Antonio team first concept, at least to some extent, is the Golden State Warriors. Head coach Steve Kerr is a Popovich mentee and former Spur. While Kerr did have the luxury of coaching the most talented collection of players in the NBA during the 10-year review period of this study, players were willing to put team over money, play their roles, and win championships.

Though holding back star players during the regular season is a tactic for preventing fatigue and injury before the playoffs (Woo, 2017), there are potential negative impacts of this approach. From an economic standpoint, the presence of a superstar player has been shown to have a statistically significant impact on fan attendance at both home and away games (Humphreys & Johnson, 2020). If a fan is paying to see star players compete, but those star players are being saved for the playoffs, this could potentially impact the loyalty or future purchasing by that fan and thus have a greater financial impact on not only the individual team(s) but the NBA as a whole (Mongeon & Winfree, 2012). This notion further supports the idea that “sacrificing” wins could have a negative impact on fan loyalty and attendance.

Finally, 80/20 percentages are important to NBA franchises because of Collective Bargaining Agreement (CBA) rules and the salary cap. The league does not operate in a free market structure; there is a limit on the maximum amount of money any one player can receive as a percentage of the salary cap. What this can often lead to is overpaid second and third-tier star players (Silver, 2017) receiving similar salaries to the very best players in the league, whose values are suppressed by the max contract. For example, during the 2017/18 season specifically, the Toronto Raptors three highest paid players made a combined \$76,505,407. The Golden State Warriors paid their top three players \$77,508,700 (Basketball Reference, 2020). By any objective measure, the Warriors top three players during this specific 2017/18 season were better than the Raptors, but they made almost the same amount of money. When a franchise makes a significant financial investment in the top 20% of its roster, it is critical that those players produce enough value to justify their salary. Otherwise, it may be better for franchises to distribute their resources more evenly by investing in quality players throughout the roster, similar to the Spurs.

There are innumerable factors that contribute to success in the NBA. Among many others, talent, team chemistry, health, and coaching are a few that impact winning. Each franchise and roster has unique challenges and advantages based on a myriad of variables. Historically, there have been star players that carry lackluster rosters to postseason success, as well as teams that succeed despite not having a clear-cut superstar (Levy, 2014). However, these are rare exceptions and have not been seen in the past 20 years through 2018. As previously mentioned, every championship team during the 10-year review period has had at least 2.5 all-stars. While there is no textbook archetype towards building a successful NBA roster, production distribution through the 80/20 model is an additional analytical variable that a franchise can longitudinally analyze in its pursuit of winnings championships.

Limitations and Future Research

This study was not without limitation as it was exploratory in nature. The lack of precedent regarding the 80/20 rule in basketball provided a challenge in determining the appropriate statistical factors to examine with respect to production distribution. Also, 80/20 research from other sports is not directly applicable because of the different statistical measures in each sport. Additionally, the 2011/12 season was shortened by a lockout due to CBA negotiations. Because only 66 games were played, statistics were extrapolated to an 82-game level for the 2011/12 season.

Future research should focus on the difference between production distribution in the regular season versus the playoffs and how it impacts team success. It has long been an adage in the NBA that star players win games in the playoffs when team rotations shorten and the pace slows down (Lowe, 2013). The results of this research, which show a negative correlation between 80/20 percentage and regular season wins, and the results from Whitehead (2017), which show that “an unbalanced roster [is] more likely to produce a championship”, seem to follow the traditional assumption that star players value is more evident in the playoffs (p. 1). As such, using the 80/20 rule as a framework, a team may be able to determine how many regular season wins it is willing to sacrifice by constructing a top-heavy roster in pursuit of playoff success. An analysis of the difference in impact that star players have in the regular season versus the playoffs would provide valuable information pertaining to roster construction, as an NBA team’s ultimate goal is success in the post season.

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