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Relative Importance of Performance Factors in Winning NBA Games in Regular Season versus Playoffs

Masaru Teramoto and Chad L. Cross

Abstract

In the National Basketball Association (NBA), there are high expectations for the post-season among the teams having the league's best regular season records. However, not every team who plays great basketball in the regular season will succeed in the playoffs. The Phoenix Suns, for example, had the third best regular season record from the 2004–05 through 2006–07 seasons; however, not once did they reach the NBA Finals during those years. We hypothesized that how teams win games in the NBA differs between the regular season and the playoffs. This paper discusses the relative importance of performance factors in winning basketball games in the past 10 years of the NBA (between the 1999–2000 and 2008–2009 seasons). Specifically, we examined the contributions of overall efficiency (offensive and defensive ratings), along with the Four Factors (effective field goal percentage, turnover percentage, rebound percentage, and free throw rate) to winning games in the regular season and the playoffs, using a multiple linear regression and a logistic regression analysis. The results of these analyses indicate that efficient offense and defense are both essential to be successful in the regular season and the playoffs, but the importance of defense in winning games may be greater in the playoffs than in the regular season. Shooting efficiency on both ends of the floor (offensive and defensive effective field goal percentages) seems to be the most critical aspect of the game in the regular season as well as the playoffs. In addition, committing fewer turnovers could be another key to winning games, especially in the regular season. It appears that defense becomes more important for winning playoff series as a team advances further in the post-season. Lastly, rebounding may play a significant role in deciding the outcome of the Conference Finals where two teams most likely have similar shooting efficiency and turnover rates.

KEYWORDS: overall efficiency, offensive and defensive ratings, Four Factors, effective field goal percentage, turnover percentage, rebound percentage, free throw rate, multiple linear regression analysis, logistic regression analysis, shooting efficiency, turnover rates, rebounding

1. Introduction

The National Basketball Association (NBA) is one of the four major professional sport leagues in North America (Fort, 2006). The league currently consists of 30 teams with two conferences (Eastern and Western Conferences), and each conference is further divided into three divisions. Every team plays 82 games in the regular season, and the eight top teams from each conference compete in the playoffs for the NBA championship.

Performance in the regular season can influence the outcome of the playoffs, as playoff seeds are determined based on the teams' regular season records. In each conference, three division champions receive the top three seeds, while the fourth through eighth seeds are assigned to the other five teams according to their regular season records (Hoopedia, n.d.). These 16 teams (eight teams from each conference) form a playoff bracket that decides the match-ups of the entire playoffs. The team with the better regular season record holds home-court advantage regardless of seed (Hoopedia).

Although having a good regular season record is certainly advantageous to the teams competing in the playoffs, it is not always translated into a successful post-season performance. For example, after they had acquired Steve Nash in 2004, the Phoenix Suns won 72% of the regular season games for the next 3 years (average of 59 wins per year). This was the third best record during the 3-year span and was only behind the Dallas Mavericks and the San Antonio Spurs (see Table 1). However, they won only 54% of the playoff games during the same 3 years, and most importantly, never reached the NBA Finals.

Table 1. Regular Season and Playoff Records by Top Five NBA Regular Season Teams from 2004–05 to 2006–07 Seasons¹

	2004–05 to 2006–07 Seasons (3 Years)		
	Win% in Regular Season	Win% in Playoffs	# of NBA Finals
	(Average # of Wins)	(# of Wins / # of Games)	Appearances
Dallas Mavericks	0.752 (62)	0.524 (22 / 42)	1
San Antonio Spurs	0.732 (60)	0.696 (39 / 56)	2
Phoenix Suns	0.720 (59)	0.543 (25 / 46)	0
Detroit Pistons	0.695 (57)	0.593 (35 / 59)	1
Miami Heat	0.630 (52)	0.643 (27 / 42)	1

Note: Win% = winning percentage; # = number.

¹ Data were from Basketball-Reference.com (<http://www.basketball-reference.com>).

The Phoenix Suns have been known for their explosive offense in which they design a play to shoot within 7 seconds from the start of a possession (McCallum, 2006). In fact, they led the league in scoring between the 2004–05 and 2006–07 seasons, posting an average of 110.4, 108.4, and 110.2 points per game, respectively. On the other hand, their defense may have been compromised by their fast paced basketball, as the Phoenix Suns ranked 30th (103.3 points), 28th (102.8 points), and 23rd (102.9 points) in the league in points allowed per game in each of those years.

It is said that “defense wins championships” in the NBA (Schuhmann, 2009). Therefore, we speculated that their particular playing style (i.e., great offense but below-average defense) was the primary reason why the Phoenix Suns came up short in the post-season each year. In other words, we hypothesized that how teams win games in the NBA is different between the regular season and the playoffs. In this study, we extended our data analysis to the past 10 years of the NBA seasons and examined the relative importance of performance factors in winning basketball games in the regular season and the playoffs, using a multiple linear regression (MLR) and a logistic regression (LR) analysis.

2. Methods

2.1 Data Collection

The current study analyzed NBA data from the 1999–2000 through 2008–09 seasons (10 years). The data were obtained from Basketball-Reference.com (<http://www.basketball-reference.com>). The league consisted of 29 teams between the 1999–2000 and 2003–04 seasons (5 years), whereas there were 30 teams in the league for the next 5 years, resulting in the sample size of 295 for the 10-year regular season data. On the other hand, there were 16 teams competing in the playoffs each year ($N = 160$ for the 10-year playoff data).

Performance factors chosen to evaluate a team’s offense and defense were as follows:

- *Offensive and defensive ratings ($ORTg_t$, $DRtg_t$)*
- *Four Factors* including:
 - 1) *Offensive and defensive effective field goal percentages ($eFG\%_t$, $eFG\%_o$)*
 - 2) *Offensive and defensive turnover percentages ($TOV\%_t$, $TOV\%_o$)*²
 - 3) *Offensive and defensive rebound percentages ($ORB\%_t$, $DRB\%_t$)*
 - 4) *Offensive and defensive free throw rates (FTM_t/FGA_t , FTM_o/FGA_o)*

² Basketball-Reference.com provides *turnover percentage* (turnovers per 100 plays) instead of *turnovers per possession* proposed by Kubatko et al (2007).

These factors were originally developed by Oliver (2004) and are recommended to be used for assessing the performance of the NBA teams by Kubatko et al. (2007). $ORTg_t$ and $DRtg_t$ evaluate the overall efficiency of a team's offense and defense, whereas the *Four Factors* "provide a breakdown of those ratings" (Kubatko et al., p. 12). Winning percentage (Win%) was used as a measure of winning basketball games, because it allowed for comparing a team's success in the regular season to that in the playoffs. Furthermore, using Win% made it possible to examine the performance in the playoffs across different teams among which the total number of games played varies. Additionally, we assessed a team's post-season success based on how far they advanced in the playoffs (i.e., lost in the First Rounds; advanced to the Conference Semifinals, Conference Finals, or NBA Finals).

2.2 Data Analysis

2.2.1 Relative Importance of Overall Efficiency and Four Factors in Winning Games in Regular Season and Playoffs

The dependent or outcome variable was Win% and a set of independent or predictor variables were: 1) $ORTg_t$ and $DRtg_t$ and 2) the offensive and defensive *Four Factors*. The first MLR analysis examined the relative contributions of $ORTg_t$ and $DRtg_t$ to predicting Win% in the regular season and the playoffs using the standard regression method (i.e., entering all predictors in a regression model simultaneously). A separate standard MLR analysis was also performed using the *Four Factors* as another set of predictors.

2.2.2 Additional Analysis of Performance on Winning Playoff Series

A total of 160 teams that competed in the playoffs during the 10 years were coded by a series of dichotomous variables. Before the following data analyses, the scores on all predictor variables were transformed into z-scores, so that the regression coefficients of a LR model would be standardized (Tabachnick and Fidell, 2007). In the first analysis, all 160 teams were coded based on whether they lost in the First Rounds of the playoffs (80 teams; coded as "0") or they advanced to the Conference Semifinals (80 teams; coded as "1"). Using this coding system, a LR analysis with the direct or forced entry method (i.e., entering all predictors into a regression model simultaneously) was conducted to compare the relative importance of $ORTg_t$ and $DRtg_t$, along with each of the offensive and defensive *Four Factors*, in predicting the outcome of the First Round playoff match-ups. Next, of the 80 teams advancing to the Conference Semifinals, those that lost in the series (40 teams) and those that advanced to the Conference Finals

(40 teams) were recoded as “0” and “1” respectively. Then, a LR analysis using the same sets of predictors was performed on this recoded data set. In the last analysis, the 40 teams that appeared in the Conference Finals were recoded according to the results of their playoff match-ups (coded as “0” for those losing in the series and “1” for those advancing to the NBA Finals; 20 teams in each category). This was followed by another LR analysis with the same sets of predictors.

3. Results

3.1 Relative Importance of Overall Efficiency and Four Factors in Winning Games in Regular Season and Playoffs

Based on the inspection of the normal probability and residual plots, it was ensured that the assumptions of a MLR analysis, normality, linearity, and homoscedasticity of the residuals, were not violated. Also, the Durbin-Watson statistics ranging from 2.171 to 2.380 for all regression models indicated no major violation of independence of residuals (Field, 2009). Correlations between $ORTg_t$ and $DRtg_t$ or any combination of the *Four Factors* did not exceed 0.500, which suggested that the degree of collinearity between the predictor variables was not an issue for the current MLR analyses. Moreover, multicollinearity was not likely to be a concern for the analyses, as the tolerance values for any predictors were between 0.669 and 0.970 for all regression models (Field). Regarding the outlying cases, no apparent univariate outliers, defined as skewness or kurtosis exceeding 1, were identified in any of the outcome or predictor variables. In addition, there appeared to be no multivariate outliers among the predictors in the regular season or the playoff data, as the Mahalanobis distances for any regression models did not exceed the critical values of the χ^2 distribution at an alpha level of 0.001 (Tabachnick and Fidell). With respect to the cases that potentially had any undue influence on the regression coefficients, no cases had Cook’s distances greater than 1 in any regression models developed by the current MLR analyses, indicating no major issues of influential cases (Tabachnick and Fidell).

Table 2 shows the results of the MLR analysis of the overall efficiency on winning games in the regular season and the playoffs. The linear relationship of $ORTg_t$ and $DRtg_t$ to Win% was significant in the regular season [$F(2, 292) = 2565.84, p < 0.01$] as well as the playoffs [$F(2, 157) = 187.72, p < 0.01$]. The regression models explained 94.6% and 70.1% of the variability in Win% in the regular season and the playoffs, respectively. $ORTg_t$ and $DRtg_t$ were both significant to the regression models of the regular season and the playoffs ($p < 0.01$). According to the standardized regression coefficients (β), along with the squared full and semipartial correlation coefficients (r^2 and sr^2), $ORTg_t$ appeared

to be slightly more important than $DRtg_t$ for winning games in the regular season, whereas the relative importance of $ORtg_t$ and $DRtg_t$ was almost identical in the playoffs.

Table 2. Multiple Regression Analysis of Overall Efficiency on Winning Games in Regular Season and Playoffs

	Predictor	B (SE)	β	r^2	sr^2
Regular Season ($N = 295$)	$ORtg_t$	0.031 (0.001)	0.765 ^a	0.404	0.568
	$DRtg_t$	-0.030 (0.001)	-0.748 ^a	0.379	0.542
Playoffs ($N = 160$)	$ORtg_t$	0.026 (0.002)	0.754 ^a	0.221	0.487
	$DRtg_t$	-0.025 (0.002)	-0.751 ^a	0.218	0.484

Note: B = regression coefficient; SE = standard error; β = standardized regression coefficient; r^2 = squared full correlation coefficient; sr^2 = squared semipartial correlation coefficient.

Regular Season: $F(2, 292) = 2565.84$, $p < 0.01$, $R^2 = 0.946$, Adjusted $R^2 = 0.946$.

Playoffs: $F(2, 157) = 187.72$, $p < 0.01$, $R^2 = 0.705$, Adjusted $R^2 = 0.701$.

^a $p < 0.01$.

The results of the MLR analysis of the *Four Factors* on winning games in the regular season and the playoffs are presented in Table 3. The regression models were significant for both the regular season [$F(8, 286) = 570.51$, $p < 0.01$] and the playoff data [$F(8, 151) = 45.24$, $p < 0.01$], explaining 93.9% (regular season) and 69.0% (playoffs) of the variability in Win%. All of the offensive and defensive *Four Factors* were found to be significant predictors of Win% in the regular season as well as the playoffs ($p < 0.01$). The most important offensive and defensive factors in winning games seemed to be $eFG\%_t$ and $eFG\%_o$ both in the regular season and in the playoffs, as each variable accounted for 22.9% and 28.6% of the variability in Win% in the regular season and 30.8% and 30.1% of that in the playoffs. Besides these two variables, $TOV\%_t$ could explain an additional 10% of the variability in Win% in the regular season. The other variables in the *Four Factors* did not explain more than 6% of the variability in Win% either in the regular season or in the playoffs despite their significant contributions to the regression models.

As an illustrative example, each team's expected Win% for the 2008–09 regular season and playoffs was calculated from the overall efficiency and the *Four Factors* using the coefficients obtained from the MLR analyses discussed above. Then, the teams were ranked according to the actual and expected Win% (see Tables 4 and 5). Overall, the team rankings by the expected Win% agreed with those by the actual Win% both in the regular season and in the playoffs. When the team rankings were compared between the regular season and the playoffs, the top regular season teams generally performed well in the playoffs.

Table 3. Multiple Regression Analysis of Four Factors on Winning Games in Regular Season and Playoffs

	Predictor	B (SE)	β	r^2	sr^2
Regular Season ($N = 295$)	$eFG\%_t$	4.391 (0.132)	0.586 ^a	0.323	0.229
	$TOV\%_t$	-4.781 (0.227)	-0.353 ^a	0.183	0.092
	$ORB\%_t$	1.273 (0.097)	0.213 ^a	0.003	0.035
	FTM_t/FGA_t	0.955 (0.097)	0.159 ^a	0.013	0.020
	$eFG\%_o$	-4.641 (0.125)	-0.586 ^a	0.322	0.286
	$TOV\%_o$	3.705 (0.223)	0.268 ^a	0.009	0.057
	$DRB\%_t$	1.249 (0.123)	0.163 ^a	0.113	0.021
	FTM_o/FGA_o	-0.782 (0.093)	-0.146 ^a	0.071	0.015
Playoffs ($N = 160$)	$eFG\%_t$	4.157 (0.331)	0.617 ^a	0.191	0.308
	$TOV\%_t$	-2.254 (0.548)	-0.200 ^a	0.010	0.033
	$ORB\%_t$	1.150 (0.238)	0.224 ^a	0.028	0.045
	FTM_t/FGA_t	0.955 (0.229)	0.193 ^a	0.026	0.034
	$eFG\%_o$	-3.732 (0.300)	-0.573 ^a	0.209	0.301
	$TOV\%_o$	2.784 (0.565)	0.242 ^a	0.000	0.047
	$DRB\%_t$	0.884 (0.247)	0.162 ^a	0.016	0.025
	FTM_o/FGA_o	-1.085 (0.219)	-0.227 ^a	0.074	0.048

Note: B = regression coefficient; SE = standard error; β = standardized regression coefficient;

r^2 = squared full correlation coefficient; sr^2 = squared semipartial correlation coefficient.

Regular Season: $F(8, 286) = 570.51$, $p < 0.01$, $R^2 = 0.941$, Adjusted $R^2 = 0.939$.

Playoffs: $F(8, 151) = 45.24$, $p < 0.01$, $R^2 = 0.706$, Adjusted $R^2 = 0.690$.

^a $p < 0.01$.

Table 4. Team Rankings by Actual and Expected Winning Percentages in 2008–09 Regular Season

Team	Ranking by Actual Win%	Ranking by Expected Win% from Overall Efficiency	Ranking by Expected Win% from Four Factors
Atlanta Hawks	12	12	11
Boston Celtics	3	2	2
Charlotte Bobcats	19	20	20
Chicago Bulls	15	16	17
Cleveland Cavaliers	1	1	1
Dallas Mavericks	9	11	10
Denver Nuggets	5	8	6
Detroit Pistons	17	17	16
Golden State Warriors	24	24	23
Houston Rockets	8	6	8
Indiana Pacers	18	18	19
Los Angeles Clippers	28	30	29
Los Angeles Lakers	2	3	4
Memphis Grizzlies	25	26	25
Miami Heat	14	14	14
Milwaukee Bucks	20	19	18
Minnesota Timberwolves	26	25	26
New Jersey Nets	21	21	21
New Orleans Hornets	10	13	13
New York Knickerbockers	23	22	24
Oklahoma City Thunder	27	27	27
Orlando Magic	4	4	3
Philadelphia 76ers	16	15	15
Phoenix Suns	13	10	9
Portland Trail Blazers	6	5	5
Sacramento Kings	30	29	30
San Antonio Spurs	7	7	7
Toronto Raptors	22	23	22
Utah Jazz	11	9	12
Washington Wizards	29	28	28

Note: Win% = winning percentage.

Expected Win% from Overall Efficiency = $0.486 + 0.031(ORtg_i) - 0.030(DRtg_i)$.

Expected Win% from Four Factors = $-0.527 + 4.391(eFG\%_i) - 4.781(TOV\%_i) + 1.273(ORB\%_i) + 0.955(FTM_i/FGA_i) - 4.641(eFG\%_o) + 3.705(TOV\%_o) + 1.249(DRB\%_i) - 0.782(FTM_o/FGA_o)$.

Table 5. Team Rankings by Actual and Expected Winning Percentages in 2008–09 Playoffs

Team	Ranking by Actual Win%	Ranking by Expected Win% from Overall Efficiency	Ranking by Expected Win% from Four Factors
Atlanta Hawks	10	12	14
Boston Celtics	6	6	6
Chicago Bulls	8	9	9
Cleveland Cavaliers	1	1	2
Dallas Mavericks	7	7	7
Denver Nuggets	3	2	1
Detroit Pistons	16	15	15
Houston Rockets	5	8	8
Los Angeles Lakers	2	3	3
Miami Heat	9	5	5
New Orleans Hornets	13	16	16
Orlando Magic	4	4	4
Philadelphia 76ers	11	13	12
Portland Trail Blazers	12	10	10
San Antonio Spurs	14	11	11
Utah Jazz	15	14	13

Note: Win% = winning percentage.

Expected Win% from Overall Efficiency = $0.353 + 0.026(ORTg_i) - 0.025(DRTg_i)$.

Expected Win% from Four Factors = $-0.725 + 4.157(eFG\%_i) - 2.254(TOV\%_i) + 1.150(ORB\%_i) + 0.955(FTM_i/FGA_i) - 3.732(eFG\%_o) + 2.784(TOV\%_o) + 0.884(DRB\%_i) - 1.085(FTM_o/FGA_o)$.

3.2 Additional Analysis of Performance on Winning Playoff Series

As was the case with the MLR analysis, the assumptions of a LR analysis were first examined. A linear relationship between any predictors and the logit of the outcome variable (Win%) was confirmed by the nonsignificant interaction term ($p > 0.05$) between each predictor and its log transformation (Box and Tidwell, 1962; Hosmer and Lemeshow, 1989). The tolerance values for the predictors in any regression models ranged between 0.441 and 0.969, indicating no serious multicollinearity among the predictors (Field). On the other hand, one case in the second LR analysis (i.e., predicting the outcome of the Conference Semifinals) and two cases in the third LR analysis (i.e., predicting the outcome of the Conference Finals) had Cook's distances exceeding 1. Because these cases may have exerted undue influence on the regression coefficients, they were removed from the subsequent LR analyses.

Table 6 shows the results of the LR analysis of the overall efficiency on winning playoff series. The full models including both $ORtg_t$ and $DRtg_t$ could predict the outcome of the First Round and the Conference Semifinal match-ups significantly better than the constant-only models [$\chi^2(2) = 125.18$, $p < 0.01$ for the First Rounds; $\chi^2(2) = 21.84$, $p < 0.01$ for the Conference Semifinals]. $ORtg_t$ and $DRtg_t$ could explain 54.3–72.4% and 23.9–31.8% of the variability in the outcome of the First Rounds and the Conference Semifinals, respectively. In contrast, either variable was not significant to the LR model for predicting the outcome of the Conference Finals, $\chi^2(2) = 3.39$, $p = 0.1833$. According to the regression coefficients (B) and Wald statistics, there was a tendency that $DRtg_t$ became more important for winning playoff series as a team advances further in the post-season.

Table 6. Logistic Regression Analysis of Overall Efficiency on Winning Playoff Series

	Predictor	B (SE)**	Wald χ^2	OR (95% C.I.)
Lost in First Rounds ($n = 80$) [*] vs.	$ORtg_t$	3.545 (0.587)	36.418 ^a	34.632 (10.952–109.513)
Advanced to Conference Semifinals ($n = 80$)	$DRtg_t$	-3.539 (0.596)	35.199 ^a	0.029 (0.009–0.094)
Lost in Conference Semifinals ($n = 40$) [*] vs.	$ORtg_t$	2.254 (0.635)	12.579 ^a	9.522 (2.741–33.082)
Advanced to Conference Finals ($n = 40$)	$DRtg_t$	-2.445 (0.663)	13.596 ^a	0.087 (0.024–0.318)
Lost in Conference Finals ($n = 20$) [*] vs.	$ORtg_t$	0.788 (0.686)	1.320	2.199 (0.573–8.440)
Advanced to NBA Finals ($n = 20$)	$DRtg_t$	-1.321 (0.779)	2.878	0.267 (0.058–1.228)

Note: B = regression coefficient; SE = standard error; OR = odds ratio; C.I. = confidence intervals.

Lost in First Rounds vs. Advanced to Conference Semifinals: $R^2 = 0.543$ (Cox & Snell) and 0.724 (Nagelkerke),

$\chi^2(2) = 125.18$, $p < 0.01$, Overall percentage corrected = 87.5.

Lost in Conference Semifinals vs. Advanced to Conference Finals: $R^2 = 0.239$ (Cox & Snell) and 0.318 (Nagelkerke),

$\chi^2(2) = 21.84$, $p < 0.01$; Overall percentage corrected = 70.0.

Lost in Conference Finals vs. Advanced to NBA Finals: $R^2 = 0.081$ (Cox & Snell R Square) and 0.108 (Nagelkerke),

$\chi^2(2) = 3.39$, $p = 0.1833$; Overall percentage corrected = 62.5.

^{*} Reference category.

^{**} Predictors were standardized using z-scores before the analysis.

^a $p < 0.01$.

The results of the LR analysis of the *Four Factors* on winning playoff series are presented in Table 7. All three regression models were significant for predicting the outcome of each playoff series [$\chi^2(8) = 108.56$, $p < 0.01$ for the First Rounds; $\chi^2(8) = 30.43$, $p < 0.01$ for the Conference Semifinals; $\chi^2(8) = 16.28$, $p = 0.0385$ for the Conference Finals]. The LR models explained 32.0% to 65.7% of the variability in the playoff outcome depending on the playoff series. The B and Wald statistics revealed that all of the offensive and defensive *Four Factors* were significant to the regression model for the outcome of the First Rounds ($p < 0.01$). Specifically, $eFG\%_t$ and $eFG\%_o$ appeared to be the most important factors in winning the series, followed by $TOV\%_t$ and $TOV\%_o$. In terms of predicting the

outcome of the Conference Semifinals, only $eFG\%_t$, $eFG\%_o$, $TOV\%_t$, and $TOV\%_o$ were significant to the model ($p < 0.01$ or $p < 0.05$), as the relative importance of $TOV\%_t$ was greater in this model than in the previous one. On the other hand, $ORB\%_t$ and $DRB\%_t$ became and were the only significant variables ($p < 0.05$) for predicting the outcome of the Conference Finals.

Table 7. Logistic Regression Analysis of Four Factors on Winning Playoff Series

	Predictor	B (SE)**	Wald χ^2	OR (95% C.I.)
Lost in First Rounds ($n = 80$) [*] vs.	$eFG\%_t$	2.133 (0.381)	31.349 ^a	8.444 (4.001–17.820)
Advanced to Conference Semifinals ($n = 80$)	$TOV\%_t$	-1.511 (0.377)	16.028 ^a	0.221 (0.105–0.462)
	$ORB\%_t$	0.704 (0.264)	7.137 ^a	2.022 (1.206–3.389)
	FTM/FGA_t	0.820 (0.284)	8.353 ^a	2.270 (1.302–3.959)
	$eFG\%_o$	-2.155 (0.392)	30.234 ^a	0.116 (0.054–0.250)
	$TOV\%_o$	1.203 (0.347)	11.995 ^a	3.332 (1.686–6.583)
	$DRB\%_t$	0.848 (0.281)	9.096 ^a	2.335 (1.346–4.051)
	FTM_o/FGA_o	-0.761 (0.268)	8.077 ^a	0.467 (0.276–0.790)
Lost in Conference Semifinals ($n = 39^{***}$) [*] vs.	$eFG\%_t$	1.693 (0.529)	10.240 ^a	5.434 (1.927–15.325)
Advanced to Conference Finals ($n = 40$)	$TOV\%_t$	-2.022 (0.597)	11.488 ^a	0.132 (0.041–0.426)
	$ORB\%_t$	0.365 (0.379)	0.928	1.441 (0.685–3.028)
	FTM/FGA_t	0.073 (0.403)	0.033	1.076 (0.489–2.369)
	$eFG\%_o$	-2.255 (0.652)	11.969 ^a	0.105 (0.029–0.376)
	$TOV\%_o$	0.986 (0.443)	4.952 ^b	2.680 (1.125–6.385)
	$DRB\%_t$	0.631 (0.361)	3.048	1.879 (0.926–3.816)
	FTM_o/FGA_o	-0.626 (0.395)	2.518	0.535 (0.247–1.159)
Lost in Conference Finals ($n = 18^{****}$) [*] vs.	$eFG\%_t$	0.764 (0.781)	0.955	2.146 (0.464–9.926)
Advanced to NBA Finals ($n = 20$)	$TOV\%_t$	-0.369 (1.090)	0.115	0.691 (0.082–5.857)
	$ORB\%_t$	1.733 (0.715)	5.875 ^b	5.659 (1.393–22.981)
	FTM/FGA_t	-0.279 (0.703)	0.158	0.756 (0.191–3.002)
	$eFG\%_o$	-0.498 (1.079)	0.213	0.608 (0.073–5.036)
	$TOV\%_o$	0.371 (0.770)	0.232	1.449 (0.321–6.547)
	$DRB\%_t$	1.999 (0.781)	6.556 ^b	7.378 (1.598–34.068)
	FTM_o/FGA_o	-0.480 (0.769)	0.389	0.619 (0.137–2.793)

Note: B = regression coefficient; SE = standard error; OR = odds ratio; C.I. = confidence intervals.

Lost in First Rounds vs. Advanced to Conference Semifinals: $R^2 = 0.493$ (Cox & Snell) and 0.657 (Nagelkerke),

$\chi^2(8) = 108.56$, $p < 0.01$, Overall percentage corrected = 85.6.

Lost in Conference Semifinals vs. Advanced to Conference Finals: $R^2 = 0.320$ (Cox & Snell) and 0.426 (Nagelkerke),

$\chi^2(8) = 30.43$, $p < 0.01$, Overall percentage corrected = 78.5.

Lost in Conference Finals vs. Advanced to NBA Finals: $R^2 = 0.349$ (Cox & Snell), 0.465 (Nagelkerke),

$\chi^2(8) = 16.28$, $p = 0.0385$, Overall percentage corrected = 73.7.

* Reference category.

** Predictors were standardized using z-scores before the analysis.

*** One team was excluded from the analysis because Cook's distance exceeded 1.

**** Two teams were excluded from the analysis because Cook's distances exceeded 1.

^a $p < 0.01$; ^b $p < 0.05$.

3.3 Summary of Analysis

The results of the data analysis can be summarized as follows:

In the NBA regular season:

- Both offense and defense are significantly associated with winning games when evaluated by overall efficiency (i.e., *offensive* and *defensive ratings*).
- Offense may play a larger role in winning games than defense, though their contributions do not seem to differ greatly.
- Shooting efficiency on both ends of the floor (i.e., *offensive* and *defensive effective field goal percentages*) is likely to be the most critical aspect of the game.
- Committing fewer turnovers could also be the key to winning games.

In the NBA playoffs:

- The importance of defense in winning games may be greater than that in the regular season, while efficient offense is still an essential part of the game.
- In a similar fashion to the regular season, shooting efficiently on both ends of the floor is most associated with winning games.
- Defense may become more important for winning playoff series in the later stages of the post-season.
- All of the offensive and defensive *Four Factors* are significant predictors of the outcome of the First Rounds, while shooting efficiency appears to be the most crucial in winning the series.
- In the Conference Semifinals, shooting efficiency and turnover rates on both ends of the floor are significantly related to the series outcome, as committing fewer turnovers potentially plays a larger role than it does in the First Rounds.
- Getting offensive and defensive rebounds (evaluated by a percentage) could be a decisive factor in winning the Conference Finals.

4. Discussion

Regarding how the Phoenix Suns performed in the regular season and the playoffs from the 2004–05 through 2006–07 seasons, Tables 8 and 9 describe their league rankings in the overall efficiency and the *Four Factors* during those years. The Phoenix Suns were one of the most efficient offensive teams in the league for those years, as they ranked either first or second in $ORTg_t$ in the regular season and the playoffs. They maintained the league's best $eFG\%_t$ both in the regular season and in the playoffs during the 3 years, demonstrating their outstanding shooting efficiency from the field. Also, taking care of the ball was their strength (potentially due to Steve Nash), as their $TOV\%_t$ ranked between third and sixth in

the regular season as well as the playoffs each year. In contrast, the Phoenix Suns struggled defensively throughout the years. Their $DRtg_t$ was ranked below the league's median in all those years, including the regular season and the playoffs, except in the 2006–07 playoffs when the Phoenix Suns ranked seventh out of the 16 playoff teams. They had difficulty in defending the opponent's shooting from the floor (i.e., low rankings in $eFG\%_o$), particularly in the playoffs. These characteristics may explain why the Phoenix Suns underachieved in the playoffs each year despite the superb regular season records.

Table 8. League Rankings in Overall Efficiency by Phoenix Suns

	2004–05		2005–06		2006–07	
	Regular Season	Playoffs	Regular Season	Playoffs	Regular Season	Playoffs
$ORtg_t$	1st	1st	2nd	2nd	1st	2nd
$DRtg_t$	17th	11th	16th	12th	13th	7th

Note: Rankings are out of 30 teams in the regular season and out of 16 teams in the playoffs.

Table 9. League Rankings in Four Factors by Phoenix Suns

		2004–05		2005–06		2006–07	
		Regular Season	Playoffs	Regular Season	Playoffs	Regular Season	Playoffs
Offensive Four Factors	$eFG\%_t$	1st	1st	1st	1st	1st	1st
	$TOV\%_t$	3rd	4th	2nd	2nd	T-6th	3rd
	$ORB\%_t$	22nd	7th	30th	16th	29th	12th
	FTM_t/FGA_t	24th	11th	30th	T-15th	T-29th	10th
Defensive Four Factors	$eFG\%_o$	10th	T-12th	T-18th	11th	12th	8th
	$TOV\%_o$	28th	15th	23rd	11th	T-24th	T-11th
	$DRB\%_t$	29th	14th	19th	14th	20th	12th
	FTM_o/FGA_o	1st	1st	2nd	3rd	3rd	3rd

Note: T = tied; Rankings are out of 30 teams in the regular season and out of 16 teams in the playoffs.

It should also be pointed out that the Phoenix Suns showed the weakness of their ability to get rebounds on both ends of the floor. They ranked near the bottom of the league in $ORB\%_t$ and $DRB\%_t$ in the regular season and the playoffs

between the 2004–05 and 2006–07 seasons (see Table 9). As the data analysis showed, shooting efficiency and turnover rates seem to be the most important factors in winning the series in the First Rounds and the Conference Semifinals, whereas rebounding may, to a certain extent, decide the outcome of the Conference Finals. During the 3 years from the 2004–05 to 2006–07 seasons, the Phoenix Suns advanced to the Western Conference Finals twice but lost the series both times. Hence, we speculate that their poor rebounding had something to do with those losses in the playoffs by the Phoenix Suns.

It is logical to assume that the teams playing in the Conference Finals are those with better shooting efficiency and fewer turnover rates, because these factors are most related to winning the series in the First Rounds and the Conference Semifinals. This also suggests that these performance factors between the two teams meeting in the Conference Finals are likely to be “equally” better than those of the other teams that lost in the previous playoff rounds. As a result, it is possible that factors other than shooting efficiency and turnover rates, such as rebounding as indicated by the results of our data analysis, give a team an edge over its opponent in the Conference Finals.

We have also noticed during the course of the data collection and analysis that the Dallas Mavericks, similar to the Phoenix Suns, compiled excellent regular season records but showed a large decline in Win% (-22.8%) in the playoffs during the 3-year period (see Table 1). Their rankings in the overall efficiency and the *Four Factors* are presented in Tables 10 and 11. The data revealed that the performance factors of the Dallas Mavericks somewhat resembled those of the Phoenix Suns. The Dallas Mavericks ranked within the top five in $ORTg_t$ both in the regular season and in the playoffs for those years but near the bottom of the 16 playoff teams in $DRtg_t$ during 2 out of 3 years (14th in the 2004–05 playoffs and 13th in the 2006–07 playoffs). In addition, their $eFG\%_o$ was ranked 14th, 10th, and 16th in the playoffs between the 2004–05 and 2006–07 seasons, respectively. It could be that these factors were part of the reasons for a lack of success in the playoffs by the Dallas Mavericks.

On the other hand, when the Dallas Mavericks reached the NBA Finals in the 2005–06 season, their defensive efficiency in the playoffs was much improved compared to that in the other two post-seasons (ranked fourth in $DRtg_t$; see Table 10) without compromising their offense (ranked fifth in $ORTg_t$; see Table 10). In addition, they were one of the best offensive rebounding teams especially in the playoffs, as the Dallas Mavericks finished within the top three in $ORB\%_t$ in each year of the playoffs (see Table 11). Furthermore, they controlled the defensive boards well in the 2005–06 playoffs, ranking second in $DRB\%_t$. Therefore, better defense and strong rebounding performance on both ends of the floor that the Phoenix Suns lacked over the years potentially helped the Dallas Mavericks advance to the NBA Finals in the 2005–06 season.

Table 10. League Rankings in Overall Efficiency by Dallas Mavericks

	2004–05		2005–06		2006–07	
	Regular Season	Playoffs	Regular Season	Playoffs	Regular Season	Playoffs
$ORtg_t$	4th	2nd	1st	T-5th	2nd	5th
$DRtg_t$	9th	14th	11th	4th	5th	13th

Note: T = tied; Rankings are out of 30 teams in the regular season and out of 16 teams in the playoffs.

Table 11. League Rankings in Four Factors by Dallas Mavericks

		2004–05		2005–06		2006–07	
		Regular Season	Playoffs	Regular Season	Playoffs	Regular Season	Playoffs
Offensive Four Factors	$eFG\%_t$	T-8th	6th	T-11th	11th	5th	12th
	$TOV\%_t$	T-5th	5th	T-9th	5th	T-6th	T-13th
	$ORB\%_t$	T-17th	2nd	2nd	T-3rd	8th	1st
	FTM/FGA_t	T-5th	T-10th	3rd	7th	11th	1st
Defensive Four Factors	$eFG\%_o$	T-9th	14th	T-8th	10th	T-5th	16th
	$TOV\%_o$	9th	8th	T-16th	5th	17th	5th
	$DRB\%_t$	23rd	11th	T-18th	2nd	5th	10th
	FTM_o/FGA_o	12th	6th	19th	9th	22nd	11th

Note: T = tied; Rankings are out of 30 teams in the regular season and out of 16 teams in the playoffs.

Unlike the Phoenix Suns and the Dallas Mavericks, the San Antonio Spurs were highly successful both in the regular season (Win% = 73.2; league's second best record) and in the post-season (Win% = 69.6; league's best record) between the 2004–05 and 2006–07 seasons (see Table 1). They reached the NBA Finals twice during the 3-year span and won the title both times. Tables 12 and 13 show the overall efficiency and the *Four Factors* of the San Antonio Spurs for those years. It seems that their success was mainly due to their excellent defensive effort. The San Antonio Spurs were among the league's top five in $DRtg_t$ in the regular season and the playoffs during all 3 years except in the 2005–06 playoffs (ranked 11th) when they lost in the Western Conference Semifinals. In particular, they defended against the opponent's shooting very well, as their $eFG\%_o$ was ranked either first or second in the regular season and fifth in the playoffs

throughout the years from the 2004–05 to 2006–07 seasons. In addition, it may not be widely recognized, but the San Antonio Spurs had solid offensive games over the years. Their $ORtg_t$ was ranked among the league's top ten in the regular season and within the top three twice in the playoffs during those 3 years. The San Antonio Spurs shot very efficiently from the field, finishing within the top three in $eFG\%_t$ both in the regular season and in the playoffs during the 2005–06 and 2006–07 seasons while ranking eighth and fifth during the 2004–05 season. They did not perform particularly well in terms of the other performance factors but did not show obvious weaknesses in these factors, either. It appears that their consistent performance on both ends of the floor, especially for shooting efficiency, with no major weaknesses is associated with their consistent success in the regular season and the playoffs by the San Antonio Spurs.

Table 12. League Rankings in Overall Efficiency by San Antonio Spurs

	2004–05		2005–06		2006–07	
	Regular Season	Playoffs	Regular Season	Playoffs	Regular Season	Playoffs
$ORtg_t$	T-9th	7th	10th	1st	5th	3rd
$DRtg_t$	1st	5th	1st	11th	2nd	5th

Note: T = tied; Rankings are out of 30 teams in the regular season and out of 16 teams in the playoffs.

Table 13. League Rankings in Four Factors by San Antonio Spurs

		2004–05		2005–06		2006–07	
		Regular Season	Playoffs	Regular Season	Playoffs	Regular Season	Playoffs
Offensive Four Factors	$eFG\%_t$	T-8th	5th	3rd	2nd	2nd	3rd
	$TOV\%_t$	12th	12th	13th	9th	T-10th	T-7th
	$ORB\%_t$	T-13th	3rd	20th	13th	27th	9th
	FTM/FGA_t	21st	8th	29th	1st	20th	11th
Defensive Four Factors	$eFG\%_o$	1st	5th	1st	5th	2nd	5th
	$TOV\%_o$	T-6th	13th	T-19th	T-13th	T-20th	T-8th
	$DRB\%_t$	3rd	8th	8th	12th	3rd	9th
	FTM_o/FGA_o	11th	2nd	4th	14th	1st	6th

Note: T = tied; Rankings are out of 30 teams in the regular season and out of 16 teams in the playoffs.

As a caveat to interpreting the results of this analysis, it should be noted that competition is tougher in the playoffs than in the regular season, in that the playoffs only include the best teams in the league. We conducted a follow-up analysis and found that the teams that advanced to the playoffs had significantly better $ORTg_t$ (106.8 vs. 103.5) and $DRtg_t$ (103.4 vs. 107.5) than did the teams that did not qualify for the playoffs during the 10 years from the 1999–2000 through 2008–09 seasons ($p < 0.01$). Furthermore, this trend (i.e., better numbers in the performance factors by the playoff teams) was also observed in the offensive and defensive *Four Factors*. Therefore, the difference in the competition levels makes it not entirely straightforward to compare the coefficients of the MLR models between the regular season and the playoffs. On the other hand, our objective in this study was not to directly compare the performance factors between the regular season and the playoffs but to examine the relative importance of these factors within the regular season and the playoffs using regression models. Future studies will directly address this issue by analyzing the performance factors while taking into account the fact that the average opponent in the playoffs is better than that in the regular season. This could be done by, for example, defining a playoff Win% adjusted for the difference in the competition levels between the regular season and the playoffs. Additionally, how teams “step up” and improve their performance factors once they reach the playoffs will be addressed in future studies.

5. Conclusions

The present study indicates that in the NBA the relative importance of performance factors in winning games may differ between the regular season and the playoffs. This could explain why some teams, such as the Phoenix Suns and the Dallas Mavericks, play great basketball in the regular season but come up short in the post-season. There is no distinct trend of whether offense or defense is more important for winning games in the NBA. Rather, the results of this study suggest that teams with good offense can still win a number of games in the regular season but may struggle in the post-season without solid defensive games. Specifically, shooting efficiency on both ends of the floor is likely to be the most critical aspect of the game to succeeding in the regular season as well as the playoffs. However, additional factors, such as rebounding, may play a significant role in surviving later in the post-season (e.g., winning the Conference Finals).

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