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Study on the Relationship Between NBA Players' Offensive and Defensive Abilities and Game Success

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Abstract: This paper aims to analyze the offensive and defensive abilities of NBA professional basketball league players, especially to explore the differences in technical indicators of players in different positions and their relationship with game results. By using analysis of variance (ANOVA) and independent samples T-test, the study found that there are significant differences in certain technical performances between players in different positions. In addition, age is also an important factor affecting a player's technical performance. Finally, the impact of technical indicators on the team's winning rate was analyzed through the least squares regression model. The research results can help basketball teams better formulate selection strategies and train young players, thereby improving the team's overall performance and winning rate.

Keywords: NBA, technical indicators, player performance

1. Introduction

Basketball is one of the most attractive sports globally, especially with its high pace and fierce competition, which attracts countless fans and participants. As the world's top basketball league, NBA has a very high international reputation, and its games and stars often become the focus of sports discussions around the world. The purpose of this study is to understand the offensive and defensive abilities, characteristics, and differences of players from each team in the NBA professional basketball league and to explore the relationship between the players' offensive and defensive abilities in eight items and their positions [1].

2. Literature statement

Official statistics are provided by www.fpb.com.br (the official website of the tournament). Statistical analysis uses analysis of variance. The results show that the home team wins about 62% of its matches and outperforms the away team in shots, rebounds, steals, assists, and shooting efficiency. The home team's offense is also more aggressive, taking more shots than the away team and being more efficient. Winning teams, regardless of position, are always better than losing teams in every metric.

3. Hypothesis

T-test Null Hypothesis (H_0): There is no significant difference in the mean values between the two age groups for each technical indicator. For each technical indicator, the mean values between the older and younger age groups are equal.

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ANOVA Null Hypothesis (H_0): There is no significant difference between the averages of players at different positions in their respective technical indicators. Specifically, whether it is three-point shooting percentage, field goal percentage, free throw percentage, rebounds, turnovers, steals, blocks, or personal fouls, the averages of these indicators for players at all positions are the same [2-4].

4. Data description

Table 1: Data display (part)

Players	Age	POSITION	W	FG%	3P%	FT%	REB	TOV	STL	BLK	PF	FP
Al Horford	38	C-F	16	47.8	36.8	63.6	7	0.6	0.8	0.8	1.5	25
Derrick White	29	G	16	45.2	40.4	92.1	4.3	0.8	0.9	1.2	2.3	33.6
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Obi Toppin	26	F	8	54.1	35.7	76	4.4	0.8	0.4	0.4	1.2	20
Pascal Siakam	30	F	8	54.1	29.8	61.9	7.5	1.1	0.8	0.4	2.8	38.7
T.J. McConnell	32	G	8	48.6	26.9	86.7	3.1	1.2	0.9	0.1	1.5	24.8

The research data comes from nba.com.

The data in table 1 are selected from the game data of players in the 2023-2024 season playoffs. Three-point shooting percentage (3P%), field goal percentage (FG%), free throw percentage (FT%), rebounds (REB), turnovers (TOV), steals (STL), blocks (BLK) and personal fouls (PF) and W (wins) are selected as key performance indicator variables.

5. Descriptive statistics

Table 2: In terms of shooting percentage (FG%, 3P%, FT%)

Indicator	W	FG%	3P%	FT%	REB	TOV	STL	BLK	PF
Min	0	0	0	0	0	0	0	0	0
1st Qu.	1	33.58	0	37.75	1	0.3	0.1	0.2	0.55
Median	2	42.9	29.9	70.95	2.8	0.7	0.4	0.2	1.5
3rd Qu.	6	49.9	38.5	86.62	4.8	1.475	0.9	0.5	2.45
Max	16	100	100	100	15.6	4.6	2.4	2.5	4.5

As Table 2 shows, most players' shooting percentages are between 33.58% and 49.9%, showing a relatively average shooting performance. Free throw shooting percentages are generally high, and the distribution is relatively concentrated, indicating that most players are relatively stable when shooting free throws. The difference in rebounding ability is large, with a median of 2.8 and a maximum of 15.6, indicating that some players have outstanding rebounding ability, strong control over the game, and control of the ball: the number of turnovers is low, indicating that most players can effectively control the ball and avoid unnecessary mistakes. It also indirectly reflects the intensity of the NBA playoffs.

6. Method

ANOVA was used to analyze the differences in each player's position's eight attack and defense statistics. Then, the players were divided into two groups, young players and old players, with the

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mean age as the boundary, and the independent sample T-test was used to compare the differences in the eight attack and defense statistics of the two groups [5].

After that, the least squares regression was used to explore the impact of eight technical indicators on the number of playoffs wins and to study the Peel correlation coefficients between the eight technical indicators. These studies can help teams understand whether a player's age and the position they play may affect their scoring performance, and then explore and compare the relationship between players' technical level and their impact on the outcome of the game. This will provide data support for the team's selection strategy and young player training strategy, thereby improving the skills and level of basketball players and bringing more victories to the team [6].

7. Empirical analysis

7.1. ANOVA

Table 3: ANOVA results

ANOVA	Sum Sq	Mean Sq	F value	Pr(>F)
anova_PF	9.9	1.415	1.06	0.391
anova_stl	3.8	0.543	2.266	0.0305 *
anova_3p	5791	827.3	1.96	0.062
anova_fg	8642	1234.6	3.942	0.000462 ***
anova_blk	4.95	0.7072	3.589	0.00114 **
anova_ft	8192	1170	0.874	0.528
anova_reb	281.1	40.16	5.154	2.01e-05 ***
anova_tov	4.78	0.6834	0.738	0.64

As the results in Table 3 show, there are significant differences in the performance of players at different positions in terms of rebounds (REB) and blocks (BLK). The P value of REB is 2.01e-05, and the P value of BLK is 0.00114, indicating that centers and forwards. Due to their frequent activities under the basket, they perform well in these technical statistics. In addition, the P value of steals (STL) is 0.0305, which also shows statistical significance. The guard position may be better in STL data due to the advantages of speed and agility. However, for field goal percentage (FG%), turnovers (TOV), and free throw percentage (FT%), the P values are 0.391, 0.528, and 0.64, respectively, showing that these indicators do not show significant differences among players at different positions. Statistical difference. This reflects that improvements in these technical abilities may depend more on individual training and the specific skills of the players than on their position on the field. These findings help guide coaches and team analysts in tailoring training plans and game strategies to better utilize the unique skills of players at each position.

7.2. T-test

The T-test results table in Table 4 provides insight into the performance of specific skills in the older group of players. The significance test revealed that there are significant differences between the older player group and the younger player group in terms of rebounds (REB) and personal fouls (PF). The P value of rebounds is 0.04776, and the P value of personal fouls is 0.04776. The P value is 0.03821, both below the conventional significance threshold of 0.05. This suggests that experience and physical confrontation may play a key role in rebounding competition, and in terms of fouls, more experienced players may commit fewer fouls due to greater defensive skills. However, for three-point shooting percentage (3P%), field goal percentage (FG%), free throw percentage (FT%), turnovers (TOV), steals (STL), and blocks (BLK), their P values did not reach the statistically significant level

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shows that age has no significant impact on this technical performance, and the performance of these technical indicators is more affected by personal skills and training level.

Table 4: T-test results

T-test	t value	p-value
3P%	0.84807	0.3974
FG%	-0.59942	0.5495
FT%	1.9639	0.05095
REB	1.9943	0.04776
TOV	1.1103	0.2683
STL	1.1183	0.265
BLK	0.48309	0.6296
PF	2.0872	0.03821

7.3. Pearson correlation coefficient

Table 5: Pearson correlation matrix

	3P%	FG%	FT%	REB	TOV	STL	BLK	PF
3P%	1.00	0.40	0.30	0.14	0.21	0.20	0.12	0.29
FG%	0.40	1.00	0.31	0.34	0.21	0.19	0.27	0.29
FT%	0.30	0.31	1.00	0.41	0.39	0.42	0.29	0.53
REB	0.14	0.34	0.41	1.00	0.68	0.55	0.58	0.68
TOV	0.21	0.21	0.39	0.68	1.00	0.69	0.41	0.64
STL	0.20	0.19	0.42	0.55	0.69	1.00	0.44	0.64
BLK	0.12	0.27	0.29	0.58	0.41	0.44	1.00	0.49
PF	0.29	0.29	0.53	0.68	0.64	0.64	0.49	1.00

The Pearson correlation coefficient matrix table shown in Table 5 provides us with a quantitative analysis of the interrelationships between basketball technical indicators. The correlation between three-point shooting percentage (3P%) and other technical statistical items is generally low, which indicates that three-point shooting performance may be relatively independent of other technical performance. Free throw percentage (FT%) shows a moderate positive correlation with turnovers (TOV) and steals (STL) (0.39 and 0.42, respectively), reflecting that players who participate more actively in the game may have more free throw opportunities and may also have more turnovers and steals in the game.

Rebounds (REB) have a relatively high correlation with turnovers (TOV) and personal fouls (PF) (0.68 and 0.68, respectively), indicating that the physical confrontation in the process of fighting for rebounds is more intense, resulting in more fouls. The correlation coefficient between turnovers (TOV) and steals (STL) is 0.69, indicating that turnovers may be prone to occur while actively stealing or that the faster game rhythm leads to more turnovers and steals on both sides.

7.4. Least squares estimation

Table 6: Regression results

Variable	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	1.05	0.68	1.55	0.12
3P%	0.05	0.01	3.29	0.00
FG%	0.00	0.02	-0.06	0.95

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Table 6: (continued)

FT%	0.03	0.01	2.99	0.00
REB	0.25	0.14	1.70	0.09
TOV	-0.60	0.43	-1.39	0.17
STL	0.57	0.77	0.75	0.46
BLK	0.98	0.70	1.40	0.16
PF	-0.47	0.36	-1.30	0.20

Fourth, the least squares regression model was used to explore the impact of eight technical indicators of NBA players on the number of playoff wins. The results showed that the overall explanatory power of the model was limited, with the multiple R-square being 17.41%, indicating that the model explained some but not all of the variability in the number of wins. The model fitting effect was not particularly good, which may be caused by the limitations of the selected data. In the model regression results in Table 6, the impact of three-point shooting percentage (3P%) and free throw shooting percentage (FT%) on Q team's playoff wins is particularly significant and positive. The regression coefficients are 0.046 and 0.046, respectively. 0.0255, which means that as long as a player improves his shooting percentage by 1% on the court, the team's expected wins will increase by 0.046 and 0.0255, respectively, which emphasizes the importance of shooting efficiency in the game. Although rebounds (REB) are close to the significance boundary and show a certain positive impact, other technical indicators such as field goal percentage (FG%), turnovers (TOV), steals (STL), blocks (BLK), and personal Fouls (PF) have an insignificant impact on a team's number of wins in the playoffs. Especially for the field goal percentage (FG%), the least squares regression coefficient is -0.0009, which shows that its impact on wins is minimal and not significant. This may be because the field goal percentage is different from other factors. The result of the interaction of relevant factors such as shot selection and opponent defense. This is obviously contrary to our understanding. People often think that as long as the field goal percentage (FG%) of the players on this team is higher, the team is more likely to win the game, but the results of the model are not like this. This may be due to the selection of too many variables, the difference in results caused by multicollinearity between variables, or the limitations of the data [7-9].

7.5. Residual plot

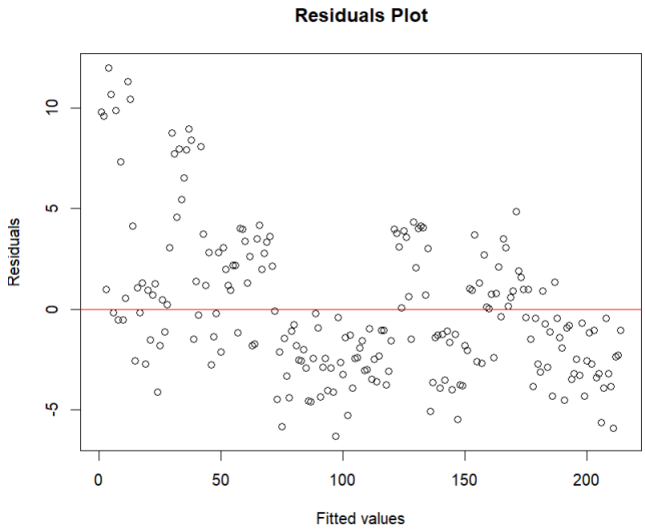

Figure 1: Residual plot

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An ideal residual plot should show that the residuals are randomly distributed around the zero line, with no obvious pattern or trend. As shown in Figure 1, the residuals in this plot are distributed around the zero line, but there seems to be some spread at both ends (that is, the absolute value of the residuals increases as the fitted value increases), which may suggest that the variance of the residuals is not constant. Some of the residual values in the figure are large, indicating that there may be outliers. These points may be caused by special, atypical observations [10].

8. Conclusion

Weaknesses of the study: Sample and data scope limitations: The study may rely on data from a single season and does not include long-term trend analysis of multiple seasons or historical data, which may limit the broad applicability and depth of the results. The limited explanatory power of the model: The explanatory power of the model is low (R-squared is 17.41%), indicating that there are many unobserved variables that may affect the number of wins, such as team strategy, opponent strength, injuries, etc. These factors is not fully considered in current models.

In-depth understanding of player performance: Through the analysis of different statistical indicators, this study helps to reveal the specific impact of player positions on their performance, providing a quantitative method to evaluate player contribution and efficiency, which is crucial for coaches and management when formulating tactics and selection strategies.

Exploration of age factors: By comparing players into two groups, young and old, the study highlights how age affects the specific technical performance of players, which is of practical significance for understanding player career development and formulating targeted training plans.

Data-driven decision support: Provides data-based insights to support team management and tactical decisions, emphasizing the importance of specific technical indicators such as three-point shooting percentage and free throw shooting percentage in improving team winning rate.

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