

MULTIVARIATE AND UNIVARIATE DIFFERENCES IN OFFENSE-DEFENSE VARIABLES AMONG THE BEST BASKETBALL LEAGUES

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(Original scientific paper)

Borce Daskalovski¹, Milan Naumovski¹, Miodrag Kocić²

¹Faculty of Physical Education, Ss. Cyril Methodius, University of Skopje, Macedonia

²Faculty of Sport and Physical Education, University of Niš, Serbian

Abstract:

A research aiming to determine intergroup differences in offense-defense variables among four studied subsamples was conducted on a sample of 368 basketball players from the NBA league, the Euroleague, the Adriatic (ABA) league, and the First Macedonian Basketball League. A total of fourteen variables were applied to assess the performance of each player, eleven of which were offense and three were defense variables. Based on the results of the performed multivariate analysis of offense variables it was found that there are statistically significant differences in the arithmetic means of the following applied variables among the four subsamples: total two-point field goals (FG), total two-point field goals attempted (FGA), and assists (ASS). NBA respondents achieved best results in the total two-point field goals (FG) variable, meaning they attempt more two-point field goals compared to other respondents, which by all means allows them to achieve higher scores. NBA respondents have the highest number of assists (ASS) per game. The results of the multivariate analysis of defense variables show statistically significant differences in the arithmetic means of the following applied variables among the four subsamples: defensive rebounds (DR) and total rebounds (TOTR). NBA respondents achieved the best results in these two variables.

Keywords: *basketball, shot, rebounds, variance, goal*

Introduction

Competition is the most adequate and stringent test for all positive and negative aspects of a team, while the analysis of the structural elements of a game directly and unarguably reflects all flaws and advantages. One cannot acquire reliable information about individual or team performance by simply watching the games or conducting an inadequate analysis. Although many factors influence a game outcome, efficient implementation of certain structural elements of a basketball game is crucial. This issue has been studied by many authors, the most significant of which are: Dežman B. and Jeras G., Trninić S., Viškič-Štalec J., Dizdar D. and Birkič Z., Naumovski M., Daskalovski B., etc.

Research topic and purpose

- The **topic** of this research are the offense-defense variables in the NBA, the Euroleague, the ABA league teams, and the teams that play in the best league in our country.
- The **purpose** of this research is to determine intergroup differences in the offense-defense variables among the four subsamples.

Approach

Respondent sample

The respondent sample was chosen from the top basketball players in the NBA league, the Euroleague, the ABA league, and the First Macedonian Basketball League. These are professional basketball players. The total respondent sample consists of 368 basketball players and it is divided into four subsamples:

First subsample covers the NBA league and has a total of 101 respondents. Second subsample covers the European Basketball League and has a total of 95 respondents. The third subsample includes the First

Macedonian Basketball League and has a total of 71 respondents. The fourth subsample covers the Adriatic League and has a total of 101 respondents.

Variables sample

A total of 14 variables—to assess the performance of each player included in this study—were applied in this research.

Variables to assess the performance of players

- 1. Number of Minutes played in the game MIN
- 2. Total Two-Point Field Goals FG
- 3. Total Two-Point Field Goals Attempted FGA
- 4. Three-Point Shooting P3
- 5. Three-Point Attempts P3A
- 6. Free Throws FT
- 7. Free Throws Attempted FTA
- 8. Offensive Rebounds OR
- 9. Defensive Rebounds DR
- 10. Total Rebounds TOTR
- 11. Assists ASS
- 12. Steals ST
- 13. Turnovers TO
- 14. Points PTS

Univariate and multivariate analysis of variance (ANOVA, MANOVA) were applied to determine the quantitative and qualitative intergroup differences; while univariate differences in variables analyzed were determined with the LSD post hoc test.

Results and discussion

Univariate and multivariate analysis of variance of offense variables in all four subsamples

Table 1. Offense variables multivariate differences in all four subsamples

	Wilks's				
	Lambda	Rao's R	df 1	df 2	p-level
1.	.558605	6.891872	33	1040	.000000

Table 1 shows the multivariate analysis of variance results for offense variables which clearly indicate the statistically significant difference in the arithmetic means among respondents from all leagues studied. Wilks's lambda is .558605 and if approximated by Rao's R = 6.891872 and degrees of freedom df1 = 33 and df2 = 1040 it would be significant p = .0000 (p < .01).

Table 2. Univariate differences of offense variables in all four subsamples

VAR.	Mean sqr	Mean sqr	F(df1,2)	
	Effect	Error	3.363	p-level
MIN	294.1216	348.6419	.84362	.470692
FG	42.3805	5.5903	7.58101	.000063
FGA	323.0787	17.5554	18.40335	.000000
PZ	.5686	.9255	.61435	.606070
PZA	4.5250	4.3659	1.03644	.376411
FT	1.4911	3.5847	.41597	.741643
FTA	4.7553	6.1348	.77514	.508475
OR	.5437	1.3253	.41029	.745705
ASS	10.9012	3.5285	3.08945	.027181
TO	1.3279	1.6434	.80801	.490051
PTS	57.3311	37.3689	1.53420	.205270

Table 2 shows the results of univariate analysis of offense variables in all four subsamples and it clearly indicates that the statistically significant differences in the arithmetic means among subsamples in the multivariant field are due to the presence of significant variable differences: total two-point field goals (FG), total two-point field goals attempted (FGA), and assists (ASS). Hereinafter results will be presented only for variables with established statistically significant intergroup differences.

The LSD test is used to determine the differences between individual variables and the level of statistical significance among the four subsamples.

Table 3. LSD test for the total two-point field goals (FG) variable in respondents of all four subsamples

	{1}	{2}	{3}	{4}
	3.504951	2.484210	3.070423	2.019802
1 {1}		.002680	.235758	.000011
2 {2}	.002680		.114586	.169854
3 {3}	.235758	.114586		.004325
4 {4}	.000011	.169854	.004325	

Differences in the total two-point field goals variable (FG) for all four subsamples are shown in Table 3. It can be concluded that there is a .00268 ($p < .01$) and a .000011 ($p < .01$) statistically significant difference in this variable among NBA and Euroleague respondents, and among NBA and ABA league respondents, respectively. The NBA players achieve better results. First Macedonian Basketball League respondents statistically make significantly larger number of two-point field goals – .004325 ($p < .01$), compared to ABA league respondents. The results show that Macedonian basketball players make approximately the same number of two-point field goals as NBA respondents.

Table 4. LSD test of the total two-point field goals attempted (FGA) variable in respondents of all four subsamples

	{1}	{2}	{3}	{4}
	7.801980	4.557895	6.535211	3.831683
1 {1}		.000000	.051377	.000000
2 {2}	.000000		.002775	.225419
3 {3}	.051377	.002775		.000038
4 {4}	.000000	.225419	.000038	

Table 4 shows the differences in the total two-point field goals attempted (FGA) variable among all four subsamples. As with the previous variable, it can be concluded that for this variable there are also statistically significant differences of .00 ($p < .01$) and .00 ($p < .01$) among NBA and Euroleague respondents, and among NBA and ABA respondents, respectively. NBA respondents attempt more two-point field goals. First Macedonian Basketball League respondents have statistically significant larger number of two-point field goals attempted compared to Euroleague respondents; significance level equals .002775 ($p < .01$). They also have statistically significant larger number of two-point field goals attempted compared to ABA league respondents. Level of significance equals .000038 ($p < .01$).

Table 5. LSD test of total assists (ASS) variable of respondents in all four subsamples

	{1}	{2}	{3}	{4}
	1.980198	1.357895	1.281690	1.247525
1 {1}		.021036	.016874	.005873
2 {2}	.021036		.796139	.681309
3 {3}	.016874	.796139		.906598
4 {4}	.005873	.681309	.906598	

Table 5 shows the differences in the total assists (ASS) variable in all four subsamples. It can be concluded that there are statistically significant differences in this variable of .021 ($p < .01$) and .005 ($p < .01$)

.01) among NBA and Euroleague respondents, and among NBA and ABA league respondents, respectively. There is also a .016 statistically significant difference among NBA and First Macedonian Basketball League respondents. It should be pointed out that the NBA rule is as follows – each final pass that leads to a score is considered an assist, while in the Euroleague the pass directly before the score is considered an assist.

Multivariate analysis of variance of defense variables

Table 6. Multivariate differences between selected variables in all four subsamples

	Wilks's				
	Lambda	Rao's R	df 1	df 2	p-level
1.	.954352	1.897755	9	881	.048977

Table 6 shows the results of the multivariate analysis of offense variables which clearly indicate a statistically significant difference in the arithmetic means between respondents from: the NBA, the Euroleague, the Macedonian League, and the ABA league. Wilks's lambda is .558605 and if approximated by Rao's R = 6.891872 and degrees of freedom df1 = 33 and df2 = 1040 it would be significant $p = .0000$ ($p < .01$).

Table 7. Univariate differences between defense variables in all four subsamples

	Mean sq	Mean sq	F(df1,2)	
	Effect	Error	3.364	p-level
DR	21.42488	4.425667	4.841050	.002571
ST	.10371	1.066752	.097220	.961537
TOTR	23.29980	6.854284	3.399306	.017968

Table 7 shows the results of the univariate analysis of defense variables in respondents from all four championships. The table shows that the statistically significant differences in the arithmetic means of the multivariate field among respondents from the four championships are due to the presence of significant differences in the following variables: defensive rebounds (DR) and total rebounds (TOTR).

Table 8. Arithmetic means of defense variables in all four subsamples

	DR	ST	TOTR
1	3.079208	.702970	4.039604
2	2.063158	.757895	3.084211
3	2.309859	.732394	3.211268
4	2.148515	.683168	2.980198

Table 8 shows the differences between arithmetic means of defense variables in all four subsamples. The LSD test is applied to establish the differences between individual variables and their level of statistical significance among all four subsamples.

Table 9. LSD test of the defensive rebounds (DR) variable in respondents from all four subsamples

	{1}	{2}	{3}	{4}
	3.079208	2.063158	2.309859	2.148515
1 {1}		.000806	.018735	.001804
2 {2}	.000806		.455236	.776659
3 {3}	.018735	.455236		.620750
4 {4}	.001804	.776659	.620750	

Table 9 shows the differences in the defensive rebounds (DR) variable in all four subsamples. It can be concluded that there is a statistically significant difference of .000806 ($p < .01$) and .001804 ($p < .01$) among NBA and Euroleague respondents, and among NBA and ABA league respondents, respectively. Statistically significant difference of .018735 ($p < .01$) in the same variable exists among NBA and First Macedonian Basketball League respondents.

Table 10. LSD test for the total rebounds (TOTR) variable in respondents of all four subsamples

	{1}	{2}	{3}	{4}
	4.039604	3.084211	3.211268	2.980198
1 {1}		.011079	.041780	.004270
2 {2}	.011079		.757230	.781193
3 {3}	.041780	.757230		.569107
4 {4}	.004270	.781193	.569107	

Table 10 shows a statistically significant difference of .011079 ($p < .01$) and .041780 ($p < .01$) among NBA and Euroleague respondents, and among NBA and First Macedonian basketball League respondents, respectively. The table also shows a statistically significant difference of .004270 ($p < .01$) among NBA and Adriatic League respondents.

Conclusion

Based on the results obtained and the analysis conducted the following conclusions were reached:

- The multivariate analysis of offense variables showed that there are statistically significant differences in the arithmetic means of the following applied variables among the four studied subsamples: total two-point field goals (FG), total two-point field goals attempted (FGA), and assists (ASS). NBA respondents achieved the best results in the total two-point field goals (FG) variable. NBA respondents achieved the best results in the total two-point field goals attempted (FGA) variable which by all means allows them to achieve higher scores. On average, the NBA respondents have the highest number of assists (ASS) per game.

- Multivariate analysis of defense variables showed that there are statistically significant differences in the arithmetic means of the following applied variables among the four studied subsamples: defensive rebounds (DR) and total rebounds (TOTR). NBA respondents achieved the best results in these two variables.

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Corresponding Author

Borce Daskalovski,

Faculty of Physical Education, Sport and Health

Skopje, 1000

Macedonia,

E-mail: borodaskalovski@yahoo.com