THE INFLUENCE OF DEFENSIVE AND OFFENSIVE REBOUNDS ON THE FINAL SCORE IN A BASKETBALL GAME

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Sažetak

The goal of this research was to determine the relationship between DEFENSIVE AND OFFENSIVE REBOUNDS as indicators of situation-related efficiency which influences the final score in a basketball game. The rebounds have been defined by the number of the balls being caught both on defense and on offense. The result was defined by the binary variable VICTORY - DEFEAT. The data have been collected during 64 games of the World Basketball Championship in Toronto in 1994. The results of the regression analysis have shown a significant influence of defensive and offensive rebounds on the final score in the basketball game. The number of the balls being caught during the play, i.e. the number of defensive rebounds, is a more significant indicator of the situation-related efficiency of the play in basketball than the number of the balls being caught on offense, i.e. than the number of offensive rebounds.

Ključne riječi: *basketball game, defensive rebounds, offensive rebounds, regression analysis, final score of the match*

Abstract

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Key words: *basketball game, defensive rebounds, offensive rebounds, regression analysis, final score of the match*

Zusamenfassung

DER EINFLUß VON DEFENSIVEN UND OFFENSIVEN REBOUNDS AUF DEN ENDRESULTAT EINES BASKETBALLMATCHES

Das Ziel dieser Forschung war, die Relationen zwischen den defensiven und offensiven Rebounds als der Indikatoren der situationsbezogenen Effizienz, die den Endresultat eines Basketballmatches beeinflußt, festzustellen. Die Rebounds wurden mittels der Anzahl von Bällen, die sowohl in der Angriffs- als auch in der Verteidigungsphase gefangen wurden, definiert. Das Ergebnis wurde mittels der binären Variabel SIEG - NIEDERLAGE definiert. Die Daten wurden während 64 Matches der Basketball Weltmeisterschaft in Toronto in 1994 gesammelt. Die Ergebnisse der Regressionsanalyse haben einen bedeutenden Einfluß von sowohl defensiven als auch offensiven Rebounds auf den Endresultat eines Basketballmatches gezeigt. Die Anzahl der Bälle, die während des Spiel angefangen wurden, d.h. die Anzahl der defensiven Rebounds, ist ein bedeutendender Indikator der situationsbezogenen Effizienz des Spieles als die Anzahl der offensiven Rebounds.

Schlüsselwörter: *Basketballspiel/ defensive Rebounds/ offensive Rebounds/ Regressionsanalyse/ Endresultat eines Matches*

Introduction

In a basketball game rebounds are an important part of the playing tactics activity and they significantly influence the efficiency of play both on defense and on offense. We should distinguish between jumps which can be defined as movement structures that appear in a large number of technical and tactical elements of play with and without the ball, and rebounds that result in a particular number of rebounds caught on defense or offense.

A defensive rebound, as an indicator of the situation-related efficiency of the players, represents the number of balls caught after the ball has unsuccessfully been thrown towards the basket by the opponent. In order to perform a successful rebound, i.e. to catch a ball on defense successfully, it is important to anticipate the shot and to take up the front or the inside position (between the opponent and the basket) for the rebound, through a high block out closing approach to the basket, to assess the trajectory of the ball flight and to anticipate its trajectory after it bounces off the basket. To be able to perform a rebound it is important to close the optimal take-off angle as well as the angles in particular areas of the take-off system encompassing the extensors of the thigh, shank and the trunk.

Catching the ball with both hands or with one hand only at the highest reaching point and continuing the sequence of activities by passing the ball during the rebound or after the landing will enable the starting phase of the transitional offense of the team that has gained possession of the ball. Since the state of conversion (defense/offense) begins at the moment when a player gains possession of the ball, a defensive rebound represents an important feature of the general efficiency of the play. The team that catches more balls also has a larger number of opportunities for a successful execution of the transition defense/offense.

The offensive rebound, as an indicator of the situation-related efficiency of the players, represents the number of balls caught after the ball has been unsuccessfully thrown towards the basket by a team-mate. After the ball has unsuccessfully been thrown towards the basket the players on offense form an "offensive rebound plan" with the goal of catching the ball and scoring the point. The prerequisite for a successful offensive and defensive rebound is for a player to position himself in front of the opponent (inside position). It is also important to anticipate the angle and the distance the ball is going to bounce off the basket after it has been unsuccessfully thrown towards the basket, and to catch the ball at the right moment. The offensive rebound can be seen as the extension of the aggressiveness of the offense, and opens up the possibility of a higher percentage of shots and simultaneously constitutes the first phase of the transitional defense while slowing down the starting phase of the transitional offense of the opposing team.

The rebounds, as indicators of the situation-related efficiency of the players on both defense and offense, can be objectively recorded during the basketball game.

Rebounds, i.e. the number of the balls being caught on defense and on offense, are significant factors of the total technical and tactical team performance, and therefore directly influence the final score in a basketball match.

A survey of past research on this issue has shown that the influence of rebounds, as an indicator of the situation-related efficiency on the final score in a basketball game, has been analyzed by the following scientists:

Trninić (1975) has analyzed the relationship between the frequency of balls caught during the phase of defense and the phase of offense and the results of basketball games on a sample of 25 games of the first league in 1973/74. He noted a real, but not too high, correlation between the frequency of balls caught during the phase of defense and offense ($r=0.459$), and a minor correlation between the frequency of balls caught during the phase of defense and offense and the final score in a basketball game ($r=0.22$). Furthermore, he stated a small correlation between the frequency of balls being caught and the number of points scored by the teams who won the matches ($r=0.25$).

Pleslić (1994) obtained data about the influence of situation-related basketball parameters on the final score in a game which was marked by two criterion variables: RANG (victory-defeat) and DIFFERENCE (relationship between the points scored by one team and the points scored by the other team. The data were obtained by analyzing a sample of 20 basketball games, played during the European Basketball Championship in Zagreb in 1989, by means of regression analysis. Predictor variables DEFENSIVE REBOUND and OFFENSIVE REBOUND with regard to the criterion variable RANG were not statistically significant. However, with regard to the criterion DIFFERENCE the common influence of predictor variables was statistically significant, although the variable OFFENSIVE REBOUND had negative influence (0.27 on the level of significance 0.01). The variable DEFENSIVE REBOUND has positively and statistically significantly (0.23 on the level of significance 0.05) influenced the final score in the game.

As for the scientists outside Croatia, the only research of the relationship between the frequency of balls caught during the phase of defense and the phase of offense and the result of the basketball game has been conducted by A. H. Ismail (according to Trninić, 1975). He obtained a significant relationship between the frequency of the balls that had been caught and the result of the basketball game, and thus he supported the fact that the defensive and offensive rebounds are a significant factor of the total efficiency in a basketball game.

The goal of this research has been to determine the influence of the number of balls caught on defense (DEFENSIVE REBOUNDS) and the number of balls caught on offense (OFFENSIVE REBOUNDS) as indicators of the situation-related efficiency on the final result in a basketball game.

Methods

Subjects

The data have been collected from a sample of 64 games played at the XII World Basketball

Championship in Hamilton and Toronto, Canada. Sixteen national basketball teams from five continents took part in this championship. Each national basketball team played 8 matches, and no match ended in overtime.

Variables

The sample of predictor variables contains two indicators of situation-related efficiency in a basketball game which are regularly recorded at basketball matches, and are defined as:

- OFFENSIVE REBOUND (ORB) - the number of balls caught (bouncing off the rim or the backboard) during the offensive phase.
- DEFENSIVE REBOUND (DRB) - the number of balls caught (bouncing off the rim or the backboard) during the defensive phase.

The criterion variable in this paper will be represented by the binary variable VICTORY-DEFEAT which emerges from the basic goal of the basketball game that is aimed at victory against the opposing team by scoring the highest possible numbers of points. Such a goal can be defined by a binary variable (O - the defeated team; 1 - the winning team).

The collected data represent one part of the official "statistics" that is conducted during each game and that has been prescribed by the FIBA technical committee. The registration of data is carried out by the officials ("statisticians") specialized in these jobs through computer programmes applicable for statistics processing during basketball games.

Statistical methods

The collected data have been processed by means of regression analysis and the following has been calculated:

- basic statistical parameters: arithmetic mean (A.M.), standard deviation (S.D.), the minimal value (Min), the maximal value (Max), skewnes (a_3) and kurtosis (a_4);
- Kolmogorov-Smirnov test for testing the normality of distribution;
- arithmetic means and coefficients of rebound efficiency (calculated as the ratio of the balls being caught and the total number of possibly caught balls) on offense and defense, separately for both the winning and the losing teams;
- the correlation between predictor variables;
- correlation between predictor and criterion variables;
- multiple correlation and coefficient of determination;
- partial correlation between predictor variables and the criterion variable;
- partial regression coefficients of predictor variables.

Testing of the statistical significance of the multiple correlation has been done by means of the F-test, whereas the statistical significance of the partial regression coefficients has been tested by means of the T-test.

Results and discussion

From the matrix of basic statistical parameters (Table 1) it can be seen that the variables DEFENSIVE REBOUND and OFFENSIVE REBOUND do not significantly deviate from the normal distribution (max D). A "slightly" positive asymmetry (a_3=0.53) can be seen in the variable OFFENSIVE REBOUND, whereas the variable DEFENSIVE REBOUND inclines towards negative asymmetry (a_3=-0.1).

A wide range in the frequency of offensive rebounds (2-25) and of defensive rebounds (7-36) is particularly significant, and it can be related to the wide difference between the qualitative characteristics of a particular team in the World Championship. One has to take into account the fact that teams from all continents took part in this championship, where the difference between the quality of teams was obvious, and also that the USA national team was made up of the best NBA players.

Table 1. Arithmetic mean (A.M.), standard deviation (S.D.), minimal value (Min.), maximal value (Max.), skewnes (a3), kurtosis(a4), difference between the relative cumulative frequency and the theoretical relative cumulative frequency (Dmax).

	A.S.	S.D.	Min.	Max	a_3	a4	Dmax
ORB	11.20	4.35	2.00	25.00	0.53	0.46	0.08
DRB	21.77	5.99	7.00	36.00	-0.10	-0.49	0.07
TEST =	0.14						

There is a low, but statistically still significant, positive correlation (0.19) at the significance level of 0.05 ($_{126}r_{0.05}$ = 0.17) between the predictor variables OFFENSIVE REBOUND and DEFENSIVE REBOUND. At the significance level of 0.01 no statistically significant correlation ($_{126}r_{0.01}$ = 0.23) has been obtained. The possibility of the prediction of one variable on the basis of another variable amounts up to only 3.61%, which tells us that there is a high level of independence between predictor variables. A team that achieves a high frequency of defensive rebounds can, but also needn't, achieve a high frequency of offensive rebounds and vice versa.

Table 2 and Chart 1 show that the winning and the losing teams on average differ insignificantly in the number of offensive rebounds, whereas a significant difference can be seen in the number of defensive rebounds.

Table 2: Arithmetic means and coefficients of rebounding efficiency for the winning and for the losing team.

	VICTORY	DEFEAT
ORB	11.28	11.13
DRB	25.11	18.42
TRB	36.39	28.91
TUS	29.7	36.24
CORE	38%	31%
CDRE	69%	62%
CTRE	56%	44%

- ORB - offensive rebound
- DRB - defensive rebound
- TRB - total number of rebounds
- TUS - total unsuccessful shots
- CORE - coefficient of the offensive rebound efficiency
- CDRE - coefficient of the defensive rebound efficiency
- CTRE - coefficient of the total rebound efficiency

Chart 1: Offensive rebounds, defensive rebounds and the total number of rebounds of both the winning and the losing teams

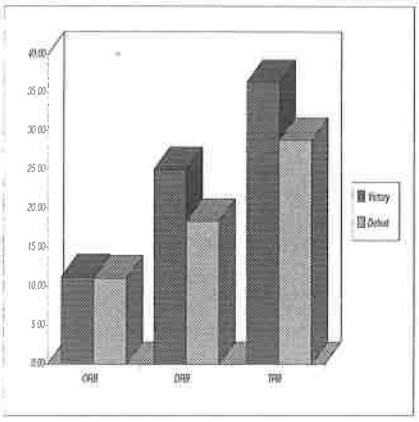
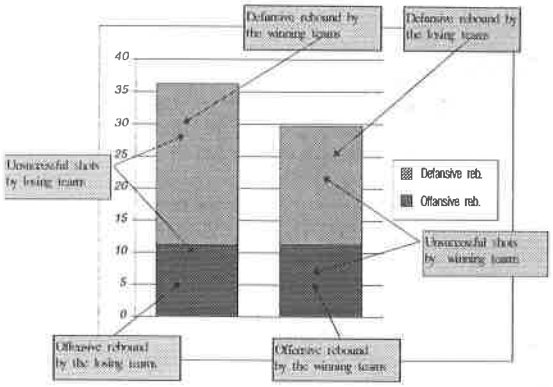


Chart 2 shows that the absolute values of offensive and defensive rebounds depend on the number of unsuccessful shots towards the basket, because it is only this that enables the offensive rebounds for the offensive team or the defensive rebounds. A larger number of unsuccessful points by one team creates the prerequisite for a larger number of offensive rebounds for the same team, and a larger number of defensive rebounds for the opposing team. Therefore it is necessary to reduce the influence of unsuccessful shots on both the offensive and defensive rebounds, i.e. it is necessary to calculate the coefficients of the rebound efficiency both on defense and on offense. The coefficients of the rebound efficiency on offense and defense represent the ratio between the number of balls caught on offense and on defense and the total number of possibly caught balls for each team. This

CHART 2: The proportion of offensive and defensive rebounds with regard to unsuccessful scoring of points by the winning and losing teams.



ratio is expressed by percentage. For example: The coefficient of the rebound efficiency on offense of the team "A" equals the ratio between the offensive rebounds of the team "A" and the unsuccessful shots of the same team (the defensive rebounds of team "B" + the offensive rebounds of team "A").

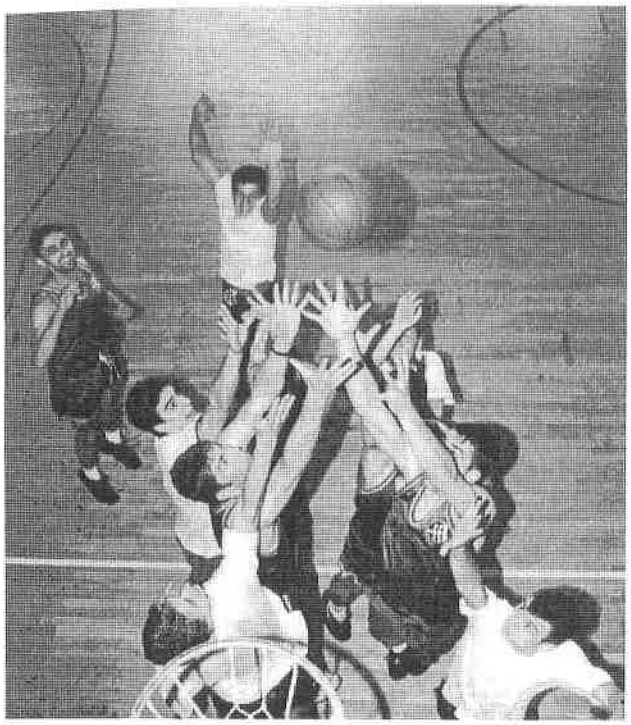
On the basis of the coefficient of the rebound efficiency both on offense and on defense it can be seen that the winning teams were statistically more efficient both during the defensive and the offensive phases. The winning teams have caught 69% of balls during the defensive phase, and the losing teams have caught 62% of balls out of the total number of balls that could have been caught. During the offensive phase, the winning teams have caught 38%, and the losing teams 31% of all possible balls. Altogether, the winning teams are more efficient in rebounds than the losing teams (56%:44%).

The results of the regression analysis (Table 3) show the statistically significant relationship between defensive and offensive rebounds and the final score in a basketball match (RO=0.57 at the significance level of 0.01). This points to the medium correlation between the group of predictor variables and the criterion variable. Namely, the final score of the match and the number of defensive and offensive rebounds have 32% of information in common.

Table 3: Multiple correlation (RO), determination coefficient (RO2), F-value (F), significance level (p), standard error of prognosis (S.E.), correlation of predictors and criteria (R), partial correlation of predictors and criteria (Part-R), standardized regression coefficients (β), non-standardized regression coefficients (B), standard error of standardized regression coefficients (S.β.), standard error of non-standardized regression coefficients (S.B.).

RO = 0.57, RO^2 2= 0.32, F (2,125) = 29.63, p 0.00, S.E.= 0.42

	R	Part-R	β	B	S.β.	S.B.	p
Intercept				-0.43		0.16	0.01
ORB	0.02	-0.11	-0.09	-0.01	0.08	0.01	0.23
DRB	0.56	0.57	0.58	0.05	0.08	0.01	0.00



Predictor variable DEFENSIVE REBOUND statistically significantly affects the final score in the match defined by the binary variable VICTORY-DEFEAT at the significance level 0.01. Because of the very low relationship between defensive and offensive rebounds we have obtained approximately the same correlation values (R), values of the partial regression coefficient (ß) and the values of the partial correlation (Part-R) of defensive rebounds with the criterion variable. The efficiency of the team on offense influences the rebound efficiency on defense firstly, and the rebound efficiency of the team on defense secondly, i.e. the rebound efficiency of the team during the offensive phase (66% of the total rebounds belongs to defensive rebounds, whereas 34% belong to offensive rebounds). The average results show that the winning teams have a significantly larger number of defensive rebounds (25.11) than the losing teams (18.42), whereas the values of offensive rebounds show no significant differences (winning team 11.28, losing team 11.13). These data express the importance of defensive rebounds with regard to offensive rebounds.

The bigger influence of defensive rebounds lies also in the fact that they indicate the completion of the basic defensive goal (to prevent the scoring of points by the opponent and to gain possession of the ball). The basic prerequisite of the efficiency in a basketball game begins during the defensive phase by maintaining pressure on the ball, by obstructing the direction of movement and the direction of passing the ball, by keeping the relationship ball-defense player-offense player ("blocking the back by a clinch position" for the defense player that imposes the pressure on the ball) and by a high block out closing approach to the basket for the players of the offensive team, which influences the number of defensive rebounds. The state of defense/offense conversion begins at the moment when a player gains possession of the ball, so that the number of defensive rebounds represents an important determinant of general efficiency in the game: the team that catches more balls under the basket also has more opportunities for realizing the offense. The successful defense/offense transitions primarily emerge from situations that are the consequence of performing defensive rebound, intercept passing, the ball being stolen by the team that is defending itself, and an inadequate selection of shots, no coverage of the offensive rebound, and finally the defensive balance of the attacking team.

Predictor variable OFFENSIVE REBOUND does not statistically significantly influence the final score of the match. Successful teams do not significantly differ from unsuccessful teams with this variable. This, of course, does not reduce the importance of the offensive rebound because the approximately same number of offensive rebounds does not necessarily imply approximately the same rebound efficiency of winning and losing teams (winning 38%, losing 31%) in the offensive phase. It is also influenced by a larger number of unsuccessful shots by losing teams (winning 29.7, losing 36.24).

It is obvious that an aggressive rebound in the phase of a set offense and in the phase of a transitional offense is also important for efficiency in the game. The offensive rebound is, from the functional point of view of the basketball game, interpreted as the extension of the aggressiveness of the offense which opens the option of a higher shooting percentage, and at the same time creates the first transition defense because it slows down the first outlet pass. Namely, the team on defense has to complete a high block out of the ball approaching the basket in the first place, and then try to catch the ball as the defensive rebound and perform the first outlet pass. The offensive team tries to gain possession of the ball and to repeat the offense, and in the case that it does not gain possession of the ball, the rebound action under the basket can still both make it difficult for the opponent to safely and quickly perform the defensive rebound and ensure the timing and the speed of the outlet pass.

Conclusions

The object of this research was to establish the relationship between the indicators of the situation-related efficiency - OFFENSIVE REBOUNDS and DEFENSIVE REBOUNDS and their influence on the final score in a basketball game that has been defined by a binary variable VICTORY-DEFEAT. For this purpose, the regression analysis has been applied on the basis of the data collected during 64 games of the World Basketball Championship in Toronto in 1994.

On the basis of the obtained data from this research it is possible to briefly conclude the following:

Predictor variables OFFENSIVE REBOUND and DEFENSIVE REBOUND do not significantly deviate from the normal distribution.

- There is a relatively small (0.19), but statistically significant correlation at the significance level of 0.05 between the predictor variables OFFENSIVE REBOUND and DEFENSIVE REBOUND.
- The winning teams had, on average, 7 rebounds more on defense than the losing teams, whereas the number of offensive rebounds for both the winning and the losing teams was approximately the same.
- It can be seen from the coefficients of the defensive and offensive rebound efficiency for both the winning and the losing teams that the winning teams are more efficient, as far as the rebound efficiency is concerned, both during the defensive (69%:62%) and during the offensive phase (38%:31%).
- A high and statistically significant multiple correlation (RO=0.57) has been determined between the predictor variables (DEFENSIVE REBOUND and OFFENSIVE REBOUND) and the criterion variable (the result of the basketball game).
- There is a statistically significant influence of the defensive rebounds on the final score in the basketball game, whereas the influence of the offensive rebounds was not found to be statistically significant. Such results appear because of a larger number of unsuccessful shots at the basket by the losing teams, and not because of the lower offensive rebound efficiency of the winning teams.

The number of balls being caught on defense (defensive rebounds) more significantly affects the result of the match than the number of balls caught on offense (offensive rebounds). The defensive rebounds contribute to the distinction between the winning and the losing teams. The losing teams are characterized by a larger number of unsuccessful shots at the basket, when the balls mostly end up in the possession of the winning teams. This is the basic prerequisite for a quick and successful transitional offense. The control and the organization of the high block out of the ball approaching the basket and the defensive rebound, together with the timely outlet pass, are the tactical elements that ensure one part of total efficiency of a winning team. The defensive rebounds are of primary importance within this system of tactical activities.

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