

Comparison of Efficiency Ratings of Turkish and International Basketball Players Playing in the Turkish Basketball League According to Their Positions

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Abstract: The purpose of this study was to evaluate the performance of the players in the Turkish National Basketball League by using an efficiency rating that compared the total number of successful and unsuccessful movement and, in doing so, to identify the differences in efficiency rating between Turkish and International players and between positions. Statistical data from 721 male players competing in the 2005-2006, 2006-2007 and 2007-2008 regular seasons of the Turkish Basketball league were used in this study. The basketball players were separated into two groups -Turkish (n=489) and International players (n=232) - which were further divided into three position subgroups - guard, forward and center. Using these data, a player efficiency rating was calculated for each player. The efficiency ratings of players were compared using a 2x3 (groupxposition) mixed design, two-way analysis of covariance (ANCOVA) with minutes played as covariate. Significant effects were further analyzed using the Bonferroni adjusted level of significance for the Post Hoc. The statistical treatment of the data obtained showed no significant interaction between the factors group and position in the efficiency ratings of the basketball players ($p>0.05$). Then the effect of each factor on efficiency rating was separately investigated. The efficiency rating of international players was higher than that of Turkish players ($p<0.001$). Also, a significant difference was found between the player efficiency ratings according to their positions ($p<0.001$). The data obtained from the comparative analysis of the players' positions showed that the efficiency rating of guard players had less value than those of forward and center players. By performing better than Turkish players, International players might increase the average quality of performance in the league.

Key words: Basketball • Efficiency rating • Statistical scores

INTRODUCTION

There are a relatively limited number of studies in literature that used statistical data from sports to evaluate the efficiency of players and teams in professional organizations such as baseball, basketball and football leagues [1-4]. And those quantitative analyses that used statistical data from basketball [5] were mostly published either in sports economy or business magazines [1-3, 6, 7]. Some of the efficiency functions and models from sport economy literature were used to evaluate the relationship between team win and performance input (player statistics), which might help determine the most valuable player or set of players in a game [1, 2, 6, 7]. The most fascinating results from efficiency analyses were the variables that affect teams' wins [3, 7]. Field goal percentage, free-throw percentage, rebounding, turnovers

and personal fouls all affected the efficiency functions [7]. The stochastic production frontier model used in some studies explained over 88% of the variation in winning. The model showed that free-throw percentages, rates related to defensive and offensive rebounds, assists and steal rates were positive effectors of team win, with defensive rebounding being the most important effector of all [2]. As this example demonstrates, the functions used in efficiency models may help determine the factors needed to win a game [8].

With modern technology and the internet, it is easier now than ever before to access a vast amount of statistical data about basketball. However, most of these statistical data tended to provide a list of successful and unsuccessful movements of the players during a given game and contained too many variables, which can make it difficult for the coaches or others to interpret the

performance of players since each variable can be said to be too specific alone to suggest an overall evaluation of a player's performance [9, 10, 11]. However, other more complex formulas exist for calculating the efficiency ratings of players and teams [1]. Although these formulas differ from each other in such aspects as covariance and coefficient, they all include the statistics that are important for a team to win. However, expressing statistics that are effective on team's win by only one comprehensive variable and evaluating a player's performance based on that variable might be an appropriate approach. In other words, instead of methods of statistical analyses that emphasize these variables separately, using a method which combines a set of variables and covariances into one single variable can be relatively more practical and make it easier to interpret the overall value of a player. Efficiency rating without efficiency functions, a method that is often used in the NBA, might be an easy and simple way at this point to evaluate the performance of players and teams in basketball [12, 13].

It is a well-known fact, on the other hand, that international basketball players play on many teams all over the world, especially in such countries where basketball is popular as Turkey, Greece, Spain and USA [9, 14]. These players are expected with their skills and talents to contribute to the overall success of the team in the league, as well as to the quality of the league itself [9, 10]. Hence, a dependable way of measurement might be considered important to show the added value and performance of an international player as compared to that of national players or the overall value of any player for a given team or for the league.

The purpose of this study was to evaluate the performances of the players in the Turkish National Basketball League by using an efficiency rating that compared the total number of successful and unsuccessful movement and, in doing so, to identify the differences in efficiency rating between Turkish and International players according to their positions.

MATERIALS AND METHODS

Participants: Player statistics used in this study as inputs to calculate the PER were obtained from the publicly announced statistical page of the official website of the Turkish Basketball Federation [15]. A total of 726 Turkish and international male basketball players playing in the Turkish Basketball League during the seasons 2005-2006, 2006-2007 and 2007-2008 were initially included. Because

they did not play in any official game during the three seasons, 5 basketball players were excluded from the study and data from the remaining 721 players were examined.

Procedures: Player efficiency rating (PER) was used as a measure that accounted for positive and negative playing statistics for the player performance [16]. In this study, a formula called PER with 12 variables and coefficients (points, field goals made, field goals attempted, free throws made, free throws attempted, offensive rebounds, defensive rebounds, steals, assists, blocks, personal fouls and turnovers) developed by Hollinger [16, 17] was used to facilitate the interpretation of the Turkish and International players' performance according to their positions. The data utilized in calculation of the PER contained player data from 3 seasons, beginning with the 2005-2006 season and concluding with the 2007-2008 season of the Turkish National Basketball League.

The 721 players examined in this study were first divided into two groups as Turkish players (n=489) and international players (n=232). Then the players in each group were further divided into three subgroups according to their positions as guard, forward and center. The seasonal mean values of each of the 12 variables were assigned to the formula to assess the PER for each player as follows:

$$\begin{aligned} \text{Player efficiency rating} = & (\text{Points} \times 1.0) + (\text{Field Goals} \\ & \text{Made} \times 0.4) + (\text{Field Goals} \\ & \text{Attempted} \times -0.7) + ((\text{Free} \\ & \text{Throws Attempted} - \text{Free} \\ & \text{Throws Made}) \times -0.4) + \\ & (\text{Offensive Rebounds} \times 0.7) + \\ & (\text{Defensive Rebounds} \times 0.3) + \\ & (\text{Steals} \times 1.0) + (\text{Assists} \times 0.7) \\ & + (\text{Blocks} \times 0.7) + (\text{Personal} \\ & \text{Fouls} \times -0.4) + (\text{Turnovers} \times - \\ & 1.0) \end{aligned}$$

Statistical Analysis: The player statistics were given as mean and standard deviation (\pm SD) or standard error of mean (\pm SE). The efficiency ratings of the Turkish and International players were compared using a 2x3 (groupxposition) mixed design, two way analysis of covariance (ANCOVA), with minutes played as covariate. Significant effects were further analyzed using the Bonferroni adjusted level of significance for the Post Hoc. The SPSS 16.0 v was used in the statistical analysis. The results were evaluated at 0.05 significant level.

RESULTS

The mean (\pm SD) values of the International basketball players were higher than those of the Turkish players for all variables. For most of the variables, the International basketball players' performance was nearly twice that of the Turkish players' performance and for some variables it was even higher (Table 1).

When the players' statistics were examined, the mean values of Turkish and International players' number of points and field goal attempts according to their positions had a similar fluctuation pattern. Among the Turkish players, the centers scored more points and made more field goal attempts, whereas the guards of the International players scored more points and field goal attempts than those playing in other positions. The mean number of field goals made among Turkish players was lower for guards, increased for forwards and the highest for centers, similarly to that of the international players. While the mean number of free throw attempts was lower for Turkish forwards than for guards and centers, international centers had more free throw attempts than International guards and forwards. The ranking for the free throws made by Turkish players according to

position was centers, guards and forwards, in decreasing order, versus guards, centers and forwards for International players. The position ranking for the mean of defensive rebounds by Turkish players was consecutively guards, forwards and centers, in increasing order. In international players, on the other hand, the mean values of defensive rebounds of centers and forwards were similar, but higher than that of guards. The mean value of offensive rebounds for both international and Turkish players was the highest for guards. The mean values of assists by international and Turkish players were found to gradually decrease from the guards, to forwards and then to centers. International and Turkish guard players stole more than forward or center players. The mean block value was the highest for International and Turkish centers. International and Turkish forwards had fewer turnovers than centers or guards. Turkish and International centers had more personal fouls than guards or forwards.

The results of the ANCOVA showed that there were significant differences between the efficiency rating values of the groups ($F_{(1,714)} = 79.74$, $p < 0.001$). The adjusted mean value of the PER in Turkish basketball players (3.97) was significantly lower than the International basketball players (5.57) (Table 2).

Table 1: The descriptive statistics of Turkish and International players according to their positions (mean \pm SD)

Player' statistics	Guard		Forward		Center	
	Turkish players	International players	Turkish players	International players	Turkish players	International players
Points	4.38 \pm 3.45	11.52 \pm 4.95	4.21 \pm 3.84	11.22 \pm 5.26	4.98 \pm 3.67	9.77 \pm 3.79
Field goals attempted	3.80 \pm 2.75	9.54 \pm 3.70	3.87 \pm 3.36	8.93 \pm 4.12	4.08 \pm 2.91	7.51 \pm 3.16
Field goals made	1.38 \pm 1.25	3.98 \pm 2.50	1.54 \pm 1.87	4.31 \pm 2.83	2.01 \pm 1.59	4.28 \pm 3.05
Free throws attempted	1.29 \pm 1.25	2.73 \pm 1.54	1.04 \pm 1.03	2.74 \pm 1.30	1.61 \pm 1.14	3.20 \pm 1.52
Free throws made	0.86 \pm 0.89	2.09 \pm 1.24	0.67 \pm 0.70	1.75 \pm 1.02	0.94 \pm 0.69	2.00 \pm 0.85
Defensive rebounds	1.09 \pm 0.78	2.32 \pm 0.90	1.48 \pm 1.36	3.94 \pm 1.65	2.14 \pm 1.60	3.94 \pm 1.55
Offensive rebounds	0.36 \pm 0.78	0.79 \pm 0.90	0.65 \pm 0.66	2.04 \pm 1.01	1.09 \pm 0.73	2.10 \pm 0.92
Assists	1.35 \pm 1.24	2.65 \pm 1.48	0.72 \pm 0.77	1.19 \pm 0.75	0.55 \pm 0.52	0.98 \pm 0.56
Steals	0.64 \pm 0.46	1.18 \pm 0.56	0.50 \pm 0.45	0.95 \pm 0.58	0.40 \pm 0.29	0.77 \pm 0.36
Blocks	0.04 \pm 0.09	0.12 \pm 0.15	0.12 \pm 0.18	0.51 \pm 0.40	0.31 \pm 0.46	0.87 \pm 0.63
Turnovers	1.01 \pm 1.05	2.09 \pm 1.20	0.75 \pm 0.67	1.80 \pm 0.83	1.05 \pm 0.71	1.91 \pm 0.69
Personal fouls	1.55 \pm 0.87	2.06 \pm 0.67	1.43 \pm 0.99	2.51 \pm 0.67	1.86 \pm 0.85	2.58 \pm 0.65

Table 2: Adjusted means (\pm SE) of Turkish and International players' efficiency ratings

Turkish players (n=489)	International players (n=232)	F-test	p-value
3.97 \pm 0.09	5.57 \pm 0.14	79.743	<0.001

Table 3: Adjusted means (\pm SE) of basketball players' efficiency ratings according to position

Guard (n=298)	Forward (n=280)	Center (n=143)	F-test	p-value
4.21 \pm 0.11*	5.04 \pm 0.12	5.06 \pm 0.16	15.812	<0.001

* a significantly difference both forward and center

Table 4: Adjusted means (\pm SE) of Turkish and International players' efficiency ratings according to their positions

Position	Turkish players	n	International players	n	F-test	p-value
Guard	3.58 \pm 0.14	185	4.84 \pm 0.19	113	2.594	0.075
Forward	4.03 \pm 0.13	208	6.05 \pm 0.22	72		
Center	4.30 \pm 0.19	96	5.82 \pm 0.27	47		

The analysis of the efficiency rating of the basketball players according to positions showed that there was a significant difference between the PER of guard, forward and center ($F_{(2,714)} = 15.812$, $p < 0.001$). The efficiency ratings of centers (5.06 \pm 0.16) and forwards (5.04 \pm 0.12) were significantly higher than that of guards (4.21 \pm 0.11). However, there was no significant difference between the forward and center players in terms of efficiency rating (Table 3).

The adjusted means (\pm SE) of the efficiency ratings were 3.58 \pm 0.14 for Turkish guard players, 4.03 \pm 0.13 for forwards and 4.30 \pm 0.19 for centers. The same ratings were 4.84 \pm 0.19 for International guard players, 6.05 \pm 0.22 for forwards and 5.82 \pm 0.27 for centers. The positions with the highest adjusted mean efficiency ratings were centers for Turkish players and forwards for International players. The efficiency rating of Turkish forward players was lower than Turkish center players. On the other hand, the efficiency rating of International forward players was higher than international center players. However, ANCOVA showed that the interaction between factors "Turkish-International" and "guard-forward-center" in the efficiency rating of players was not statistically significant ($F_{(2,714)} = 2.594$, $p = 0.075$) (Table 4).

DISCUSSION

It had been showed in previous studies that high ratios of successful field goals, free throw shooting percentages and successful offensive and defensive rebounds had a positive impact on the number of team wins [9, 10, 11]. The first two variables indicated the quality of a team's shooting. It was also demonstrated that the team making more rebounds increased its chance to score and thus to win the game [9]. Additionally, it was assumed that assists increased the percentage of win and that high numbers of steals and blocked shots had a positive effect. Lastly, a high ratio of turnovers was hypothesized to have a negative impact on team win [1, 2, 6, 7]. In some studies, positive and negative factors were related to the positions of the players. Consequently, each player's productivity should be evaluated according to his position. By using efficiency analysis to determine the variables that affected team win,

it was found that the number of offensive rebounds was extremely important. Rebounds, which are important positive factors, were usually made by the centers or power forward players [1, 7]. The finding of the present study also suggested that Turkish and International centers and forwards made more defensive and offensive rebounds than guards. The team's skill in shooting depended upon the team's ability to acquire the ball (via rebounds, steals or turnovers). From this line of reasoning, the team that fails to make rebounds can be said to be punished not only by their lack of shooting opportunities but also by the opponent team's opportunities to shoot, leading to a severe handicap and diminishing the success of the team [1].

It was determined in another study that the decrease in a team's performance, i.e. the decrease in players' productivity, had a negative effect on the team's success; it caused the team to lose the game [10, 11]. It had also been reported that the teams that often lost games did so either by a lack of sufficient positive statistics or by an excess of negative factors. Player turnovers, a substantial negative factor, were generally committed by guards [1]. Berri's indications were parallel to the findings of this study. In this study, the mean number of turnovers by Turkish guards and centers were higher than by Turkish forwards. The average number of turnovers by International players was higher by guards than by centers or forwards.

It was found in this study that the average efficiency rating of the International players playing during the three seasons was higher than that of the Turkish players. When examined by position, the efficiency ratings of forwards and centers were higher than guards. It was found that the position effect on efficiency rating was similar for both Turkish and International players. Given the findings of the present study, it was obvious that a high efficiency rating was closely related to a player's physical and conditional features, his skills during the game and his position [3, 18].

As a result, there are some advantages to evaluating a basketball player's performance by efficiency rating. By giving better performances than Turkish players, International players might increase the average quality of performance in the league and help drive Turkish players

to develop their technical and tactical skills. The International players might also increase the average performance of the teams they were on.

According to finding of this study, efficiency ratings might be used as feedback about performances both for team performance and for individual players. In basketball, players' and teams' efficiency ratings are evaluated with statistics specific to basketball. Each of the statistics forms part of the main characteristic structure of the basketball game and helps determine the chance to win. However, evaluating a player's performance according to just one or two of these single statistics could be an insufficient and limited approach. In this case, it can be easier and more practical to evaluate the player's overall performance with only one concept, namely with PER, instead of evaluating all the statistical variables one by one.

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