
The Methods of Analyzing and Evaluating NBA's Competition Agenda

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Abstract. NBA is one of the most popular basketball games to big fans of basketball, but it's game agenda is widely doubted. The essay analyzes the positive and the negative effects of agenda on the basketball team through analyzing the days between games, the flying distance of the teams, the background of the teams and the number of constant away matches, and the capacity of the opponent team, and applies Dimensionless Method to the data, to conclude the teams that agenda does the best benefit to and the least benefit to using Weighted Comprehensive Score Method, conducting quantitative analysis and evaluating in a mathematical modeling way, and draw a reasonable assessment to the agenda with the value-agenda quantity indexes mentioned in the essay.

Keywords: Rationality of NBA's competition agenda; influential factors; Weighted Comprehensive Score Method

1. Introduction

To the basketball fans, NBA is one of the fondest basketball games. It is quite complicated to arrange an complete agenda which is fair to every teams for such a huge basketball game, but the agenda influence the team's performance and the final record to some extents. All of these result in the complaint and the judgment about the agenda from players or the coaches reported by the media, in that case, the rationality of the agenda has become a hot controversial issue.

In the just-end regular season of 2013-2014, Suns ranked ninth in the west which is the very reason the team could not get the access to the playoffs, but ranked third in the east. This gigantic difference of the strength between west and east leads to discussion about whether the agenda is reasonable again, many rational indexes and parsing algorithms are brought out spontaneously. While, the existing approaches of evaluating are based on the just-end season's performance to analyze the next season's agenda irrationally, without taking the huge changes happened on the team because of changing players during the offseason into consideration. The essay analyzes the agenda's advantages and disadvantages to a team via considering four factors :between games, times of constant away games ,the distance of back to back flying and numbers of strong opponents, conducting quantitative analysis and assessments by mathematics modeling and providing the quantity indexes about evaluating agenda in the same time.

2. Analysis of factors involved in agenda’s rationality

There are thirty teams in NBA, and the western alliance has fifteen teams, the same number as the eastern teams’. According to the geographic position, the west area can be divided into three parts: southwest, southeast and Pacific part, the east can be divided into northeast, the middle and the Atlantic part, every part has five teams. Each season has 1230 games in total and each team has to play 82 games.

2.1. Analysis of the effects raised by between games

The balance of between games can affect the performance of a team in a direct way. It can be predicted that the shorter between games is, the worse the players’ refreshing condition will be, what’s more, the worse the team will perform. If the between games is overlong, on the contrary, players cannot get them into the game when the games start, this will also put a harmful effect on the performance. Based on data of between games from 2013-2014 regular games’ agenda, acquiring the average number of days between games of all 30 teams according to distribution of the day numbers of between games:

$$\bar{x} = \sum x_j / N \tag{1}$$

In the first equation, N=2430, acquiring 2643 via Excel calculation, and from that acquiring X=1.08765(D).Afterwards, calculating each team for the center with X = 1.08765 days apart variance between adjacent two games.

$$\sigma^2 = \sum (x_j - X)^2 / n \tag{2}$$

When n=81(82games have 81 data of between games), it can reflect the balance of games precisely. The smaller of the variance, the better for the team. However, if the variance is overlarge, given Z as the average figure of total variance of 30 teams’ between games’ number series, and defining comparative between games “P” according to it as index of between games. It’s apparently that when P<1, agenda is good for team; While when P>1, agenda is harmful to team, and the larger P is, the worse situation is. The chart 1 informs specific effects on each team.

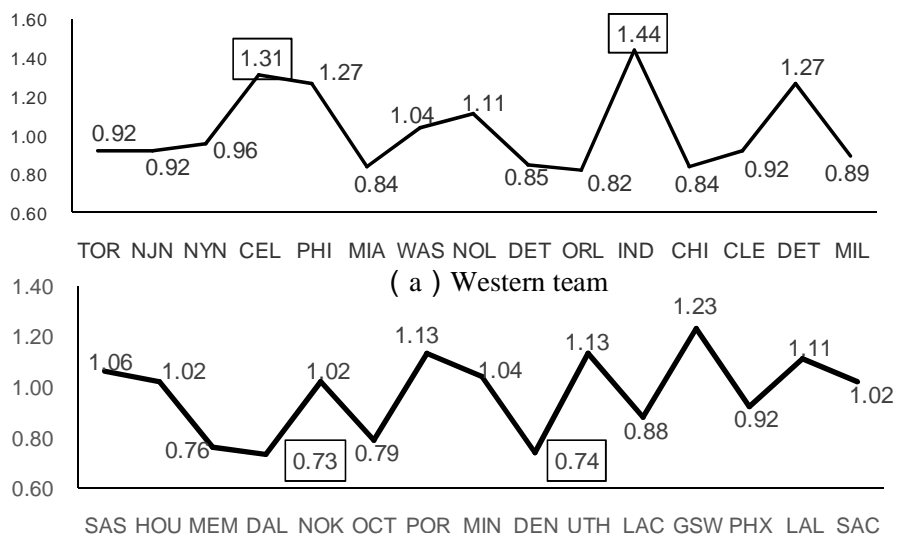


Chart 1: Line Chart of P (a) Western team (b) Eastern team

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From the chart, the factor does best benefits to Dallas Mavericks, Grizzlies and Denver Nuggets while harm to Boston Celtics, Indiana Pacers.

2.2. Analysis of the factor related to constant away games

In NBA, players feel more stressful when they are playing away games than the home games, and it put more pressure on the team when constant away games. NBA's official media calls the constant away games as "Death Journey". Constant away games strike the momentum of the team, thereby influence players' performance, naturally, put a bad influence on the final record.

It can be found that statistics of constant away games are distributed unevenly. Supposing n (the number of away games) as $n-1$ (the number of constant away games),and N as the total numbers of constant away games, in this circumstance N can reflect the effect constant away games put on the team's performance. Obviously, the larger N is, the worse effect on the team. Same ,if N is overlarge, picking the average number of times of constant away games of the 30 teams to make the influence N brought more directly, defining comparative index $A = N_j / \bar{N}$ as index of constant away games($j=1,2,3,\dots,30$), the chart 2 is about the influence the factor resulted in:

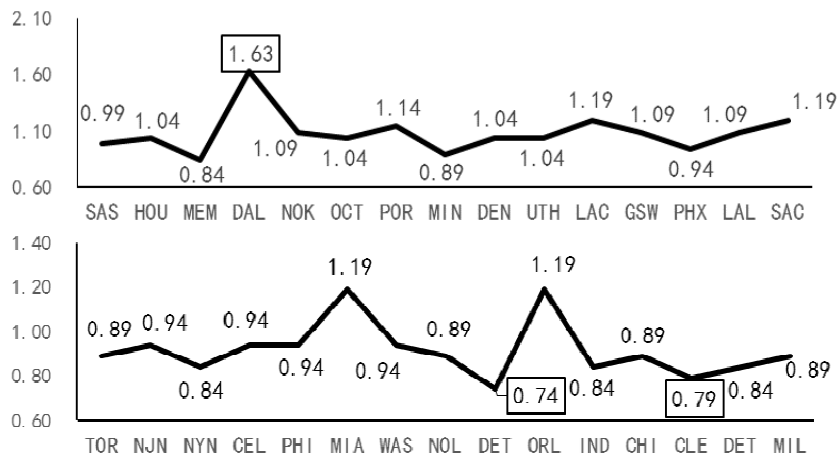


Chart 2: Line Chart of A Distribution

Finding that when $A < 1$, the factor is advantageous to the very team comparing with others, and the smaller it is, the bigger advantages it brings; when $A > 1$, the factor is disadvantageous to the very team than others, and the larger A is, the bigger disadvantages it brings. Meanwhile, it is not hard to notice that the factor is best for Cavaliers and Hawks while least for Mavericks, whose A is 2.2 times as Cavaliers'.

1.3. Analysis of the distant of back to back flying

Because NBA' game is in Home-Away system, each team has to fly between different cities in one season. The distant of flight between two games must have an influence on the team's relaxing times. If the time between two games is one day or more, no matter how long the distance between two cities is, the team always has enough time to adjusting, so the influence is so small that can be ignored. But the two games are in "Back to Back" situation (having games on one day and the next day), the distant of

flight is fatal. Due to the incredible short relaxing time, Back to Back games themselves are huge challenge for players' physical energy, besides, the long distant flight exhausts players, increasing the chance of getting hurt, influencing the performance of the team.

Handling the distance of flying in "Back to Back" games situation in the way below for the complication of calculating the distance between cities:

- 0 stands for the two near games are in the same place
- 1 stands for the two near games are in the same part but different places.
- 2 stands for the two near games are in the same area but different parts;
- 3 stands for the two near games are in the different areas.

Defining C_j as total length of one team's flying distance in Back to Back situation in one season. Dealing with the data using Excel to acquire the numbers of each team's Back-to-Back games n_j and the whole times of flight C. The same, because C is overlarge, picking up the average of the 30 teams' Back-to-Back games' flight distance for clearing the influence C put on the team, defining the comparative index $C = C_j / \bar{C}$ as index of Back-to-Back flying distance factor ($j=1,2,3,\dots,30$), the effects of the factor just as the chart 3 shows:

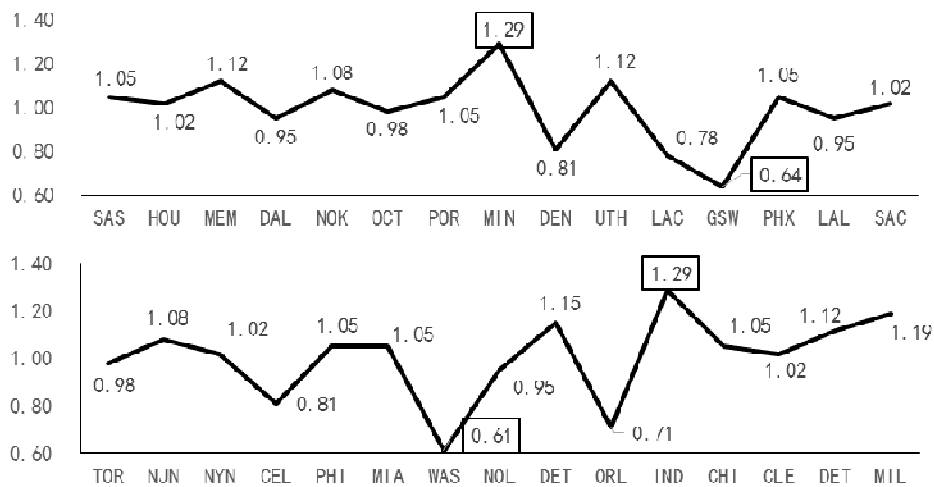


Chart 3: Line Chart of C Distribution

It can be noticed that when $C_j < 1$, the factor is good for other teams, and the smaller the C_j is, the better it is for the very team; when $C_j > 1$, the factor is harmful to other teams, and the larger the C_j is, the worse it is for the very team. Thus, the factor is best for Atlanta Braves and Washington Wizards, on the contrary, the least for Minnesota Timberwolves and Indiana Pacers.

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1.4. Analysis of factor of powerful team

NBA has 30 teams and 6 competition zones including east and west, each team has 4 games with other team belonging to the same part(2 home games and 2 away games),2 games against the another area' each team (one home game and one away game),but it has two different situations when one team play against the team from the same area but different parts' :4 games or 3 games(2 home games and 1 away game or 2 away games and 1 home game),in this case,t the final record related to the number of powerful opponents in the all 82 games directly. Recognizing the teams won 50 games or more of 80 games in regular season 2013-2014 as powerful teams, defining D_j as the whole times a team against these 9 powerful teams. Acquiring m_j as the times of each team facing these 9 teams by using Excel to conduct data, defining the average number of times the 30 teams facing powerful teams as comparative index $D = D_j / \bar{D}$ as index of powerful team factor($j=1,2,3,\dots,30$),calculating influence as the chart 4 informs:

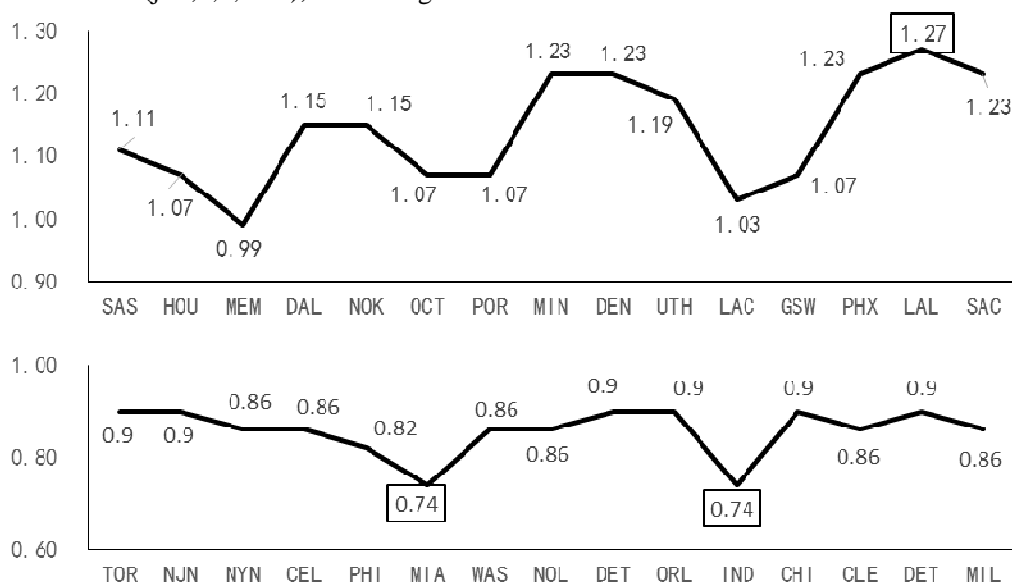


Chart 4: Line Chart of D Distribution.

It can be showed that, when $D_j < 1$, the factor does good to other team, and the smaller D_j is, the better for the very team; when $D_j > 1$, the factor is disadvantageous to other team, and the larger D_j is, the worse it is for the very team. This factor shows the preference to Miami Heat and Indiana Pacer, but is adverse to Los Angeles Lakers.

Besides, it is obvious that D_j of eastern teams are less than 1 while the western are more than 1,this phenomenon came from the huge difference between eastern and western teams' strength. Among the 9 selected powerful teams, seven located in west and only two in east. But in NBA, there are two games between east and west and 4 games between teams from same parts,3games between different parts, this kind of system force the western teams to play against more strong teams only leading to unfairness.

3. Analysis of factors affecting team strength

Although 4 assessing agenda factors are given, the dimensions of these four factors are

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quite distinct from each other, it's hard to put all these four kinds of data together. To solve these problem, weighted summation of these 4 quantity factors through Weighted Comprehension Score Method to acquire evaluating index of team strength. Obtaining the final record of teams' correlation indexes via SPSS based on factors of between games, times of constant away games, the distance of Back to Back flying and the times of facing powerful teams, and they are:-0.06382, -0.05173, -0.20198, -0.30478. Considering these correlation indexes, factors of between games and times of constant away games have little influence on the performance and the factors of Back to Back flying distance and times of facing powerful teams have much heavier influence on the performance. Using the equations of Weighted Comprehension

$$R_k = \varepsilon_i / \sum_{i=1}^4 \varepsilon_i \quad (3)$$

Score Method to acquire the weights of each factors are:

$$x_P = 0.06382 / (0.06382 + 0.05173 + 0.20198 + 0.20478) = 0.12219$$

$$x_A = 0.05173 / (0.06382 + 0.05173 + 0.20198 + 0.20478) = 0.09004$$

$$x_C = 0.20198 / (0.06382 + 0.05173 + 0.20198 + 0.20478) = 0.38671$$

$$x_D = 0.20478 / (0.06382 + 0.05173 + 0.20198 + 0.20478) = 0.40196$$

Defining the index λ as the factor of comprehensive influence which reflects the influence level the factors of between games, times of away games, Back to Back flying distance and times of facing powerful opponents, as table 1 shows:

$$\lambda = P \times X_P + A \times X_A + C \times X_C + D \times X_D \quad (4)$$

WEST	P	A	C	D	λ	EAST	P	A	C	D	λ
SAS	1.06	0.99	1.05	1.11	1.07	TOR	0.92	0.89	0.98	0.9	0.94
HOU	1.02	1.04	1.02	1.07	1.04	NJN	0.92	0.94	1.08	0.9	0.98
MEM	0.76	0.84	1.12	0.99	1	NYN	0.96	0.84	1.02	0.86	0.93
DAL	0.73	1.63	0.95	1.15	1.06	CEL	1.31	0.94	0.81	0.86	0.91
NOK	1.02	1.09	1.08	1.15	1.1	PHI	1.27	0.94	1.05	0.82	0.98
OCT	0.79	1.04	0.98	1.07	1	MIA	0.84	1.19	1.05	0.74	0.91
POR	1.13	1.14	1.05	1.07	1.08	WAS	1.04	0.94	0.61	0.86	0.79
MIN	1.04	0.89	1.29	1.23	1.2	NOL	1.11	0.89	0.95	0.86	0.93
DEN	0.74	1.04	0.81	1.23	0.99	DET	0.85	0.74	1.15	0.9	0.98
UTH	1.13	1.04	1.12	1.19	1.14	ORL	0.82	1.19	0.71	0.9	0.85
LAC	0.88	1.19	0.78	1.03	0.93	IND	1.44	0.84	1.29	0.74	1.05
GSW	1.23	1.09	0.64	1.07	0.93	CHI	0.84	0.89	1.05	0.9	0.95
PHX	0.92	0.94	1.05	1.23	1.1	CLE	0.92	0.79	1.02	0.86	0.92
LAL	1.11	1.09	0.95	1.27	1.11	DET	1.27	0.84	1.12	0.9	1.03
SAC	1.02	1.19	1.02	1.23	1.12	MIL	0.89	0.89	1.19	0.86	0.99

From the table it can be found the agenda is best for Washington Wizards while least for the Timberwolves, his is corresponding to the results that Washington Wizards struggled into the playoffs as the fifth of the east and Timberwolves is just out, proving

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that these factors can affect the teams to some extents. Besides, for Suns, the most controversial team in this season it's unfair to be the fifth of the alliance when it's $\lambda=1.10$.

4. Conclusions

Games' agenda affects teams in several aspects, the mathematics modeling above just takes four main factors into consideration. Generally, between games, times of constant away games and facing powerful teams put bigger influence on the final record comparing to other two factors. However, from the correlation indexes based on 2013-2014 regular games, the most influential factors are flying distance and times of facing powerful teams. The main reason is every teams' between games and times of constant away games are similar according to the agenda through analyzing factors, therefore the effects of them are not as strong as what are supposed before. In addition, the flying distance defined as 0,1,2,3 is not realistic, more research should be done about calculating the distance. Of course, there are still other factors that can affect the fairness of games, like: each team's number of Back to Back games are not even in different seasons. But ,the modeling here is direct ,simple and easy to be done ,what's more, it can reflect the reality specifically and prove the agenda has unreasonable aspects efficiently, showing that the system still has a long way to go with the fairness.

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