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# Cost Reduction, Competitive Balance, and the Scheduling of Back-to-Back Games in the NBA

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**Abstract**

The NBA league office states that the playing schedule is devised to ensure competitive balance while keeping an eye towards minimizing costs. This paper examines those claims. Three years of travel data were analyzed and the results imply that the use of back-to-back road games in the NBA schedule may assist with competitive balance and that back-to-back games indeed reduce team travel costs.

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*Introduction*

The National Basketball Association (NBA) league office establishes a regular season playing schedule of 82 games for each team in the league. Each team plays a combination of 41 home games and 41 away games. These games are not scheduled in any particular pattern and a team may play a sequence of several home games or several road games in a row. In addition, teams may play games on consecutive nights, which will be referred to here as back-to-back games.

An earlier study (Kelly, 2006) found that the winning percentages of teams are reduced when they are involved in back-to-back games. This was explained by teams having less opportunity for rest and preparation, especially in the case of the second game. The playing of back-to-back games on the road brings additional physical and psychological demands on players and coaches and further reduces success rates. Five years of regular season data from the 1999-2000 to the 2003-2004 seasons found that teams playing back-to-back games on the road won both games at a rate of only 18.04%, significantly below a normally distributed probability rate of 25% for winning both games. The chances of losing both of the games are greater than those for winning both games. The expected normal probability for losing both road games is 25%, but in a back-to-back setting the observed losing percentage rises to 41.35%.

Despite assertions made to this author by eight present or past NBA head coaches and one team owner who all claimed that their team's schedule of back-to-back games was more disadvantageous to their team than others, it was previously determined (Kelly, 2006) that the scheduling of these back-to-back games by the NBA league office was

assigned randomly and that there was no statistical evidence that the schedule was constructed to reward certain teams. Since back-to-back games are not used to reward teams, that is, to bring about a lack of competitive balance; it may be possible that the NBA schedule actually helps to actually achieve competitive balance.

*The NBA Schedule*

According to Matt Winick, Vice President of Scheduling and Game Operations for the NBA, the NBA sets the league schedule to accomplish both competitive balance and a reduction of costs. The goal of the NBA schedule, as it is constructed, is to be "efficient from a competitive standpoint with an indirect consideration of travel costs" (Winick, 2007).

The scheduling process begins, Winick describes, with teams submitting to the league the dates that are available to them on which they can play their home games. Since most teams do not own the venue in which they play, despite often times being the primary tenant, not all dates are available to them for the scheduling of games. Conflicts may exist with another tenant or with concerts and shows scheduled to take place in the facility. As examples, the Toronto Raptors submit no Saturday dates, since this is traditionally when the Toronto Maple Leafs play their home games in the Air Canada Centre and the New York Knicks cannot submit dates when the Ringling Brothers – Barnum & Bailey Circus is in town. In addition, some teams add further self-imposed restrictions on their available dates. An example being the Utah Jazz who do not submit any dates for home games to be played on Sundays. All these constraints impose complications for the league office in constructing the playing schedule and result in the scheduling of back-to-back games.

The NBA states that it attempts to minimize the number of back-to-back games as much as possible. While there is no absolute minimum number of times back-to-backs will occur, and while Winick stated that ideally teams would have none, the maximum range of back-to-backs allowed per team is 22 to 23 times per season. Two-thirds of these back-to-backs will occur on the road. If, when the schedule is constructed, the number of back-to-back games varies per team, the league office will not add back-to-back games to teams' schedules in order to make them equal with other teams. In the end, no two schedules are alike.

If the goal of the NBA was to minimize travel costs for teams, the 41 road games each team plays would occur in a most curious fashion. The Miami Heat, as an example, would take one road trip per season lasting 41 days, playing 41 consecutive games, and logging 12,840 miles (mileage figures from mapquest.com)[1]. The opposite format, and the one that would seem to have the highest travel costs for teams would be to have teams make 41 distinct road trips to play the 41 road games. In the case of the Heat, they would log a total of 126,052 miles in doing so. The NBA league office establishes a travel schedule for the Heat, and all other teams, that lies somewhere between these two extremes.

With an eye towards reducing travel costs, the league office establishes certain general rules in scheduling. When teams from the Eastern conference travel to play teams in the Western conference (and vice versa), the trip involves a minimum of three games. Away games are also usually scheduled to be in the same geographic area (Winnick, 2007). These trips may or may not involve back-to-back games.

[1] Not all teams could simultaneously be on the road, so this type of scheduling may turn out to be a very complex linear programming problem.

*Competitive Balance*

The literature contains many works on competitive balance, most deal primarily with labor markets. Rottenberg's seminal article in 1956 dealt with competitive balance through the use of "unequally distributed playing talent" (Sanderson & Siegried, 2006, p. 3). Kesenne (2000) showed how salary caps, an alteration of the labor market, can improve competitive balance. Quirk (2004) used the Gini coefficient to measure competitive balance in the National Football League (NFL) and college football conferences and found that all colleges (except the Southwest Conference) had less competitive balance than the NFL, which he attributed to the labor issue of team depth. Berri, Schmidt, and Brook (2005) determined that the reason for the lack of competitive balance in the NBA is the short supply of tall people, another labor market conclusion.

Beyond labor, Fort and Lee (2007) found a "general negative trend in competitive balance" (p.527) in the NBA, but found that rules changes in the NBA did not have an impact on balance. Sanderson and Siegfried (2003) included the use of scheduling in their study which found that college basketball teams, who to a greater extent are able to determine their own playing schedule than NBA teams, helped some teams in dominating the collegiate national rankings. Depken and Wilson (2006) used a Herfindahl-Hirschman Index, to determine that, on the collegiate level, cheating on NCAA rules may have been a reason for the competitive imbalance observed in college football. Since the NBA imposes a salary cap on teams and since the league determines the playing schedule, many of the explanations for a lack of competitive balance can not be used to explain the NBA situation.

There exists in the NBA a home court advantage. The NBA advantage is the greatest observed of the four major professional sports leagues. Entine and Small (2008) studied back-to-back games and the amount of travel and rest teams had prior to games. They estimated rest accounts for 10.5% of the home court advantage.

*Travel Costs*

The scheduling of games as a successful means of reducing team travel costs does not seem to have been previously studied and there appears to be no body of literature concerning it. The variable costs of team travel include: hotels, per diem, and ground transportation. Due to the collective bargaining agreement between the NBA and the National Basketball Players Association, teams are required to fly first class or by charter jet on trips of one-hour or longer (NBA Collective Bargaining Agreement, 2005). Because of contractual obligations with air charter companies, air transportation is more of a fixed cost for teams.

The NBA has operating rules concerning when teams must travel. League rules require teams to travel so as to be in the city where a game is to be played the night prior to the game. This requires teams to often travel immediately following a game in order to get to the next city, as required (Johnson, 2008).

Teams are required to stay in first class hotels and also to provide players a per diem of $109 (in 2008) to each player, an amount adjusted annually using the Consumer Price Index (NBA Collective Bargaining Agreement, 2005). The average hotel room in the eight largest markets (New York, Los Angeles, Chicago, etc.) is approximately $275 per night, while the average room in the remaining 22 smaller markets (Milwaukee, Salt Lake City, etc.) is $225 per night (Pfund, 2008). The weighted average for hotel costs is

$238 per person per night. Ground transportation, for most teams, involves two charter buses and one medium sized truck to carry people, equipment and luggage. Ground transportation costs average $3,000 per day.

The typical NBA travel party consists of around 35 people and includes players, coaches, trainers, administrative staff, and media personnel (particularly if the media shares the same ownership as the team). Ground transportation costs an average of $85 per person per day, making the typical average cost per person in the traveling party total $432 per day (including hotel and per diem). The marginal cost of the group is roughly $15,120 per night (Johnson, 2008).

While first class air travel is allowed contractually, the nature of most NBA team travel is to use charter planes. Many NBA teams are part of the NBA charter program which prevents teams from having to absorb the complete cost of ownership and maintenance of a jet. Typically the charter service involves transporting a team to a city and then flying to another city to transport a different team (Pfund, 2008). This lowers the average fixed cost by increasing the quantity of trips the plane makes and not having it sit idly on the ground while a different team uses a separate plane. The clustering of games in a geographic area makes travel cheaper as less jet fuel is used per trip. In general though, the scheduling of back-to-back games would have virtually no impact on the costs of the charter flights, thus they can be viewed as fixed costs. Because of the contractual limitations with the players association and with the air charters, one of the few remaining ways a team can realize cost savings in travel is to simply reduce the number of nights the team is on the road.

*A Model to Explain Back-to-Back Games*

To analyze the relationship between back-to-back games and travel time (and hence travel costs), three years of travel data for each NBA team from the 1999-2000 to 2001-2002 seasons were examined. During these years there were no expansion teams added, no stoppage of play due to labor issues, and no divisional realignment. The only change to occur in the NBA during this time period was the Grizzlies franchise which moved from Vancouver to Memphis.

Team playing schedules for road games were found in the NBA Guide for each season. The data on the number of nights needed to be spent on the road, the number of miles per trip, and the number of back-to-back games played were counted and calculated using mapquest mileage amounts. There were a total of 1,867 trips taken by all teams during this three year time period. The away/away back-to-back games are the focus of this study as these represent the greatest number of back-to-back games, are the games that have the highest incidence of failure, and thus would have the greatest impact on competitive balance.

As it turned out, each division had a different number of back-to-back games scheduled. This may have been the result of their geographic location. The Central division had the fewest number of back-to-back away/away games, averaging 5.71 sets of these type games per team. The Pacific division had the most, averaging 9.54 sets per team (see Table 1). The difference from the mean was statistically significant for the Central and Pacific divisions.

In constructing a model to examine the number of back-to-back games scheduled, the following variables were used:

B2B – the total number of sets of back-to-back away/away games played by each team per season

TNT – Total Nights spent on the road by each NBA team per season

AMI – Average miles per trip. This number is the total miles traveled per season divided by the total number of trips taken per season

CENT – a dummy variable for the Central Division

HOCKEY – a dummy variable signifying a National Hockey League (NHL) team uses the same venue as an NBA team

An econometric model using the Data Count Method was constructed using the number of back-to-back away/away games as the dependent variable. The ML/QML Poisson Data Count approach was chosen because of the small values observed in the dependent variable and the two dummy independent variables. While some of the data here were not qualitative in nature, as is the case in many data count uses, the nonlinear regression of the Poisson model allowed for improved results (Greene, 2003). The model is:

$$\mathbf{B2B} = \alpha_i + \beta_1 (\mathbf{TNT}) + \beta_2 (\mathbf{AMI}) + \beta_3 (\mathbf{CENT}) + \beta_4 (\mathbf{HOCKEY}) + \varepsilon$$

The results, shown in Table 2, show an $R^2$ of .663. Both the total nights and the average miles variables were significant at the .05 level. Neither the Central Division variable nor the hockey variable were significant, reinforcing the notion that there is no bias towards any one division over another and that the presence of a hockey team does not increase the number of back-to-back games.

The direct relationship shown between back-to-back road games and average miles per trip indicates that the longer in distance a trip is, the more likely there will be

back-to-back games scheduled on it. The inverse relationship between the total nights on the road and the presence of back-to-back road games may, though, at first seem counterintuitive. While it may seem logical that the longer the trip, in terms of the number of days spent on the road, the more likely a back-to-back would occur, the presence of the inverse relationship indicates that fewer nights on the road increases the likelihood of back-to-back games occurring. Another way to state this is that having back-to-back games reduces the number of nights a team must be out on the road.

These results are consistent with a league that is trying to reduce the costs of travel. By increasing the number of back-to-back games it reduces the costs associated with being on the road. For the average NBA team, playing 7.31 away/away back-to-backs means enjoying cost savings of $110,527 on average per season. In one season, the entire NBA enjoys a cost saving of $3,315,816.

*Conclusion*

The NBA league office states that its goal in assembling the season schedule is primarily competitive balance with cost minimization as a secondary goal. This study constructed a model whose results show this to be generally true. The lack of bias in back-to-back scheduling may indicate an effort towards competitive balance. While all teams are not treated equally, they are statistically treated similarly enough. The schedule is more clear concerning the matter of cost reduction. Through increasing the number of back-to-back games the NBA is able to reduce the number of nights a team in on the road thus saving on hotel, ground transportation, and per diem costs.

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www.mapquest.com

Table 1

Annual Averages by Division

| | Average of Total Nights on the Road | Total Away/Away Back-to-Backs | Average Number of Away/Away Back-to-Backs | Total Miles | Average Miles per Trip | Average Miles per Game |
|---|---|---|---|---|---|---|
| Atlantic | 57.00 | 137 | 6.52 | 54,549.95 | 2,466.97 | 1,330.49 |
| Central | 57.50 | 137 | 5.71 | 48,999.54 | 2,182.46 | 1,195.11 |
| Midwest | 55.95 | 165 | 7.86 | 58,620.86 | 2,809.51 | 1,429.78 |
| Pacific | 55.19 | 192 | 9.14 | 61,288.24 | 3,092.83 | 1,494.84 |
| | | | | | | |
| Average | 56.41 | 157.75 | 7.31 | 55,864.65 | 2,637.94 | 1,362.55 |
| Standard Deviation | 1.038 | 26.374 | 1.51 | 5,350.082 | 397.095 | 130.490 |

Table 2

Dependent Variable: Number of back-to-back away/away games

| Variable | Coefficient | Standard Error | z-Statistic |
|---|---|---|---|
| C | 3.6059 | 0.812 | 4.441* |
| TNT | -0.043 | 0.013 | -3.338* |
| AMI | 0.0003 | 0.000 | 2.600* |
| CENT | -0.0512 | 0.125 | -0.411 |
| HOCKEY | -0.0455 | 0.090 | -0.506 |

$R^2 = 0.663$
Adjusted $R^2 = 0.646$