TELEVISION REVENUE AND THE STRUCTURE OF ATHLETIC CONTESTS:

THE CASE OF THE NATIONAL BASKETBALL ASSOCIATION

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INTRODUCTION

Beginning in 1985, the format of the NBA championship series changed. The championship series in the NBA has always been a best-of-seven series. The team in the finals with the higher winning percentage during the regular season (henceforth First) is rewarded by playing four of the seven games on its home court, the opponent (henceforth Second) plays three games at home. Prior to 1985, the series consisted of two games on the First team's home court, followed by two away, followed by a game at home, followed by a game away, and ending with a game at home (henceforth HHAAHAH). In 1985, although the series remained a best-of-seven playoff with four home games for the First team, the order of the home games changed. The new format consists of two home games, followed by three away, and then ending with two at home (henceforth HHAAAHH). The only difference between the two formats is that the new format switches the locations of games five and six: under the HHAAAHH format, the First team plays game five away and game six at home. The consequence is that the first team plays three of the First five games away under the new playoff format.

According to the NBA the reason for the format change was to reduce the inconvenience of travel. A report in *USA Today* stated that part of the problem with the old format arose due to CBS's scheduling of games in the 1984 championship series between Boston and Los Angeles [*USA Today*, June 25, 1984]. In that series there were three and two days off between some of the first four games because CBS did not want to televise the games during prime time in May. The series then ended with three games in five days with a cross-country trip between each game. According to *USA Today*, the NBA commissioner, David Stern, favored the 2-3-2 format because the reduced travel would give players more rest and encourage media attendance.

The new format, no doubt, leads to less travel, but it also has other benefits. This paper presents evidence to show that, under reasonable assumptions about the probability of winning and the home-court advantage, the change in format has lengthened the championship series and reduced the variance in the length of the series. These changes occur because the new, HHAAAHH, format increases the probability of a series-ending game six and decreases the probability of a series-ending game five. It is not surprising that the HHAAAHH format leads to a longer series. The Second team gets to play three of the first five games at home. With a home court advantage, the Second team is more likely to win those games and the series is likely to continue.

Why is a longer playoff series desirable? A longer series with less variance is a more valuable commodity because the ratings for games in a series increase as the series continues. NBA basketball is a valuable television commodity. According to McClellan [1993], the NBA recently signed a four-year $750 million deal plus revenue sharing with NBC for the rights to televise NBA basketball. It is reported that the revenue sharing was to begin when advertising revenues exceeded $1.06 billion. TNT also recently signed a four-year $350 million deal with revenue sharing to begin above $350 million. The numbers are even more impressive if local television and radio revenues are considered. According to Cooper [1993] the NBA expected to receive $150 million for the rights to local television and radio for the 1993-94 season to go along with an estimated $248 million from NBC and TNT for a total of nearly $400 million for the rights to the 1993-94 season. With so much money at stake the NBA would be foolish not to explore ways to increase television revenues.

The NBA championship series games are the among the games with the largest television audience and so contribute greatly to the value of the television rights. Any efforts to change the championship format to increase the value of the television rights is desirable, and a longer championship series is a more valuable championship series. Thus, from the standpoint of revenue generation, a series format which increases the probability of a series-ending game six, at the expense of reducing the probability of a series-ending game five, is desirable.

Under varying assumptions about the probability of winning and the home-court advantage, we show that the new format increases the probability that a series will end at game six and reduces the probability of the series ending at game five. Furthermore, we present empirical evidence to show that game six of the championship series is, on average, watched by more viewers than game five. Not only does this new format reduce travel costs, but it substantially increases the value of NBA television rights.

THE PROBABILITY OF A SERIES-ENDING GAME

The NBA championship series has always been a best-of-seven series, with four of the games being played on the home court of the team with the better winning percentage during the regular season. Harville and Smith [1994] discuss three reasons for a home-court advantage: 1) increased crowd support, 2) distinctive features

TABLE 1
Differences in Means and Differences in Standard Deviations between HHAAAHH and HHAAHAH Playoff Formats

	H					
P	**0.0**	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**
0.50	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
0.55	0.000	0.021	0.046	0.081	0.130	
	(0.000)	(-0.006)	(-0.019)	(-0.049)	(-0.138)	
0.60	0.000	0.040	0.090	0.158	0.256	
	(0.000)	(-0.009)	(-0.027)	(-0.076)	(-0.215)	
0.65	0.000	0.057	0.128	0.229		
	(0.000)	(-0.004)	(-0.019)	(-0.066)		
0.70	0.000	0.070	0.160	0.288		
	(0.000)	(0.007)	(0.007)	(-0.017)		
0.75	0.000	0.079	0.182			
	(0.000)	(0.025)	(0.052)			
0.80	0.000	0.082	0.192			
	(0.000)	(0.049)	(0.116)			
0.85	0.000	0.077				
	(0.000)	(0.077)				
0.90	0.000	0.064				
	(0.000)	(0.105)				
0.95	0.000					
	(0.000)					
1.00	0.000					
	(0.000)					

of the playing facility, and 3) travel. During the 1993-94 NBA regular season, playing on one's home court increased the probability of winning, on average, by 11 percent. For teams making the playoffs, the increased probability of winning was, on average, an even larger 14 percent [*Street and Smith's Guide to Pro Basketball*, 1994-1995, 1]. The home-court advantage provides the teams with an incentive to play well during the regular season.

The home-court advantage is an important determinant of the probability of winning and is incorporated into our model. The model we develop is based on two parameters: the probability of the First team (the one with the better regular season record) winning on a neutral court and the increase in the probability of winning on one's home court. The probability of the First team winning on a neutral court against the Second team is denoted by p (for the opponent the probability of winning on a neutral court is q, and $p + q = 1$). The increase in the probability of winning on one's home court is denoted by h. In the absence of any reason to do otherwise, we assume that the home court advantage is the same for both teams. (Harville and Smith [1994] found no differences in home-court advantage for college basketball teams). If the First team plays at home, the probability of winning is given by $p_* = p + h$, and the probability of losing is $1 - p_*$. For the opponent, the probability of winning at home is given by $q_* = q + h$, and the probability of losing at home is given by $1 - q_*$.

Using these parameters, one can derive the probabilities that the series ends in four, five, six, or seven games for the HHAAHAH playoff format and the HHAAAHH format. The probabilities are similar to binomial and multinomial probabilities, but differ because there are two outcomes for each location, win or lose, and the probability of winning depends upon the location of the game. These probability expressions are given in the Appendix.

The issue we examine is the change in average playoff length associated with the change to the new format. Table 1 shows the differences in means and differences in standard deviations of playoff length between the HHAAAHH and the HHAAHAH formats. The table indicates that there in no difference between the two playoff formats when $p = .5$ or $h = 0$. This result is unsurprising because the teams are essentially the same if $p = .5$. There is no "better" team and so $p = q$ and $p_* = q_*$ for any value of h. Similarly, when $h = 0$ there is no home-court advantage, so it does not matter where or in what order the games are played.

The table clearly shows some effects of the change in format. For the plausible values of h and p, the table shows that the new playoff format has the effect of lengthening the playoff and reducing the variance in the number of games. This effect is present when the probability of winning on a neutral court is larger than .5, but less than .7, regardless of the value of h. Interestingly, in our model the format change has no effect on the probability that the First team will win the tournament. That probability is determined by having four games at home, regardless of the order. Any format change that adversely affected the probability of winning for either the First or the Second team would probably have met with much resistance.

A longer series should benefit the NBA by providing higher media ratings, as the next section shows. A smaller variance in the length of the series should also be beneficial, because a lower variance implies less uncertainty about the length of time that televising the series will disrupt regular programming.

PLAYOFF RATINGS

Even to a casual observer it is clear that the seventh game of the NBA championship series is unique. The seventh is the only game in which the series is *certain* to end. That cannot be said of any other game. In the sixth game one team *can* end the series because the series must be three games to two. Games six and seven are the only games that *must* have some chance of being series-ending (for game seven it is a certainty). The same is not true for games four and five. Consequently, one would not expect them to be as highly rated as games six or seven.

To determine whether the sixth game of a series is watched by more people than the fifth, data on the household ratings for games in the NBA championship series are used as the dependent variable in a regression model. Data on individual household playoff ratings are collected from 1972 to 1994 for those series in which all games were televised. (The 1973 series was omitted because game one was not televised.) This variable measures the percentage of households in the U.S. having television sets that are tuned to the NBA playoff game.

To isolate the effects of individual games in the championship series, we included several independent variables in the model. Dummy variables were constructed for each playoff game, first through seventh. A dummy variable equal to one if the game was played on the weekend, zero otherwise, is included. Also, dummy variables for each series except 1973 are included to account for effects such as differences in network, advertising, small-market/large-market differences, presence of star players, and time of the year the series was played. Our data set consisted of 127 observations.

Estimations for three specifications of the model are found in Table 2. Models one and two are estimated for the purpose of comparison with model three. Model one contains the weekend dummy variable and dummy variables for games five, six, and seven. Model two also includes the dummy variable for game four. Our most reasonable specification, model three, includes the weekend dummy, dummy variables for games two through six, and dummy variables for each individual series to account for the series effects discussed above. The R^2s are 0.19, 0.24, and 0.85, respectively. In each of the three models the dummy variables for games five, six, and seven are statistically different from zero at the usual levels of significance. The coefficient of the game seven dummy is, not surprisingly, the largest, followed by the game six coefficient and the game five coefficient. Most important for the hypothesis asserted in this paper is the relationship between the Game5 and Game6 dummy variable coefficients. In all three models the coefficient of the Game6 dummy exceeds the coefficient of the Game5 dummy. The differences are 1.225, 1.081, and 0.831, respectively (based on data from the most recent series, one household rating point is worth about one million additional households tuned to the game so, for example, the difference of 1.225 corresponds roughly to an increase of 1.2 million households). Although these differences are consistent with our hypothesis that a longer series improves television ratings, a statistical test is necessary.

TABLE 2
Household Ratings Regression Results

INTERCEPT	12.705	12.039	10.016
	(29.86)	(25.18)	(14.50)
GAME 2	-----	-----	0.887
			(1.81)
GAME 3	-----	-----	1.018
			(2.09)
GAME 4	-----	2.211	2.926
		(2.79)	(6.09)
GAME 5	0.890	1.525	2.369
	(1.05)	(1.79)	(4.64)
GAME 6	2.155	2.606	3.200
	(2.30)	(2.81)	(5.86)
GAME 7	5.606	6.21	7.653
	(3.73)	(4.20)	(9.29)
WEEKEND	-1.955	-1.662	-1.285
	(-3.08)	(-2.65)	(-3.63)
A SET of SERIES DUMMIES	-----	-----	a
R^2	0.19	0.24	0.85
F	7.09	7.54	19.67
N	127	127	127

a. For the sake of brevity, these results are not given here, but are available from the authors upon request.

To provide additional evidence in support of our hypothesis, we tested the hypotheses

(1) $$H_0{:}\beta_{game6} \leq \beta_{game5}$$
$$H_a{:}\beta_{game6} > \beta_{game5}.$$

For each of the three models estimated, the null hypothesis can be rejected at the $\alpha = .10$ level, or better. These test results further support our claim about the benefits of a longer series.

CONCLUSIONS

This paper shows that the change in the NBA championship format from a 2-2-1-1-1 to a 2-3-2 format had the effect of increasing the tournament length and reducing its standard deviation, in addition to reducing the inconvenience of travel. The new format increases the probability of a series-ending game six and reduces the probability of a series-ending game five. We present empirical evidence to show that game six is more highly watched, on average, than game five, so the net effect is increased viewing. More viewers means more advertising revenues and a more valuable tournament.

APPENDIX

Each probability below consists of two terms. The first is the probability that the First team wins the series in the specified number of games and the second term is the probability that the opponent wins the series in the specified number of games.

The expressions below are the probabilities in the original, HHAAHAH, scheme.

$$P(4) = \left[\left(\binom{2}{2}p_*^2\,(1-p_*)\right)^0\left(\binom{1}{1}(1-q_*)^1 q_*^0\right)\right](1-q_*) +$$
$$\left[\left(\binom{2}{2}(1-p_*)^2 p_*^0\right)\left(\binom{1}{1}q_*^1\,(1-q_*)^0\right)\right]q_*$$

$$P(5) = \left[\sum_{1=0}^{1}\left(\binom{2}{i+1}p_*^{i+1}(1-p_*)^{1-i}\right)\left(\binom{2}{2-i}(1-q_*)^{2-i}q_*^i\right)\right]p_* +$$
$$\left[\sum_{i=0}^{1}\left(\binom{2}{i+1}(1-p_*)^{i+1}p_*^{1-i}\right)\left(\binom{2}{2-i}q_*^{2-i}(1-q_*)^i\right)\right](1-p_*)$$

$$P(6) = \left[\sum_{1=0}^{2}\left(\binom{2}{i}p_*^i\,(1-p_*)^{2-i}\right)\left(\binom{3}{3-i}(1-q_*)^{3-i}q_*^i\right)\right](1-q_*) +$$
$$\left[\sum_{i=0}^{2}\left(\binom{2}{i}(1-p_*)^i p_*^{2-i}\right)\left(\binom{3}{3-i}q_*^{3-i}(1-q_*)^i\right)\right]q_*$$

$$P(7) = \left[\sum_{1=0}^{3}\left(\binom{3}{i}p_*^i\,(1-p_*)^{3-i}\right)\left(\binom{3}{3-i}(1-q_*)^{3-i}q_*^i\right)\right]p_* +$$
$$\left[\sum_{i=0}^{3}\left(\binom{3}{i}(1-p_*)^i p_*^{3-i}\right)\left(\binom{3}{3-i}q_*^{3-i}(1-q_*)^i\right)\right](1-p_*).$$

Under the new, HHAAAHH, playoff format, the probability that the series ends in four or seven games is exactly the same as under the old HHAAHAH format. The difference in the two playoff schemes occurs because the locations of games five and six have been switched. Under the new scheme the First team plays only two games at home prior to the sixth. Consequently, the expressions for the series ending in games five and six are different under the new, HHAAAHH, format. The expressions for the probability of winning the series in five or in six games are, respectively

$$P(5) = \left[\sum_{1=0}^{1}\left(\binom{2}{i+1}p_*^{i+1}(1-p_*)^{1-i}\right)\left(\binom{2}{2-i}(1-q_*)^{2-i}q_*^{i}\right)\right](1-q_*) + \left[\sum_{i=0}^{1}\left(\binom{2}{i+1}(1-p_*)^{i+1}p_*^{1-i}\right)\left(\binom{2}{2-i}q_*^{2-i}(1-q_*)^{i}\right)\right]q_*$$

$$P(6) = \left[\sum_{1=0}^{2}\left(\binom{2}{i}p_*^{i}(1-p_*)^{2-i}\right)\left(\binom{3}{3-i}(1-q_*)^{3-i}q_*^{i}\right)\right]p_* + \left[\sum_{i=0}^{2}\left(\binom{2}{i}(1-p_*)^{i}p_*^{2-i}\right)\left(\binom{3}{3-i}q_*^{3-i}(1-q_*)^{i}\right)\right](1-p_*)$$

NOTES

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