

Stars at the Gate

The Impact of Star Power on NBA Gate Revenues

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Investigations into the level of competitive balance within the four major North American professional team sports leagues suggest that the National Basketball Association (NBA) exhibits the lowest level of competitive balance. Given the role competitive balance plays in maintaining consumer demand, the authors examine the role the star attractions of the NBA play in promoting fan interest. The evidence presented suggests the choice of functional form alters the significance of the relationships uncovered. Specifically, the significance of star power is only uncovered in a multiplicative model rather than in the commonly employed linear form. Additional empirical results are reported in the text.

Keywords: *consumer demand; competitive balance; superstar effect; basketball*

Competitive balance in professional team sports has been the subject of numerous theoretical and empirical publications. The theoretical literature argues competitive imbalance, or the on-field domination of one or a small number of organizations, reduces the level of uncertainty of outcome and consequently reduces the level of consumer demand.¹ The empirical literature, whether examining game day attendance² or aggregate season attendance,³ has also generally confirmed a relationship between uncertainty of outcome or competitive balance and demand for tickets to sporting events.

Decision makers in the professional sports industry have not needed economists to understand this basic relationship. Virtually from the inception of organized

sports in North America, leagues have enacted various institutions to promote competitive balance.⁴ Such institutions include the reserve clause, the rookie draft, payroll caps, salary caps, revenue sharing, and luxury taxes. Despite the similarity of effort, professional team sports leagues continue to have varying degrees of competitive balance.

The variability of competitive balance across professional team sports was illustrated by Quirk and Fort (1992). One of the findings of this seminal work, extended by Berri and Vicente-Mayoral (2001) and Berri (in press), was the relative lack of competitive balance in the National Basketball Association (NBA). The relative imbalance continued in spite of the NBA's institution of a rookie draft, payroll caps, revenue sharing, free agency, and, at times, a reserve clause. By virtually any measure, the NBA has been unable to achieve the level of competitive balance observed in the other North American professional sports leagues.

The purpose of this article is not to examine why the NBA is competitively imbalanced but rather to examine the impact competitive imbalance has on consumer demand for the NBA product. The works of Knowles, Sherony, and Hauptert (1992) and Rascher (1999) found that Major League Baseball attendance was maximized when the probability of the home team winning was approximately .6.⁵ These studies suggest that consumers prefer to see the home team win but do not wish to be completely certain this will occur prior to the game being played. For fans of NBA teams located near the bottom of the league rankings, though, the opposite is often true. Not only is their team not likely to win, but often the fan is quite certain of this negative outcome. The question is therefore "How do these NBA teams still maintain demand in the face of the certainty of an unwelcomed outcome?"

One possible strategy is for teams to shift their focus from the promotion of team performance to the promotion of individual stars. Hausman and Leonard (1997) found the presence of stars had a substantial affect on television ratings, even after controlling for team quality. Although this work also considered the affect stars had on team attendance, the inquiry into team attendance was "less formal" (p. 609). In essence, these authors only looked at how attendance changed when a team either added or played one of the stars these authors identified.

An objective of the present work is to extend the work of Hausman and Leonard (1997) in a more comprehensive study of the relationship between team attendance and both team performance and the team's employment of star players. The structure of the study is as follows: The following section details the empirical model we will utilize to examine the demand for professional basketball. This discussion is followed by a review of the econometric estimation of the aforementioned model. The final section offers concluding observations.

TABLE 1: Dependent and Independent Variables Sample: 1992-1993 through 1995-1996

<i>Item</i>	<i>Label</i>	<i>M</i>	<i>Maximum</i>	<i>Minimum</i>	<i>SD</i>
Dependent variable					
Gate revenue (in \$ millions)	GATE	20.13	41.20	9.90	7.67
Independent variables					
Team performance characteristics					
Regular season wins	WINS	41.43	72.00	11.00	13.28
Playoff wins	WPLAY	2.72	15.00	.00	4.20
Lagged playoff wins	WPLAY(-1)	2.77	15.00	.00	4.22
Championships won, weighted	WCHM20	7.76	67.00	.00	16.10
All-Star votes received	STARVOT	894,482.33	3,176,443.00	.00	813,666.48
Franchise characteristics					
Stadium capacity	SCAP	17,953.86	24,042.00	12,888.00	2,382.28
Teams at capacity	DCAP	.343	1.000	.000	.477
Age of stadium	OLD	16.472	66.000	.000	14.975
Expansion team, dummy	DEXP5	.06	1.00	.00	.23
Roster stability	RSTAB	.71	.97	.40	.13
White ratio (WHITEMIN/ WHITEPOP)	WHITERATIO	.20	.68	.00	.14
Team attendance	ATTEND	677,196	985,722	414,560	126,079
Market characteristics					
Competitive balance in conference	CB	2.944	3.335	2.344	.310
Competing teams	COMPTM	2.602	8.000	.000	2.230
Real per-capita income	RYCAP	167.92	247.37	111.97	25.62
Population	POP	5,361,974.97	18,204,047.00	1,159,845.00	5,165,118.64
Racial variables					
Percentage of White minutes	WHITEMIN	.16	.47	.00	.11
Percentage of Whites in population	WHITEPOP	.82	.95	.69	.07

THE DATA TO BE EMPLOYED

Given rudimentary consumer theory, demand is primarily determined by three factors: team performance, franchise characteristics, and market characteristics. The literature on attendance in professional sports has turned to a variety of factors designed to capture these primary determinants of demand. Table 1 lists our choice of dependent and independent variables. In addition to listing the variables and the nomenclature we employ, we report the hypothesized affect of the independent variables and corresponding descriptive statistics. We follow with a brief review of the theoretical reasoning behind this chosen list of factors.

Consumer Demand

The data utilized to tabulate the variables listed in Table 1 comes from four seasons, beginning with the 1992-1993 campaign and concluding with the 1995-1996 season.⁶ A common practice within the professional team sports literature is to utilize aggregate attendance data as the dependent variable in a study of consumer demand. Over the period our study highlights, though, such a choice is problematic. Specifically, if one compares the reported attendance figures to the maximum attendance the stadium capacity of these teams would allow, one would note that of the 108 teams considered, 43 teams, or 40%, sold out every single home game. Given the divergence between attendance and demand, we employ gate revenue⁷ as a proxy for the level of consumer attraction to professional basketball.⁸ The use of gate revenue incorporates price adjustments and therefore allows for full variation in the dependent variable.⁹

Team Performance

The most common measure of team performance is regular season wins. Team performance can also be captured via playoff wins, lagged values of both regular season and playoff victories, and past championships won. Following Berri and Brook (1999), the affect of past championships is estimated via the calculation of WCHM20. This calculation involved assigning a value to a team for each championship won in the past 20 years. This value was 20 if the team captured a championship during the prior season, 19 if the championship was won two seasons past, and so forth.¹⁰

In addition to these measures, we also consider the impact of a team's star attractions. The relationship between demand and stars has been considered by Scott, Long, and Sompii (1985), Brown, Spiro, and Keenan (1991), and Burdekin and Idson (1991), as well as the aforementioned work of Hausman and Leonard (1997). Of these studies, only Brown et al. (1991) was able to find a statistically significant relationship between a measure of consumer demand and a team's star attractions.

Each of these studies employed a different definition of star attraction. Scott et al. (1985) defined a superstar as "a player who has made the All-Pro team five times or, if he has only played a few years, dominates his position" (p. 53). Brown et al. (1991) defined a superstar as "a player who has played in the NBA All-Star Game for at least 50% of his years in the league" (p. 338). Finally, Burdekin and Idson (1991) considered a player a star if he was voted by the media to either the first or second All-NBA teams.

Given our focus on consumer demand, we sought a measure that would directly incorporate fan preference. We therefore introduced All-Star Game votes as our measure. Specifically, the starters for the midseason All-Star Game are chosen via balloting by the fans. We were able to obtain the number of votes received by the top 10 players at guard, forward, and center.¹¹ For each team, we summed the number

of votes received by the players employed. In addition, following Hausman and Leonard (1997), we also considered dummy variables for four superstars: Michael Jordan, Shaquille O'Neal, Grant Hill, and Charles Barkley. Each of these players was either explicitly noted by Hausman and Leonard (Jordan, O'Neal) or led the league in All-Star votes received in one of the years examined in the study (Jordan, Barkley, Hill).

Franchise Characteristics

In general, the variables utilized to capture the characteristics of the franchise follow convention. Both stadium capacity and being an expansion team are expected to have a positive affect on both team attendance and team revenue. Along similar lines, the age of a stadium is expected to decrease demand. We introduced a dummy variable for expansion teams, equal to 1 if the team is less than 5 years old.¹²

As noted, the data set contains a number of teams that consistently sell out their venue. Shmanske (1998), in a study of golf courses, noted that an increase in demand would elicit different responses from courses at capacity relative to those that still were capable of serving additional customers. Specifically, a course with excess capacity could increase both quantity and price in response to an increase in demand. Courses at capacity, though, could only increase price. Therefore, as Shmanske argued, the estimated parameters in the demand function may differ depending on whether an organization is at capacity. To account for these differences, Shmanske incorporated a dummy variable equal to 1 if a course was at capacity. Given the similarity between Shmanske's subject and our own, we have incorporated DCAP as an independent variable.¹³

In addition to these factors, we consider a factor suggested by Blass (1992) and Kahane and Shmanske (1997). Each of these authors considered the affect that roster stability or, conversely, turnover has on team attendance. Although Blass failed to find a relationship between team attendance and player tenure with the team, Kahane and Shmanske presented evidence that a negative relationship existed between roster turnover and team attendance. In other words, the more stability a roster exhibits from year to year, the greater the level of consumer demand. To the best of our knowledge, this study is the first to consider the affect of this variable on consumer demand in the NBA. Roster stability was measured by examining the minutes played by returning players over both the current and prior seasons. We then averaged the percentage of minutes played by these players for both of these campaigns.¹⁴

Market Characteristics

This exposition began by noting the lack of competitive balance in the NBA. Previously, Schmidt and Berri (2001) found that the level of competitive balance affected consumer demand in Major League Baseball. To ascertain if such a rela-

relationship exists for the NBA, a measure of competitive balance is required. Following the lead of Quirk and Fort (1992), who in turn built on the writings of Noll (1988) and Scully (1989), competitive balance can be measured by comparing

the actual performance of a league to the performance that would have occurred if the league had the maximum degree of competitive balance in the sense that all teams were equal in playing strengths. The less the deviation of actual league performance from that of the ideal league, the greater is the degree of competitive balance. (Quirk & Fort, 1992, p. 244)

$$CB_{it} = \frac{\sigma(wp)_{it}^{actual}}{\sigma(wp)_{it}^{ideal}}; \text{ where } \sigma_{it}^{ideal} = \frac{\mu(wp)_{it}}{\sqrt{N}}.$$

The above intuition suggests the following measure of competitive balance (*CB*), where $\sigma(wp)_{it}$ represents the standard deviation of winning percentages within league (*I*) in period (*t*). Also, $\mu(wp)_{it}$ represents league (*I*)'s mean, and *N* the total number of games. As noted by Quirk and Fort (1992), the idealized standard deviation represents the standard deviation of winning percentage if each team in a league has an equal probability to win each game. The greater the actual standard deviation is relative to the ideal, the less balance exists within the professional sports league. The measure of competitive balance reported in Equation 1 was calculated for each conference, Eastern and Western, and each year, examined by this study.

The remaining market characteristics utilized follow the standard list employed in the literature. The number of competing teams is simply the number of teams from each of the four major North American professional team sports located in each franchise's city. This is expected to have a negative affect on consumer demand. In contrast, population and per-capita income should each increase team revenue. Population is measured for each team's standard metropolitan area. We also consider per-capita income in real terms, which we ascertained by adjusting nominal income for each city's cost of living.¹⁵

The final independent variables listed in Table 1 are associated with measuring the affect the racial composition of the team has on NBA demand. Following the lead of Hoang and Rascher (1999), we employed the ratio of the percentage of minutes on the team allocated to White players (WHITEMIN) to the percentage of White persons in the population of the city (WHITEPOP). If this variable increases in size, the racial match between the team and the city improves. Consequently, we would expect WHITERATIO to have a positive sign if people within the market prefer a team that represents the racial mix of the city.¹⁶

In addition to the variables listed in Table 1, we also employ dummy variables for each year this study considers. The inclusion of these dummies is inspired by the general upward trend in gate revenues. For example, in 1992-1993, the average

team accumulated \$16.5 million from gate revenue. By 1995-1996, the final year considered in this study, this average had risen 41% to \$23.3 million.

ECONOMETRIC ISSUES AND ESTIMATION

The aforementioned list of dependent and independent variables was utilized to construct the following model:

$$Y_n = \sum_{i=1}^4 \alpha_i + \sum_{k=1}^{19} \alpha_k X_{kn} + \varepsilon_n \quad n = 1, 2, \dots, 108.$$

We next deal with the choice of functional form.

Reviewing the Work of Rottenberg and Scully

Two works brought legitimacy to the economic study of professional sports. The first was offered by Rottenberg (1956), who argued that the reserve clause would not alter the distribution of playing talent in Major League Baseball. Playing talent under the reserve clause or free agency would migrate to teams located in cities with larger populations, and hence larger revenues. In essence, Rottenberg argued that equivalent player performances would not have equivalent affects on revenue for large and small market teams.¹⁷

Although Rottenberg's (1956) article presented a theoretical basis for the affect of the reserve clause, Scully (1974) provided an empirical model. Scully's seminal estimation of the marginal revenue product of a Major League Baseball player offered a methodology that has been utilized by a number of researchers in the field.¹⁸ Briefly, Scully proposed a two-equation system, with the first equation connecting the player's actions on the field to team wins. In essence, the estimation of this equation allows one to measure the number of wins a player creates. The second equation connects team revenue to team wins and a number of additional explanatory variables. The results of the second equation allow one to measure the value of a player's production. Together these equations allow one to measure the marginal revenue product of the individual worker.

Of interest to this current work is the second equation. Following the work of Rottenberg (1956), one would expect the value of a win to vary from team to team. Scully (1974), though, like Medoff (1976), Scott et al. (1985), Zimbalist (1992), and Berri and Brook (1999), estimated the revenue function as a linear model.¹⁹ Scully (1974) did, however, state in the conclusion to his article the following:

As El Hodiri and Quirk have proved, the distribution of playing talent would be the same with or without the reserve clause; *because the MRPs of players vary by city size* [italics added], only equal distribution of revenues among the teams would effectively bring about equalization of play. (p. 930)

This quote argues that the value of players varies by city size, which implies the revenue model should not be linear.

The primarily alternative to a linear model is the double-logged, or multiplicative, functional form. This form allows the value of a win to vary across the population of teams. Scully (1974) argued in footnote 6 (p. 919) that the primary implication of a logged model was that with this functional form, wins exhibit diminishing returns. This can be seen when one examines how the marginal value of a win is ascertained in a logged model.

$$\text{Marginal value of } X_i = \left[\frac{Y}{X_i} \right] \alpha_i.$$

From the list of variables examined in Equation 1, Y is the value of GATE, X_i is the value of team wins, and α_i is the estimated coefficient from the double-logged model. From this, one can see that additional wins in a logged model will reduce the marginal value of team victories, whereas teams with higher revenues reap greater returns from additional wins.

The relationship between revenues and the value of wins highlights an advantage of the double-logged or multiplicative model. This advantage can be seen if one rewrites Equation 2 as follows:

$$Y_{\ln} = \left[\alpha_i \prod_{k=1}^{19} X^{\alpha_k} \right].$$

Again, Y is GATE and X_i represents the aforementioned list of 19 independent variables. From this formulation, the value of a win will not be constant across the sample²⁰ as it is in the linear model. Rather, with a multiplicative equation, $\partial \text{GATE} / \partial \text{WINS}$ is dependent on the values of each of the remaining independent variables in the model. Consequently, assuming population has a positive affect on revenue, increases in population will increase the value of a win. Does the data support the functional form implied in the work of Rottenberg (1956) or the model employed by Scully (1974)?

The choice of functional forms is not generally made strictly via an appeal to theory but also by examining the empirical evidence. A frequently cited test for functional form is the Box-Cox test, introduced by Box and Cox (1964). We utilize the version developed by Zarembka (1968). Briefly, the first step in this test involves scaling the dependent variable (GATE) by its geometric mean. We then estimated Equations 2 and 4, with the dependent variable in the former being GATE scaled and in the latter, the logged of GATE scaled. With the dependent variable in each equation scaled, the residual sum of squares of the two regressions is now comparable. The results indicate that the logged model is the appropriate choice for the estimation of the aforementioned revenue model.²¹ Consequently, we estimated

a logged model, a model that allows the value of a win to vary across the sample of teams examined.²²

The Estimation of the Model

The review of functional form indicated that the double-logged model was the appropriate choice for this inquiry. For comparison, both the estimation of the double-logged and linear models are offered in Tables 2 and 3, respectively.

The stated focus of this article is the affect two measures of team performance, wins and the star attraction, have on team revenue. The choice of functional form does not appear to dramatically affect the estimation of the relationship between measures of team wins and revenue. With respect to either functional form, a statistically significant relationship for regular season wins, playoff wins, and championships won is found. Furthermore, the reported relationships conform to the expected signs. The affect of star votes, though, does differ substantially across the two models. According to the linear model, the functional form frequently utilized in the literature, no relationship exists between a team's accumulation of star votes and gate revenue. With the double-logged model, though, the estimated coefficient is of the correct sign and statistically significant. Given the results of the Box-Cox test, we have some confidence that a relationship between star power and gate revenue exists.

In addition to the case of star power, the choice of functional forms appears relevant with respect to OLD, DEXP5, POP, and DCAP. The first of these three variables was found to have a statistically significant affect on revenue in the double-logged specification yet were statistically insignificant in the linear model. The opposite could be said with respect to DCAP. In sum, the choice of functional form does influence one's interpretation of these relationships.

Consistency in results was found with respect to the other variables considered. For example, all of the other variables designed to capture team performance were statistically significant. In addition, stadium capacity was found to have a significantly positive affect on gate revenue. In other words, with respect to a team's arena, bigger does appear to be better. Finally, of the specific players we examined, only DHILL was found to be statistically significant. The sign, though, was negative, indicating that the presence of Grant Hill actually diminished gate revenues in Detroit. Given the failure of the Pistons to win a playoff game in Hill's first two seasons, though, a more plausible explanation is that the Pistons' failures on the floor led to declines at the gate that the star power of Hill could not overcome. Unlike Hausman and Leonard (1997), none of the other players we examined were found to have a statistically significant affect on gate revenue. Such a result suggests that individual players do not have a significant affect on revenue beyond their contribution to team wins.²³

In addition to many of the individual player dummies, a number of variables were found to not statistically affect gate revenue. This list includes the level of ros-

TABLE 2: Estimated Coefficients for Equation 1, Dependent Variable Is GATE, Double-Logged Specification, White Heteroskedasticity-Consistent Standard Errors and Covariance

<i>Variable</i>	<i>Coefficient</i>	<i>SE</i>	<i>t Statistic</i>	<i>p Value</i>
WINS**	.171	.073	2.334	.022
WPLAY*	.079	.029	2.718	.008
WPLAY(-1)*	.084	.022	3.896	.000
WCHM20*	.072	.020	3.547	.001
STARVOT**	.010	.004	2.474	.015
DMJ	-.194	.216	-.901	.370
DSHAQ	.086	.092	.935	.353
DCB	-.018	.040	-.448	.655
DHILL***	-.164	.089	-1.828	.071
SCAP*	.675	.180	3.761	.000
OLD*	-.092	.031	-2.940	.004
DEXP5**	.159	.069	2.319	.023
RSTAB	.081	.104	.781	.437
COMPTM	-.028	.073	-.379	.706
POP**	.106	.048	2.197	.031
RYCAP	-.023	.205	-.110	.912
WHITERATIO	-.008	.018	-.471	.639
CB	.129	.228	.567	.572
DCAP	.084	.053	1.592	.115
Year fixed effects				
D1993*	-6.167	1.806	-3.415	.001
D1994*	-6.063	1.819	-3.334	.001
D1995*	-5.937	1.817	-3.268	.002
D1996*	-5.892	1.825	-3.229	.002
Observations = 108				
R^2	.815	F statistic = 17.038		
Adjusted R^2	.767	p value: F statistic = .000		

NOTE: WINS = Regular season wins. WPLAY = Playoff wins. WPLAY(-1) = Lagged playoff wins. WCHM20 = Championships won, weighted. STARVOT = All-Star votes received. DMJ = Dummy variable, Michael Jordan. DSHAQ = Dummy variable, Shaquille O'Neal. DCB = Dummy variable, Charles Barkley. DHILL = Dummy variable, Grant Hill. SCAP = Stadium capacity. OLD = Age of stadium. DEXP5 = Dummy variable, expansion team. RSTAB = Roster stability. COMPTM = Competing teams. POP = Population. RYCAP = Real per-capita income. WHITERATIO = White ratio. CB = Competitive balance in conference. DCAP = Teams at capacity.

*Significant at the 1% level. **Significant at the 5% level. ***Significant at the 10% level.

ter stability on the team, per-capita income in the market, the measure of racial matching, and the level of competitive balance in the conference. The latter result is inconsistent with the work of Schmidt and Berri (2001), who found competitive balance to significantly affect Major League Baseball attendance. One should note

TABLE 3: Estimated Coefficients for Equation 3, Dependent Variable Is GATE, Linear Specification, White Heteroskedasticity-Consistent Standard Errors and Covariance

<i>Variable</i>	<i>Coefficient</i>	<i>SE</i>	<i>t Statistic</i>	<i>p Value</i>
WINS*	.135	.038	3.544	.001
WPLAY*	.401	.112	3.578	.001
WPLAY(-1)*	.384	.111	3.466	.001
WCHM20*	.157	.051	3.089	.003
STARVOT	.000	.000	.407	.685
DMJ	-5.868	4.105	-1.430	.157
DSHAQ	1.194	2.100	.568	.571
DCB	.341	.962	.355	.724
DHILL**	-4.378	1.975	-2.217	.029
SCAP*	.001	.000	3.519	.001
OLD	-.069	.048	-1.444	.152
DEXP5	1.659	1.461	1.136	.259
RSTAB	1.112	3.387	.328	.744
COMPTM	.016	.858	.018	.985
POP	.000	.000	.843	.402
RYCAP	.008	.025	.333	.740
WHITERATIO	-.491	2.943	-.167	.868
CB	.427	1.785	.239	.812
DCAP**	2.469	1.206	2.048	.044
Year fixed effects				
D1993*	-13.693	9.899	-1.383	.170
D1994*	-11.481	10.635	-1.080	.283
D1995*	-9.765	9.871	-.989	.325
D1996*	-7.855	10.046	-.782	.436
Observations = 108				
R^2	.760	F statistic = 12.231		
Adjusted R^2	.698	p value: F statistic = .000		

NOTE: WINS = Regular season wins. WPLAY = Playoff wins. WPLAY(-1) = Lagged playoff wins. WCHM20 = Championships won, weighted. STARVOT = All-Star votes received. DMJ = Dummy variable, Michael Jordan. DSHAQ = Dummy variable, Shaquille O'Neal. DCB = Dummy variable, Charles Barkley. DHILL = Dummy variable, Grant Hill. SCAP = Stadium capacity. OLD = Age of stadium. DEXP5 = Dummy variable, expansion team. RSTAB = Roster stability. COMPTM = Competing teams. POP = Population. RYCAP = Real per-capita income. WHITERATIO = White ratio. CB = Competitive balance in conference. DCAP = Teams at capacity.

*Significant at the 1% level. **Significant at the 5% level. ***Significant at the 10% level.

that the previous work of Schmidt and Berri considered a much longer time period than that which was considered for this study. However, such results do suggest that NBA fans do not respond as baseball fans do to the level of competitive balance in the sport.

TABLE 4: Elasticities and Marginal Values

<i>Variable</i>	<i>Coefficient or Elasticity</i>	<i>M</i>	<i>\$ Average Marginal Value</i>
GATE		20.13	
WINS	.171	41.43	83,036.89
WPLAY	.079	2.72	587,485.81
WPLAY(-1)	.084	2.77	610,632.91
WCHM20	.072	7.76	185,771.69
STARVOT	.010	894,482.33	.22
SCAP	.675	17,953.86	757.32
OLD	-.092	16.47	-112,124.14
POP	.106	5,361,974.97	.40

NOTE: GATE = Gate revenue. WINS = Regular season wins. WPLAY = Playoff wins. WPLAY(-1) = Lagged playoff wins. WCHM20 = Championships won, weighted. STARVOT = All-Star votes received. SCAP = Stadium capacity. OLD = Age of stadium. POP = Population.

The Affect of Wins and the Star Attractions

With the choice of models made and subsequently estimated, what is the answer to the question posed by this inquiry? To answer this question, we turn to an examination of the economic significance of both wins and star votes.

Following Equation 2, we ascertained the marginal affect of both wins and the star attraction. For each team, the value of the dependent variables and the regressors will be different, hence for each team, a different marginal value exists. For comparison purposes, the average marginal value can be determined by utilizing the mean of each of the statistically significant, nonqualitative, independent variables employed. This analysis is reported in Table 4.

The coefficients from a logged model are the estimated elasticities between GATE and each of the independent variables. From Tables 2 and 4, it can be seen that GATE is most responsive to changes in stadium capacity and wins. In terms of elasticities, revenue is the least responsive to the star attraction. The relative affect of wins and star power is also revealed in an examination of the marginal values. An additional win produces \$83,037 in GATE revenue, on average. Given that one All-Star vote generates, on average, \$.22, the players on a team would need to receive nearly 370,000 votes to generate the revenue a team receives from one win. To equal the revenue generated by 41 wins, or the average number of regular season victories, a team would need to receive approximately 15.1 million votes. Such a total represents nearly 5 times the maximum number of votes any team received in the sample. These results suggest that it is performance on the court, not star power, that attracts the fans in the NBA.

How does the value of a win differ between large- and small-market teams? From Tables 2 and 4, one can see that increases in population will increase gate rev-

enue. Specifically, one additional person is worth, on average, \$.40. Given this result, moving to a city with an additional million persons is worth \$399,503. Such an increase in revenue would increase the value of a win by \$1,648. Again, consistent with the work of Rottenberg (1956), additional persons in the population enhance the monetary value of on-court performance.

One final extension is the issue of pricing strategies of NBA teams.²⁴ Past studies (see Burdekin & Idson, 1991; Demmert, 1973; Fort, in press; Fort & Quirk, 1995, 1996; Heilmann & Wendling, 1976; Jennett, 1984; Medoff, 1986; Noll, 1974; Scully, 1989) have presented both empirical evidence and theoretical arguments that teams in professional sports may price in the inelastic portion of the demand curve. We therefore included attendance as an additional regressor. If the coefficient on attendance is negative, one may infer that the teams are posting inelastic prices.

Equations 2 and 4 were estimated with attendance, and the coefficients were both positive and statistically significant. Such results suggest that NBA teams do not set prices in the inelastic range. Given the capacity constraints noted above, such a finding should not surprise. One caveat to this result is that NBA teams may benefit from additional revenue from parking and concessions by lowering prices and hence attracting additional fans. The size of NBA facilities, though, limits this strategy option. These results are available from the authors on request.

CONCLUDING OBSERVATIONS

The lack of competitive balance in professional basketball leads one to question how one can best generate demand for this sport. Hausman and Leonard (1997) suggested that it is star power, rather than on-court productivity, that attracts the fans. Although star power was found to be statistically significant in this present study, the ability of a team to generate wins appears to be the engine that drives consumer demand.

The propensity of NBA teams to sell out each and every contest shifted the focus of this study from attendance to gate revenue. Therefore, a second purpose of this inquiry was to distinguish between the models proposed by Rottenberg (1956) and Scully (1974). Beginning with the seminal work of Scully, revenue functions have generally been estimated as linear models. Such a practice runs contrary to the theoretical work of Rottenberg. To bridge this gap between the theoretical and empirical study of team revenue, the Box-Cox (1964) test was employed. This test indicated that for the data set employed, the double-logged or multiplicative model was the preferred choice. Such a model is not only consistent with the theoretical characterization of demand but also uncovered a relationship between revenue and star power that a linear model could not reveal.

One final question remains: Do the reported results suggest that stars are not important in the NBA? The true power of star power may lie in the revenue received by the star's opponent.²⁵ In other words, the true power of the star may lie in his abil-

ity to enhance attendance on the road. This is certainly a plausible subject for future research.

NOTES

1. See Rottenberg (1956), Neale (1964), El-Hodiri and Quirk (1971), and Quirk and Fort (1992).
2. See Jennett (1984), Peel and Thomas (1988), Borland and Lye (1992), Knowles et al. (1992), and Rascher (1999).

3. See Schmidt and Berri (2001).

4. We are focusing on the stated objective of these institutions. As noted first by Rottenberg (1956), if transaction costs are low, the reserve clause would not likely affect competitive balance. Rather, its primary affect would be on the profit potential of the individual teams. A similar story could be told with respect to the rookie draft.

5. Knowles et al. (1992), in their study of the 1988 Major League Baseball season, found that balance is achieved (i.e., attendance is maximized) when the probability of the home team winning was .6. Rascher (1999) offered an examination of the 1996 Major League Baseball season that examined a larger sample of games and a greater number of independent variables.

Rascher's study demonstrated that fans prefer to see the home team win, and consistent with the work of Knowles et al., fan attendance is maximized when the home team's probability of winning equals .66. Each of these studies suggested that a home team with a high probability of winning the contest will see a decline in fan attendance, indicating that uncertainty of outcome is a significant determinant of demand.

6. For the first 3 years considered, the population of NBA teams equaled 27. For the 1995-1996 season, 2 teams were added in Vancouver and Toronto. The model we employ, though, utilizes lagged values of several independent variables. Consequently, data from these 2 teams could not be utilized, and the final number of observations employed was 108.

7. Data on gate revenue were reported in various issues of *Financial World* (Atre et al., 1996; Badenhausen, Nikolov, Alkin, & Ozanian, 1997; Ozanian, Atre et al., 1995; Ozanian, Fink, et al., 1994). The last season this periodical reported such information was the 1995-1996 campaign. To the best of our knowledge, such information was not reported for the 1996-1997 campaign. Data on revenue are reported for more recent years by *Forbes* magazine, although *Forbes* does not report data specifically on gate revenue. Rather, a team's media revenues, stadium revenues, and gate are aggregated and simply reported as total revenue in *Forbes*. This change in reporting prevents us from examining seasons after 1995-1996.

8. The examination of team revenue was initially conducted by Scully (1974) in his seminal examination of marginal revenue product. A list of additional studies that have examined revenue would include Medoff (1976), Scott et al. (1985), Zimbalist (1992), and Berri and Brook (1999).

9. We would like to thank an anonymous referee for noting the potential link between gate revenue and other revenue streams. For example, if stadium revenues (concessions, parking, and so forth) are high, the firm has an incentive to lower ticket prices so that more people are admitted to take advantage of this revenue stream. In addition, one might expect a link between gate and media revenues. Again, as the referee notes, a sold-out stadium may enhance TV ratings, hence enhancing media revenues. One possible solution is to include stadium and media revenues as additional regressors in the model. However, because such revenue streams would be related independent of causal factors, such a solution is not attractive econometrically. Indeed, when such a model was estimated, both stadium and media revenues were found to be positively related to gate revenue. Furthermore, the remaining regressors are largely unaffected by the inclusion of these two variables. Therefore, we have chosen to omit the results with these two regressors. Such results are available from the authors on request.

10. Data on regular season wins, playoff wins, and championships won were obtained from various issues of *The Sporting News: Official NBA Guide* (1993-1996).

11. These data were obtained from various daily newspapers. The top finishers at each position are chosen as starters for the midseason classic. In addition, the guard and forward receiving the second-most votes at these positions are also named as starters. Because only one center is chosen, the above analysis only considered the top five recipients of votes at this position.

12. Data on stadium capacity, age of the stadium, and the expansion status of the team were obtained from various issues of *The Sporting News: Official NBA Guide* (1993-1996).

13. We thank an anonymous referee for alerting us to this issue and the work of Shmanske (1998).

14. An example may help illustrate the method employed to measure roster stability. During the 1994-1995 season, George McCloud's NBA career was resurrected by the Dallas Mavericks, who employed him for 802 minutes. The following year, McCloud's minutes increased more than threefold to 2,846. If we only consider McCloud's minutes during the 1995-1996 season, we would be overstating the level of roster stability because McCloud was not an integral part of the Mavericks in 1994-1995. Consequently, in measuring roster stability, we consider more than just how many minutes a player played during the current season but also the number of minutes the team allocated to the player during the prior campaign. We wish to acknowledge the assistance of Dean Oliver, who argued that a better label for this measure is roster stability, as opposed to roster turnover. Data on minutes played, utilized to construct the roster stability variable, were obtained from various issues of *The Sporting News: Official NBA Guide* (1993-1996).

15. Data on metropolitan statistics area (MSA) population was taken from Missouri State Census Data Center (2001). Personal income came from U.S. Bureau of Economic Analysis (1992-1996), whereas MSA Consumer Price Indexes came from U.S. Bureau of Labor Statistics (1992-1996).

16. An anonymous referee noted that WHITERATIO only implies an improvement in racial match if it does not exceed 1. If the value of the ratio exceeds 1, then further increases actually imply a worsening of the racial match. Although this is true theoretically, in the sample, was the value of this variable was below 1 for every team. Data on the size of the White population in each city was obtained from Missouri State Census Data Center (2001). For the racial mix of the team, we consulted both *The Sporting News: Official NBA Guide* (1993-1996) and the pictures of the players offered in *The Sporting News NBA Register* (1993-1996).

17. As previously noted in the academic literature, Rottenberg's (1956) argument anticipates the work of Coase (1960).

18. A representative sample of this literature would include Medoff (1976), Scott et al. (1985), Zimbalist (1992), Blass (1992), and Berri and Brook (1999).

19. Not all researchers followed the lead of Scully (1974). Sommers and Quinton (1982), in an examination of team revenue in Major League Baseball, presented evidence that the marginal revenue generated by a win varies from small- to large-market teams. More recently, Burger and Walters (2003) also presented evidence that market size significantly affects the valuation of player productivity.

20. To illustrate, consider the basic Cobb-Douglas production function:

$$Y = AK^aL^b, \text{ where } Y = \text{output, } K = \text{capital, and } L = \text{labor.}$$

The marginal value of labor from this model is as follows:

$$\partial Y / \partial L = bAK^aL^{b-1}.$$

In other words, the value of labor increases as capital increases but diminishes with additional labor employed.

21. The residual sum of squares (RSS) for the linear model was 4.25. For the logged model, the RSS fell to 3.63. Zarembka (1968) suggested a test statistic, calculated as

$$(n/2) \times \log(Z), \text{ where } Z = \text{ratio of the residual sum of squares} \\ \text{and } n \text{ is the number of observations}$$

The test statistic is distributed as a χ^2 statistic with 1 degree of freedom. The value of the test statistic was 3.74, which indicates that the double-logged model provides a superior fit at the 10% level of significance.

22. In addition to the proper choice of functional form, one may also be concerned about the possibility of multicollinearity. Specifically, Hausman and Leonard (1997) argued that star power and team wins are linked. To test for this possibility, we calculated the variance inflation factor (VIF). We would note that the VIF for WINS and STARVOT was 3.04 and 1.60, respectively. Although there is no statistical test for significance of the VIF, a general rule of thumb is if the VIF exceeds 10, multicollinearity is at such a level that the interpretation of results may prove difficult. Consequently, we do not believe multicollinearity is an issue with respect to WINS or STARVOT. The complete results of this test are available from the authors on request.

23. In a previous version of this article, we estimated the double-logged model without DCAP, CB, and the year fixed effects. The results with respect to the remaining independent variables were quite similar. The lone exceptions were the star dummy variables. In the previous estimation, DSHAQ was positive and significant, and the remaining dummies were statistically insignificant. As noted, in the current formulation, DSHAQ is now statistically insignificant whereas DHILL has become statistically significant. Such variation in results cast suspicion on the validity of these dummy variables.

24. We wish to thank an anonymous referee for raising this issue.

25. We wish to thank an anonymous referee for raising this issue.

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