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Does NBA Attendance Respond to Increased Offensive Quality and Production?

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DOES NBA ATTENDANCE RESPOND TO INCREASED OFFENSIVE QUALITY AND PRODUCTION?

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Spring 2009

Abstract

Over the past ten years the NBA has instituted numerous rule changes meant to aid offensive production with the goal of increasing attendance and improving the NBA's product. If the NBA has accurately predicted its fan's preferences, these changes should result in increased attendance. Using econometric techniques, I use three different specifications to evaluate this hypothesis using different measures of offensive quality: fast break points, offensive efficiencies, and turnovers per game. The three specifications employed yield consistent results that turnovers, fast break points, offensive efficiency, and points scored for the home team are all positive and significant determinants of attendance.

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After Michael Jordan retired from basketball for the second time in 1998, strong power forwards and centers have dominated the NBA. For first 5 years after the "Jordan Era," either Tim Duncan or Shaquille O'Neal, widely recognized as the two most dominant "big men" ever, won the NBA Finals. While both Tim Duncan and Shaquille O'Neal are almost unanimously respected and praised for their unmatched skills, their style of play is generally described as "vanilla", as noted by Eifling (2003). The NBA responded to this criticism with subtle alterations to the rules of basketball, which empowered smaller players and promoted a faster paced game with increased scoring and more fast breaks[1]. As described by Dupree (2006), the league decided to decrease their tolerance for hand checks after the 2003-2004 season, giving offensive players more power to score and control the tempo of the game, which led to more fast breaks and more overall scoring. As shown in Figure 1, per game attendance increased dramatically following the rule changes between the 2003-2004 season and the 2004-2005 season. This change in the NBA's product from a physical sport reliant on brute strength and stifling defenses to a sport reliant on speed, finesse, and offensive prowess, immediately changed the competitive landscape of the NBA, leading teams to sign players fit for this new style of play. The results of these changes in many dimensions currently remain unexamined. This paper seeks to answer the question: does this increased emphasis on offense lead to higher attendance as predicted by the league?

In many ways, the NBA has been the most aggressive sports league when it comes to experimenting with its product. In 1947, zone defense was outlawed with the stated intent of opening up the game and increasing offensive strength. In 1954, maybe the most important rule change in the history of the NBA, the shot clock, was adopted. The most recent drastic change

[1] A fast break is a game situation in which the offensive team has more players on the offensive side of the court, often after a defensive rebound.

occurred in 1979, when NBA adopted the 3-point line from the ABA's set of rules. Each of these changes was meant to increase the excitement of an NBA game, and with the exception of the ban on zone defenses (which was abolished on 2001), they produced the intended effect.

Every major professional sports league in the United States uses rule changes in an attempt to increase the quality of their product. The NFL engaged in a period of rapid rule changes between 1974 and 1980, addressing the prevalence of injuries and increasing offensive power. By decreasing tolerance for defensive contact with wide receivers, moving back the kickoff position five yards, and restricting certain kinds of contact, offenses were given greater opportunity to break free from the defense without increasing their probability of injury. The MLB, a league that largely refrains from tampering with its product, undertook one of the most radical rule changes by introducing the Designated Hitter (DH) position to the American League in an effort to increase scoring by precluding the pitcher (often the weakest hitter in the line up) from an obligation to participate in the offense. The NHL, following a particularly complicated lock out that threatened the health of the league once it reached a collective bargaining agreement, instituted sweeping changes "to reduce the scope of defensive 'tools' a team may effectively employ, and to create a corresponding benefit to the offensive part of the game -- thus allowing skill players to use their skills and increasing the number and quality of scoring chances in the game" (NHL). Included within these changes were smaller pads for the goalie to create more room in the goal to score, redefining the boundaries of the rink and the position of the goal to open up the ice for the offense, and numerous other rules meant to increase the flow of the game. Not all of these rule changes elicited the intended response, but the potential gains of perfecting your league often outweigh the prospective alienation of current fans.

While this paper is rooted in the team sports league literature, institutional changes aimed at producing certain behaviors are present in a myriad of systems, sporting or otherwise. The United States criminal justice system's success is predicated on well-formulated penalties for those caught committing crimes to illicit the proper behavioral response. When the government does not see a tolerable level of crime, their tools for changing the incentives of committing a crime are increased enforcement (an increase in the probability of catching a criminal) and increased penalty (an increase in the cost to a caught criminal). The NBA has similar methods of affecting outcomes by increasing enforcement, which is the case here, or increasing a penalty. These mechanisms of affecting outcomes with altered incentives are important mechanisms to understand.

The paper is organized as follows. Section two explores the basic model for sporting attendance and existing literature related to the effect of "quality" of the game on the consumption of sports. Section three outlines the theoretical framework employed in this particular paper. Section four describes the data used in the empirical work. Section five presents the regression results and analysis. Section six provides a conclusion and a direction for further research.

Review of Existing Literature

This study, in its most generalized form, investigates what consumers value when purchasing tickets to a professional basketball game. Surprisingly, the sports economics literature largely ignores such "game quality" considerations. The basic theoretical framework models attendance as a linear function of metropolitan area incomes, population surrounding the team, ticket prices relative to the prices of recreation substitutes, stadium attributes, the team rank, and the "goodness of substitutes" (Rottenberg 1956). Neale (1964) refined Rottenberg's rudimentary model by arguing the existence of the Louis-Schmelling Paradox (named after the boxers Joe Louis and Max Schmelling). The Louis-Schmelling Paradox states that sporting competition drives attendance more than sporting monopoly, a phenomena exhibited by the New York Yankees in the 1950's, who saw declining attendance despite winning six World Series in seven years. Seeing this paradox's effect, Neale argued that parity was always more important than dominating the competition every year.

Whitney (1986) presents an alternative theory, arguing that winning percentages and parity are secondary to a team's championship prospects. If a team's attendance were predominately a function of winning percentages, then there would exist no trade offs between playoffs and simply extending the regular season. Whitney examined season attendance at major league baseball games, observing that pennant race probabilities played a statistically significant role in determining attendance. The attendance theories regarding rank and winning percentages outline the Uncertainty of Outcome Hypothesis (UOH), a prominent proposition in sports economics. The UOH states that consumers want their home team to win, but they receive the greatest utility when their team wins a close contest in which the outcome is uncertain (Fizel 2006). The underlying theory that drives this hypothesis is that a league maximizes revenue by having a perfectly balanced league, as described by Fort and Quirk (1995). Szymanski (2004) finds that the equilibrium of competitive balance is dependent on market capacity rather than perfect competitive balance, which proves to be more congruent with the current market conditions present in the NBA. Despite its best efforts, the NBA is the least competitively balanced league of the four major North American professional sports according to Berri et al. (2004).

Instead of drawing fans based on uncertainty of outcome, multiple studies show a positive significant effect of visiting superstars. First investigated by Hausman and Leonard (1997) using television ratings on a per game basis as the dependent variable, Berri and Schmidt (2005) studied the superstar eternality's impact on attendance during Michael Jordan's prime, finding that superstars playing for the road team increased home team attendance.

The most similar investigation of game quality are the studies of similar institutional changes made by the NHL regarding violence and scoring. During the past decade, the NHL and the NBA in particular have been "perfecting" their product through rule changes that attempt to increase attendance. The NHL, for example, instituted policies to curb violence and increase scoring, because the NHL believed that consumers responded negatively to violence and positively to scoring. Paul (2003) found that the opposite was true: violence had a positive and significant effect on attendance while scoring had a negative and significant effect on attendance. While violence is a strong selling point for hockey, the NBA rules do not provide the same kind of leniency for fighting. The NBA decided instead to focus on increasing offensive production in an attempt to improve NBA contests' entertainment quality.

There is a noticeable lack of econometric studies on NBA rule changes despite the numerous significant changes to the NBA rule book. Investigating these changes and their subsequent consumer response helps assess the effectiveness of the rule revision itself, but institutional incentive changes as well. This study seeks to fill the gap in sports economics literature by asking the question: Does NBA attendance respond to fast break points, offensive quality, and prolific scoring? Assuming the NBA changes its product with the goal of increasing league profits through increasing attendance, an increased emphasis on offense should, *ceteris paribus*, increase attendance.

Theoretical Framework

We begin with the basic model for attendance synthesized from the consensus present in the literature[2]:

$$A_{gha} = f(E(Q_{gha}), L_h, P_h)$$

where *g* denotes the game, *h* represents the home team, *a* represents the away team. A_{gha} is the attendance at game *g* of home team *h against away team a*, Q_{gha} is a vector of the qualities of the home and away teams, L_h is a vector of the location attributes of home team *h*, and P_h denotes the price charged by the home team *h*. Because the quality of game *g* is unknown, it is the expected quality of game *g* based on previous performance captured by Q_{gha}. $E(Q_{gha})$ **can be more precisely specified by the following equation:**

$$E(Q_{gha}) = f(T_{gh}, T_{ga}, T_{h_{t-1}}, T_{a_{t-1}})$$

where T_{gh} and T_{ga} are current season team attributes for home team *h* and away team *a* respectively playing in game *g*, $T_{h_{t-1}}$ and $T_{a_{t-1}}$ are vectors of the team attributes indicated by past season performances for the home team *h* and away team *a respectively*. The vectors T_{gh} and T_{ga} represent many qualities of a basketball game, including offensive qualities such as fast break points, total points per game, as well as their current success in winning games. $T_{h_{t-1}}$ and $T_{a_{t-1}}$ represent different qualities of teams that are determined by previous seasons performance such as their previous season win totals and points scored.

Ticket prices are set before the season starts. We assume that teams set ticket prices in order to maximize profits based on a monopolistic model where marginal revenue is equal to

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[2] This formula is never explicitly stated in previous papers, but is consistent with the principles behind other equations generalizing attendance demand (see Paul (2003) and Berri & Schmidt (2005)).

marginal cost. Because the relative cost of adding one extra fan is negligible up to stadium capacity, we also assume that all teams face marginal costs of zero. We must also assume for the purpose of this study that a single, profit maximizing price is charged by each team at the beginning of the season based on a monopolistic demand function derived from the expected mean quality of the games for the coming season of the home team.

$$P_h = f(E(Q_{h\bar{a}}), L_h)$$

where P_h is the price charged by the home team, $E(Q_{h\bar{a}})$ is the expected quality of the home team as it relates to the mean expected quality of the away teams the home team will face throughout the season, and L_h is a vector of the location attributes of the home team *h*. These expectations are derived from previous season performance. As shown in Figure 2, the price setting condition is where expected quality of the season's games against the mean value of opponent attributes and location attributes determine the demand curve. Once the season starts, because prices have been set, a decrease in quality causes a greater than usual drop in demand, as depicted in Figure 3.

Because marginal cost is assumed to be zero[3], the profit maximizing condition is synonymous with the revenue maximizing condition:

$$\max_{p} E(R_h) = P_h \times \sum_{g} A_{gh} \text{ s.t. } S_h$$

where $E(R_h)$ is the home team's expected total season gate revenue, P_h is the price charged for admission by home team *h*, and A_{gh} is the attendance at home game *g* for home team *h,* subject to stadium capacity S_h for home team *h*.

Existing sports economics literature states that econometric analysis of attendance often

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[3] This assumption does not change the outcomes even if the true marginal cost is greater than 0.

yields the disturbing result of an upward sloping demand curve, which is blamed on an omitted variable, as detailed in Fizel (2006). This conclusion fails to take into account what is modeled when performing econometrics analysis of game-to-game attendance variation. Instead of modeling demand and movements along the demand curve, econometric analysis of game-to-game attendance variation actually models the price-quality schedule, where the *shifts* in the demand curve identify the price-quality schedule. See Figure 4 for a graphical representation.

Including home team fixed effects has many implications regarding the estimation equation formulation. All the predetermined variables are captured with the home team fixed effects, which includes previous season success (or failure) of the home team, locational qualities, and ticket prices. Since we are not controlling for the away team, the fixed qualities of the away team are included in the final estimation equation. In addition, it should be noted that because of this approach, we are modeling the shifts in the demand function as a result of quality variations over the course of the season. From this we find the only remaining terms in the equation are:

$$A_{gha} = f(E(T_{gh}, T_{ga}, T_{a_{t-1}}), H_h)$$

where the first two variables remain the same, but we now only include T_{at-1}, as the fixed effects are controlling for the home team previous season performance, and add the home team fixed effects terms represented by H_h. Price and locational aspects, because they are fixed throughout the season, are also dropped from the final estimation equation.

Fast break points are only one of many metrics that can evaluate offensive game quality. Turnovers, often an indicator of sloppy play, are an alternate measure of offensive quality that should affect attendance. In addition to these traditional statistics tracked by the NBA, a new statistic called Offensive Efficiency[4] is yet another metric of offensive quality. We will employ these variables in alternate specifications to test the predictive power of these different game elements. This yields the following linear estimation equations:

$$\text{Attendance}_t = \beta_0 + \beta_1\,\text{WEEKEND} + \beta_2\,\text{LASTWINAWAY} + \beta_3\,\text{LASTPOINTAWAY} + \beta_4\,\text{PHOME}_{t-1} + \beta_5\,\text{PAWAY}_{t-1} + \beta_6\,\text{FBHOME}_{t-1} + \beta_7\,\text{FBAWAY}_{t-1} + \beta_8\,\text{WINHOME}_{t-1} + \beta_9\,\text{WINAWAY}_{t-1} + \beta_{10}\,\text{KG} + \beta_{11}\,\text{LEBRON} + \beta_{12}\,\text{KOBE} + \beta_{(13\text{-}36)}\text{HOMETEAM} + \varepsilon_t$$

$$\text{Attendance}_t = \beta_0 + \beta_1\,\text{WEEKEND} + \beta_2\,\text{LASTWINAWAY} + \beta_3\,\text{LASTPOINTAWAY} + \beta_4\,\text{PHOME}_{t-1} + \beta_5\,\text{PAWAY}_{t-1} + \beta_6\,\text{TOHOME}_{t-1} + \beta_7\,\text{TOAWAY}_{t-1} + \beta_8\,\text{WINHOME}_{t-1} + \beta_9\,\text{WINAWAY}_{t-1} + \beta_{10}\,\text{KG} + \beta_{11}\,\text{LEBRON} + \beta_{12}\,\text{KOBE} + \beta_{(13\text{-}36)}\text{HOMETEAM} + \varepsilon_t$$

$$\text{Attendance}_t = \beta_0 + \beta_1\,\text{WEEKEND} + \beta_2\,\text{LASTWINAWAY} + \beta_3\,\text{LASTPOINTAWAY} + \beta_4\,\text{OEFFHOME}_{t-1} + \beta_5\,\text{OEFFAWAY}_{t-1} + \beta_6\,\text{WINHOME}_{t-1} + \beta_7\,\text{WINAWAY}_{t-1} + \beta_8\,\text{KG} + \beta_9\,\text{LEBRON} + \beta_{10}\,\text{KOBE} + \beta_{(11\text{-}34)}\text{HOMETEAM} + \varepsilon_t$$

Refer to Table 1 for explanations of each of the variables included in the estimation equations.

Many of these variables come in pairs, one for the home team and one for the away team, which is necessary to show the relationship the competition has on the attendance of each game. As discussed earlier, previous season variables are only used for the away team due to the inclusion of home team fixed effects.

The first variable, WEEKEND, controls for varying demand on different days of the week. Games played on the weekend should have greater attendance, as the opportunity cost of attending games on the weekend is less for those who work during the typical work week. The coefficient for weekend games should be positive and significant.

While employing home team fixed effects controls for previous season performance characteristics of the home team, it is still necessary to control for the away team's previous season success. The away team's number of wins and average points scored in the last season

[4] Offensive Efficiency=100*(Points Scored)/(Possessions)

both should have positive and significant coefficients according to the theory of game quality as defined in this study. The previous season variables are relevant as many tickets are sold before the season begins, and previous season performance for both teams is the information that many fans base their individual game purchasing decisions on.

The next four variables are the average total points scored by each team as well as the average number of those points that were scored on a fast break. If a team averages abundant scoring, has an efficient offense, or scores many fast break points, the team is more interesting according to the theory promoted by this paper. *A priori*, each of these variables' coefficients should have a positive and significant sign. The final two performance variables control for the winning percentage of each team. A higher winning percentage for either team should positively affect the desire of a fan to see the more successful teams.

Also included in the estimation equation are variables for the presence of Star players on the away team. This effect is captured by including a dummy variable for each of the three most popular players in the league during the 2007-2008 season, as measured by jersey sales rank. Kevin Garnett was number one in jersey sales, followed by Kobe Bryant, and LeBron James in third. Theory and previous research suggest these variables will have a positive coefficient, as the more "star power" playing in the game, the better the quality of the game, with the magnitude of the coefficient estimates descending with the sales ranking.

The second and third estimation equations employ alternate measures of offensive quality in order to ascertain whether these less common measures are also factors in the consumer's choice to attend an NBA game. The second estimation equation uses turnovers per game of the home and away team instead of fast break points. This variable is expected to have a negative and significant sign as turnovers are an indicator of poor offensive performance. The third estimation equation includes John Hollinger's Offensive Efficiency statistic. This estimation equation also drops the points per game variables, as Offensive efficiency is calculated through points and possessions, causing severe multicollinearity to arise.

Summary Statistics

Data for the 2007-2008 NBA season contain observations for each of the 1,230 games played during the regular season by the 30 teams in the NBA, all of which were entered manually using box scores provided by the National Basketball Association on NBA.com. The 2006-2007 season results used for previous season performance variables and the sales figures for player jersey sales were compiled from information provided by the National Basketball Association, also available on NBA.com. I entered the data myself.

Teams that sold out every game of the season, the Detroit Pistons, the Boston Celtics, the Los Angeles Lakers, the San Antonio Spurs, the Phoenix Suns, and the Utah Jazz, lack variation in the dependent variable. These teams' home games are excluded from the data set. See Table 2 for a comparison of the means and standard deviations of the sample teams and the omitted teams. It is important to note that the excluded teams are largely some of the best performing teams in the league, as exhibited by their significant difference from the means of the sample. The first five home games for each team were dropped in order to let the variables reach a central tendency, instead of reflecting the potentially erratic values present by having outlier performances have strong effects in the early stages of the running total.

The final data set, after dropping the six previously mentioned teams and early games, totaled 864 observations. The data were inspected for irregularities and accuracy during the data entry process, and again after compiling the entire set using histograms and summary statistics. See Table 1 for a description of the data and the basic characteristics of each variable. The attendance figures range from 8,393 to 22,778, which is within expected limits given the capacity of the NBA stadiums. The attendance values are also generally normally distributed. All of the continuous game variables are generally normally distributed. The variables for points average are both within expected ranges, as the use of cumulative averages causes the first few observations to exhibit greater variation from typical values that usually range from 85.36 to 111.10. Not every team excels at scoring fast break points, which is why the relatively large range for fast break points for home and away teams of 5.44 to 22.84 is reasonable. Average turnovers range from 10.88 to 18.40 with a mean of approximately 14. Offensive efficiency has a range of 93 to 116 with a mean of 107. The two win variables have similar ranges, although the away win variable has a higher upper and lower value. All regressions and robustness checks were performed using Stata 10.1.

Results and Analysis

The regression results are reported in Table 3. In all three regressions, the team based fixed effects were statistically significant with F-statistics well above the critical value. Weekend games were also shown to be significant with a positive coefficient as predicted. Weekend games are estimated to have 1,200 more fans in attendance than games played during the week. The variable for the away team's previous season wins had a positive and significant coefficient as expected in all specifications, but the away team's previous season scoring average had an insignificant coefficient in all specifications. These results could be attributed to the severe multicollinearity present between wins and scoring.

The variables for the star players for the away team all had positive coefficients and were significant at the 99% level, as predicted by the theory. Of the three stars, Kevin Garnet (along with his all-star colleagues Paul Pierce and Ray Allen) had the greatest impact on attendance, drawing approximately 2,900 more fans per game. Kobe Bryant attracted approximately 1700 more fans per game. LeBron James had the smallest effect of the three stars examined in this study, drawing approximately 800 more fans per contest.

Current season wins for the home and away team produced mixed results. The away team current season wins were insignificant with a negative sign. This could be attributed to the multicollinearity present between previous season performance and current season performance. The home team's winning percentage was significant and positive in regression 1 and 2, with a positive coefficient.

The variables for offensive performance were mostly significant with signs congruent with the theory. The home team's points per game were significant in regression 1 and 2 at the 99% level, while the away team's points per game were only significant in the regression at the 95% level. The effect of home team total scoring is much stronger than that of the away team, with approximately 200 more fans for every point averaged by the home team and an elastic relationship with attendance. As the home team points average has a mean of 98.96 and a standard deviation of 5.51, a home team that averages one standard deviation from the mean in points per game, *ceteris paribus*, draws almost 1,100 more fans than an home team that scores the league mean.

All of the different measures of offensive quality employed were significant for the home team, but only a few of those were significant for the away team. Fast break points were significant for both the home and away teams at the 95% level. Those teams that score one standard deviation more fast break points per game draw approximately 570 more fans per game at home, and approximately 170 more fans on the road. The significance of the home and away team fast break points suggests that the speed of the game does in fact have a statistically significant effect on attendance.

The second regression, which substituted turnovers for fast break points, yielded significant results as well. For each turnover committed by the home team, game attendance fell by over 625 fans. The away team's turnovers had a positive sign, but failed to reject the null hypothesis of being statistically different from zero. For the third regression, we used offensive efficiency instead of points to test if the overall quality of offense determines game attendance. Offensive efficiency was positive and insignificant for the away team, but positive and significant at the 99% level for the home team. A home team like Detroit that scores one standard deviation above the league mean draws an extra 1,146 fans per home game for their efficient offense. Home team offensive efficiency also has an elastic relationship with attendance, which is not surprising due to how the variable is formed and the elastic relationship between points and attendance seen in the previous two regressions.

All of the offensive quality indicators yielded significance for the home team, which suggests that the type of offense employed by the home team, *ceteris paribus*, does in fact, affect attendance.

Conclusions and Directions for Further Research

This study estimated the impact of an increased emphasis on offense and speed in the NBA on attendance. Using data from the 2007-2008 NBA season, this study found evidence of away team points scored does have an economically significant effect on attendance, while game speed as represented by fast break points does not have any significant effect on attendance.

It should be noted that this is not the end of the exploration of structural changes in the NBA. This study focused on one structural change, while over the course of NBA history the institution of rules like the 24-second shot clock and the three-point line changed the rules of basketball even more drastically than the changes explored in this paper. These changes warrant separate studies from a more historical perspective.

This study only examines a small element of the determinants of professional basketball's value and institutional renovations of professional basketball. More analysis of these topics could help inform our understanding of consumer preferences for professional basketball and the behavioral response to rule changes in general.

Appendix A: Robustness

Before the first regressions, the variables were tested for multicollinearity and stationarity. The VIF and simple correlation coefficients reveal multicollinearity, as would be expected with many of the game quality variables. Points and winning percentage for both the home and away teams performance variables exhibited the most multicollinearity, with simple correlation coefficients over .74. Previous season points for the away team also exhibited strong multicollinearity with that team's current season points average. The theoretical validity of the variables included leads us to take no corrective action for multicollinearity. See Table 4 for the pair-wise correlation matrix.

The use of panel data presents a multitude of possible robustness deficiencies, with no simple solutions in most cases. Because panel data span both time and space, it is important to test for predominately cross sectional issues such as heteroskedasticity as well as predominately time series issues such as serial correlation and stationarity. For the time series issues in particular, testing each panel's time series individually is an important step in checking the robustness of the regression results.

Non-Stationarity, primarily a time series problem, was tested for panel by panel for each variable using the Dickey-Fuller test. Attendance rejected the null hypothesis of unit roots for nearly all of the panels, leading us to take no corrective action.

After running the regressions, the residuals were tested for serial correlation and heteroskedasticity. Similar to the Dickey Fuller test, we used the Durban-Watson test repeated for each panel to test for first order serial correlation. Because the panels were not ordered in a meaningful way, we did not test for serial correlation across panels. All of the panels' d-statistics were within the inconclusive region, failing to reject the null of no first order serial correlation. We tested for heteroskedasticity using both the Breusch-Pagan and the White test, isolating a single cross sectional unit, given that the proportionality factor is unknown. Both tests failed to reject the null hypothesis of constant variance, providing evidence of homoskedasticity. The evidence provided by these robustness tests suggests that the regression results are in fact robust.

Appendix B: Alternate Specifications

Some alternate estimation techniques were attempted in addition to the standard OLS model, all of which produced nearly identical results to the main regressions. One alternate technique involved adding a lagged dependent variable to capture the network effects involved in attending a sporting event. The marginal utility of attending a sports game is expected to increase as attendance increases, as a larger crowd is preferable to a smaller crowd. See Table 5 for the results. Qualitatively, only winning percentage of the home team from regression 1 experienced any change from the original regression, with winning percentage of the home team becoming insignificant.

Due to the censored nature of the measurable demand for attendance, the use of a censored regression technique is worth exploring for robustness purposes. Before delving into the results, there are two important caveats to keep in mind when interpreting these regression results. First, because of the way tobit estimators are programmed in Stata, the dependent variable must be changed from raw attendance to a percentage, which may produce biased estimates, as discussed by Fizel (2006). In addition, employing fixed effects in a tobit model also introduces biases. See Table 6 for the tobit estimator results. Like the network effects regression, the qualitative results remain largely the same when employing a tobit estimator. Winning percentage of the home team, as with the network effects model, is statistically insignificant in regression 1 of the tobit estimator. In addition, points for the away team become significant while fast break points for the away team become insignificant. The likely reasons for these results are the aforementioned biases.

Table 1

Variable	Mean	Std. Dev.	Min	Max	Description
attendance	16914.04	3213.44	8393.00	22778.00	The number of people in attendance at game *i*.
psptsaway	98.74	3.97	93.70	110.20	The previous season's points per game total for away team *a*.
pswinsaway	40.92	10.62	22.00	67.00	The previous season's win total for away team *a*.
KG	0.04	0.19	0.00	1.00	Whether Kevin Garnett played in game *i* for the away team *a*.
lebron	0.03	0.18	0.00	1.00	Whether LeBron James played in game *i* for the away team *a*.
kobe	0.04	0.19	0.00	1.00	Whether Kobe Bryant played in game *i* for the away team *a*.
weekend	0.47	0.50	0.00	1.00	Whether game *i* was played on a Friday, Saturday, or Sunday.
winpaway	0.50	0.17	0.10	0.92	The winning percentage of away team *a* in game *i* lagged one period.
ptsaway	99.03	5.10	85.44	111.10	The average points per game of away team *a* in game *i* lagged one period.
fast_breakaway	12.19	3.29	5.44	22.36	The average fast break per game of away team *a* in game *i* lagged one period.
turnoversaway	14.09	1.31	10.88	18.40	The average turnovers per game of away team *a* in game *i* lagged one period.
oeffaway	108.50	4.24	92.46	116.50	The average offensive efficiency per game of away team *a* in game *i* lagged one period.
winphome	0.45	0.15	0.09	0.80	The winning percentage of home team *h* in game *i* lagged one period.
ptshome	97.93	4.73	85.36	111.06	The average points per game of home team *h* in game *i* lagged one period.
fast_breakhome	12.12	3.37	5.88	22.84	The average fast break per game of home team *h* in game *i* lagged one period.
turnovershome	14.24	1.26	11.10	18.08	The average turnovers per game of home team *h* in game *i* lagged one period.
oeffhome	107.24	3.88	93.24	115.62	The average offensive efficiency per game of home team *h* in game *i* lagged one period.
			Observations:		864

Table 2

Variable	Sample Mean	Omitted Mean	Sample Std. Dev.	Omitted Std. Dev.
winphome	0.45	0.71	0.15	0.08
ptshome	97.93	103.17	4.73	4.75
fast_breakhome	12.12	12.53	3.37	2.97
turnovershome	14.24	13.49	1.26	1.54
oeffhome	107.24	113.44	3.88	1.63

Table 3

Variables	Regression 1 Coef.	Regression 1 t-stat	Regression 1 Elasticity	Regression 2 Coef.	Regression 2 t-stat	Regression 2 Elasticity	Regression 3 Coef.	Regression 3 t-stat	Regression 3 Elasticity
winpaway	-374.85	-0.63	-0.011	-599.67	-1.10	-0.018	-451.47	-0.67	-0.013
ptsaway	**41.00**	2.16	0.240	28.12	1.35	0.165	-	-	-
turnoversay	34.75	0.63	0.029	-	-	-	-	-	-
fast_breakaway	-	-	-	**50.40**	2.37	0.036	-	-	-
oeffaway	-	-	-	-	-	-	32.01	1.28	0.205
psptsaway	-7.60	-0.37	-0.044	-18.06	-0.87	-0.105	19.64	1.24	0.115
pswinsaway	**44.05**	5.94	0.107	**45.96**	6.21	0.111	**38.70**	5.54	0.094
winphome	**2267.00**	1.89	0.060	**2932.13**	2.43	0.078	2001.02	1.63	0.053
ptshome	**187.25**	4.65	1.084	**213.86**	4.55	1.238	-	-	-
turnovershome	**-625.34**	-6.21	-0.527	-	-	-	-	-	-
fast_breakhome	-	-	-	**168.49**	2.15	0.121	-	-	-
oeffhome	-	-	-	-	-	-	**287.98**	7.93	1.826
KG	**2888.18**	7.54	0.006	**3152.99**	8.14	0.007	**2880.31**	7.66	0.006
lebron	**814.84**	2.75	0.002	**826.86**	2.75	0.002	**903.71**	3.00	0.002
kobe	**1613.13**	5.39	0.003	**1829.70**	6.01	0.004	**1703.72**	5.74	0.004
weekend	**1204.22**	11.57	0.033	**1167.34**	11.03	0.032	**1206.27**	11.43	0.034
Constant	291.18	0.06	-	**-11345.05**	-2.62	-	**-22402.11**	-5.50	-
Fixed Effects	F(23, 828)	84.02		F(23, 830)	96.49		F(23, 828)	103.09	
F-test		88.03			84.37			90.02	
R^2		0.788			0.781			0.78	
Adj R^2		0.779			0.773			0.77	

Observations: 864

Table 4

	psptsaway	KG	lebron	kobe	pswinsaway	winpaway	ptsaway	fast_breakaway	turnoversaway	oeffaway	winphome	ptshome	fast_breakhome	turnovershome	oeffhome
psptsaway	1.0000														
KG	-0.1374	1.0000													
lebron	-0.0906	-0.0345	1.0000												
kobe	0.2130	-0.0345	-0.0345	1.0000											
pswinsaway	0.3207	-0.2961	0.1568	0.0174	1.0000										
winpaway	0.1612	0.3398	0.0246	0.1456	0.4211	1.0000									
ptsaway	***0.6408***	0.0658	-0.0682	0.2714	0.2213	0.5329	1.0000								
fast_breakaway	0.4828	-0.1188	-0.0179	0.0911	0.0837	0.1563	***0.5635***	1.0000							
turnoversaway	0.0311	0.0513	-0.0227	0.0868	-0.4725	-0.4424	-0.0517	0.1682	1.0000						
oeffaway	0.3365	0.1956	-0.0585	0.1814	0.3605	***0.7859***	***0.7470***	0.2291	-0.5214	1.0000					
winphome	-0.0032	-0.0150	-0.0196	0.0061	-0.0415	-0.1301	-0.0478	-0.0127	0.0378	-0.0724	1.0000				
ptshome	0.0099	-0.0176	-0.0115	-0.0028	0.0213	-0.0126	-0.0197	0.0002	-0.0366	-0.0059	0.4995	1.0000			
fast_breakhome	0.0080	-0.0153	-0.0244	-0.0012	0.0110	0.0250	-0.0044	-0.0304	-0.0098	0.0093	0.1305	0.5480	1.0000		
turnovershome	-0.0071	-0.0203	0.0112	-0.0116	0.0198	0.0200	-0.0208	-0.0006	0.1360	-0.0755	-0.4139	-0.0519	0.1466	1.0000	
oeffhome	0.0029	-0.0117	-0.0096	0.0052	0.0045	-0.0419	-0.0141	0.0032	-0.0871	0.0119	***0.7571***	***0.7528***	0.2452	-0.5362	1.0000

Table 5

Variables	Regression 1 Coef.	Regression 1 t-stat	Regression 1 Elasticity	Regression 2 Coef.	Regression 2 t-stat	Regression 2 Elasticity	Regression 3 Coef.	Regression 3 t-stat	Regression 3 Elasticity
winpaway	-347.48	-0.60	-0.010	-520.30	-0.99	-0.015	-384.34	-0.59	-0.011
ptsaway	**37.61**	2.02	0.220	23.95	1.18	0.140	-	-	-
turnoversay	28.58	0.53	0.024	-	-	-	-	-	-
fast_breakaway	-	-	-	**46.84**	2.26	0.034	-	-	-
oeffaway	-	-	-	-	-	-	28.14	1.15	0.181
psptsaway	-2.69	-0.13	-0.016	-10.88	-0.54	-0.064	22.52	1.46	0.131
pswinsaway	**42.85**	5.91	0.104	**44.55**	6.19	0.108	**37.98**	5.59	0.092
winphome	1957.68	1.67	0.052	**2433.59**	2.07	0.065	1687.18	1.41	0.045
ptshome	**155.41**	3.91	0.900	**167.78**	3.64	0.971	-	-	-
turnovershome	**-509.93**	-5.09	-0.429	-	-	-	-	-	-
fast_breakhome	-	-	-	**146.69**	1.92	0.105	-	-	-
oeffhome	-	-	-	-	-	-	**233.35**	6.43	1.479
KG	**2896.86**	7.73	0.006	**3130.10**	8.31	0.007	**2879.77**	7.87	0.006
lebron	**825.16**	2.85	0.002	**829.65**	2.84	0.002	**901.30**	3.07	0.002
kobe	**1575.33**	5.38	0.003	**1761.48**	5.95	0.004	**1651.51**	5.72	0.004
weekend	**1288.18**	12.54	0.036	**1269.24**	12.22	0.035	**1299.32**	12.54	0.036
$attendance_{t-1}$	**0.18**	6.16	0.181	**0.21**	7.03	0.205	**0.20**	6.82	0.200
Constant	-1222.31	-0.26	-	**-10090.72**	-2.40	-	**-19687.68**	-4.94	-
Fixed Effects	F(23, 827)	20.89		F(23, 830)	21.08		F(23, 828)	21.53	
F-test		90.46			88.20			93.52	
R^2		0.79			0.79			0.79	
Adj R^2		0.79			0.78			0.78	

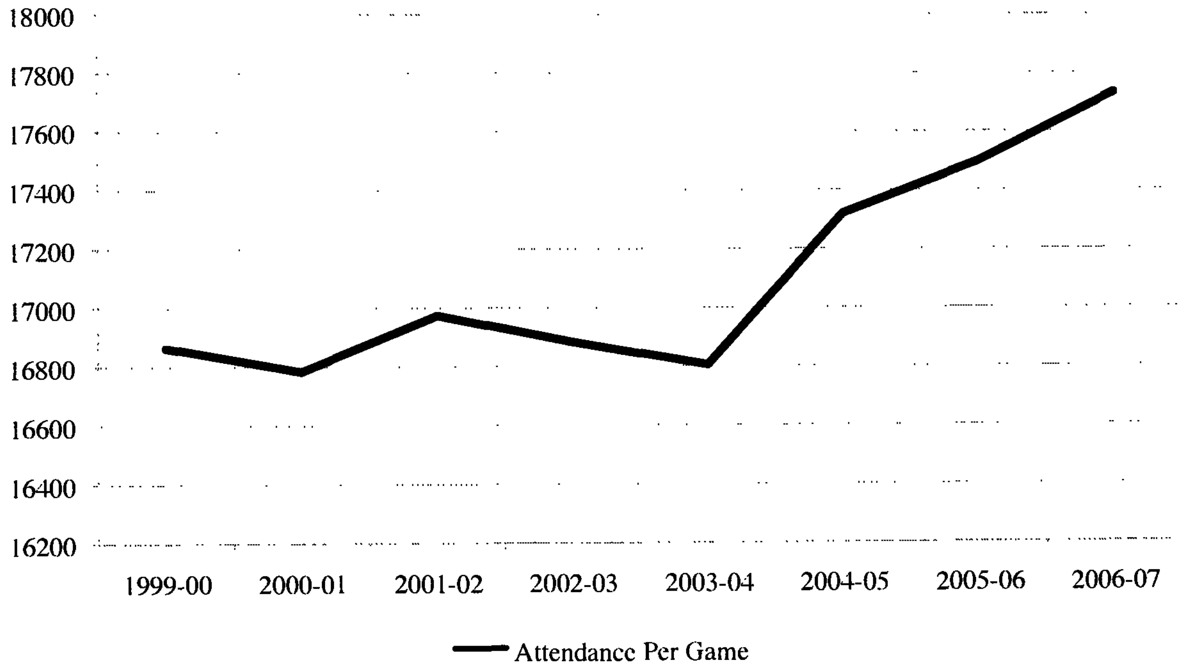
Observations: 864

Table 6

Variables	Tobit 1 Coef.	Tobit 1 t-stat	Tobit 2 Coef.	Tobit 2 t-stat	Tobit 3 Coef.	Tobit 3 t-stat
winpaway	-2.55	-0.79	-3.78	-1.28	-2.55	-0.70
ptsaway	**0.26**	2.51	**0.23**	2.06	-	-
turnoversay	0.10	0.34	-	-	-	-
fast_breakaway	-	-	0.18	1.54	-	-
oeffaway	-	-	-	-	0.20	1.46
psptsaway	-0.06	-0.54	-0.10	-0.93	0.11	1.28
pswinsaway	**0.24**	5.98	**0.25**	6.28	**0.21**	5.57
winphome	10.63	1.66	**13.12**	2.03	7.78	1.19
ptshome	**0.89**	4.05	**0.96**	3.88	-	-
turnovershome	**-3.18**	-5.84	-	-	-	-
fast_breakhome	-	-	**1.02**	2.42	-	-
oeffhome	-	-	-	-	**1.50**	7.55
KG	**20.67**	8.98	**21.82**	9.41	**20.31**	8.97
lebron	**4.27**	2.58	**4.34**	2.59	**4.67**	2.78
kobe	**10.20**	6.01	**10.88**	6.30	**10.61**	6.30
weekend	**7.14**	12.54	**6.93**	12.00	**7.16**	12.43
Constant	4.63	0.18	**-62.68**	-2.81	**-126.02**	-5.72
Psuedo R^2		0.225		0.221		0.222
Uncensored		767		767		767
Censored		313		313		313

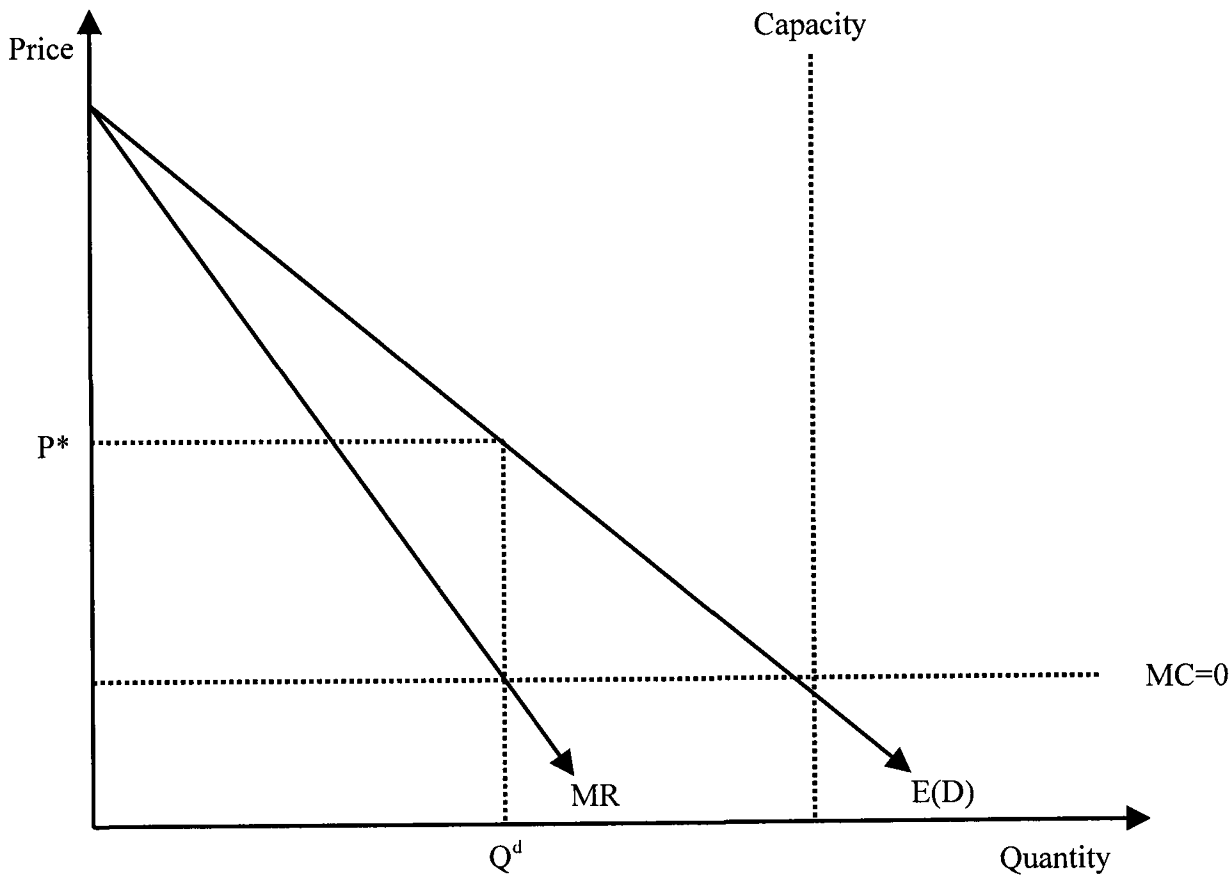
Notes: Attendance is measured as a percent of capacity multiplied by 100. Team based fixed effects included, but not reported due to space.

Figure 1



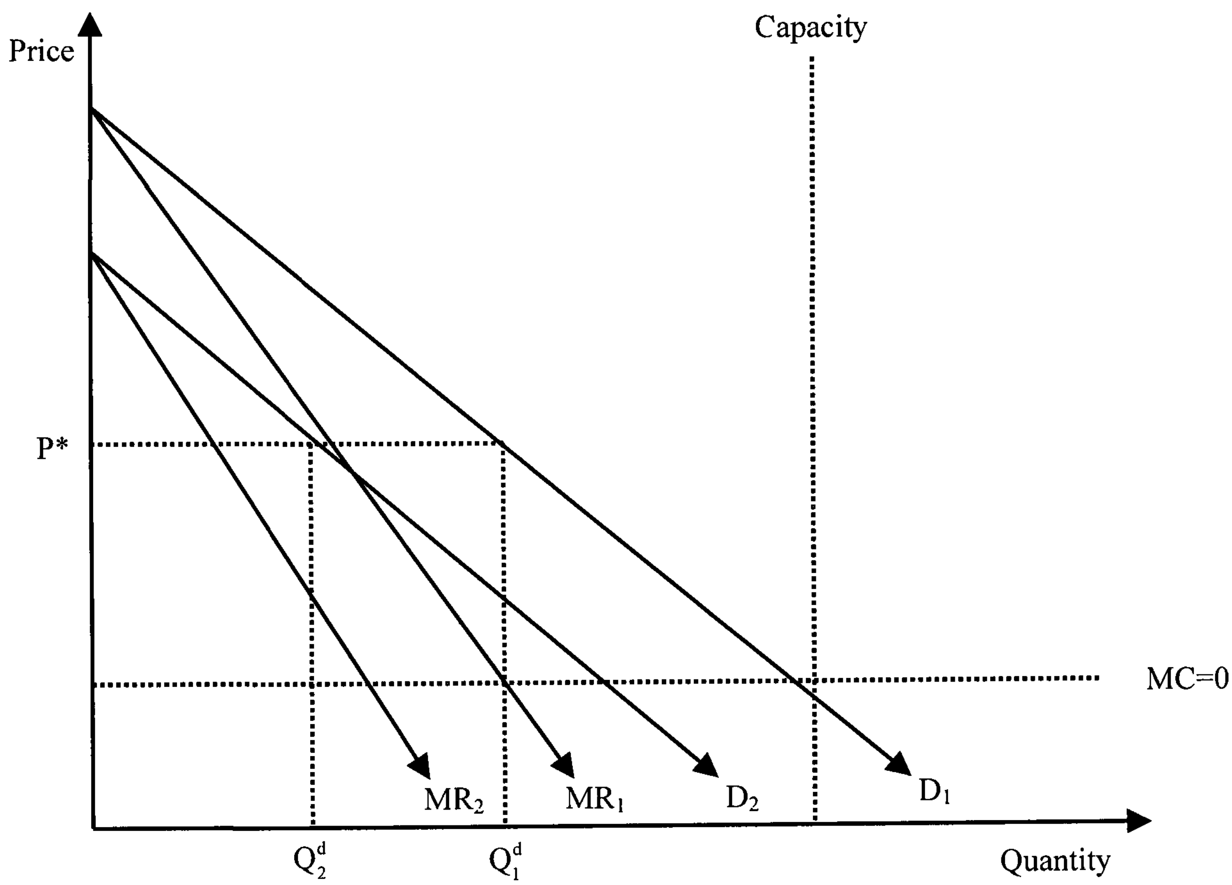
18000
17800
17600
17400
17200
17000
16800
16600
16400
16200
1999-00
2000-01
2001-02
2002-03
2003-04
2004-05
2005-06
2006-07
Attendance Per Game

Figure 2



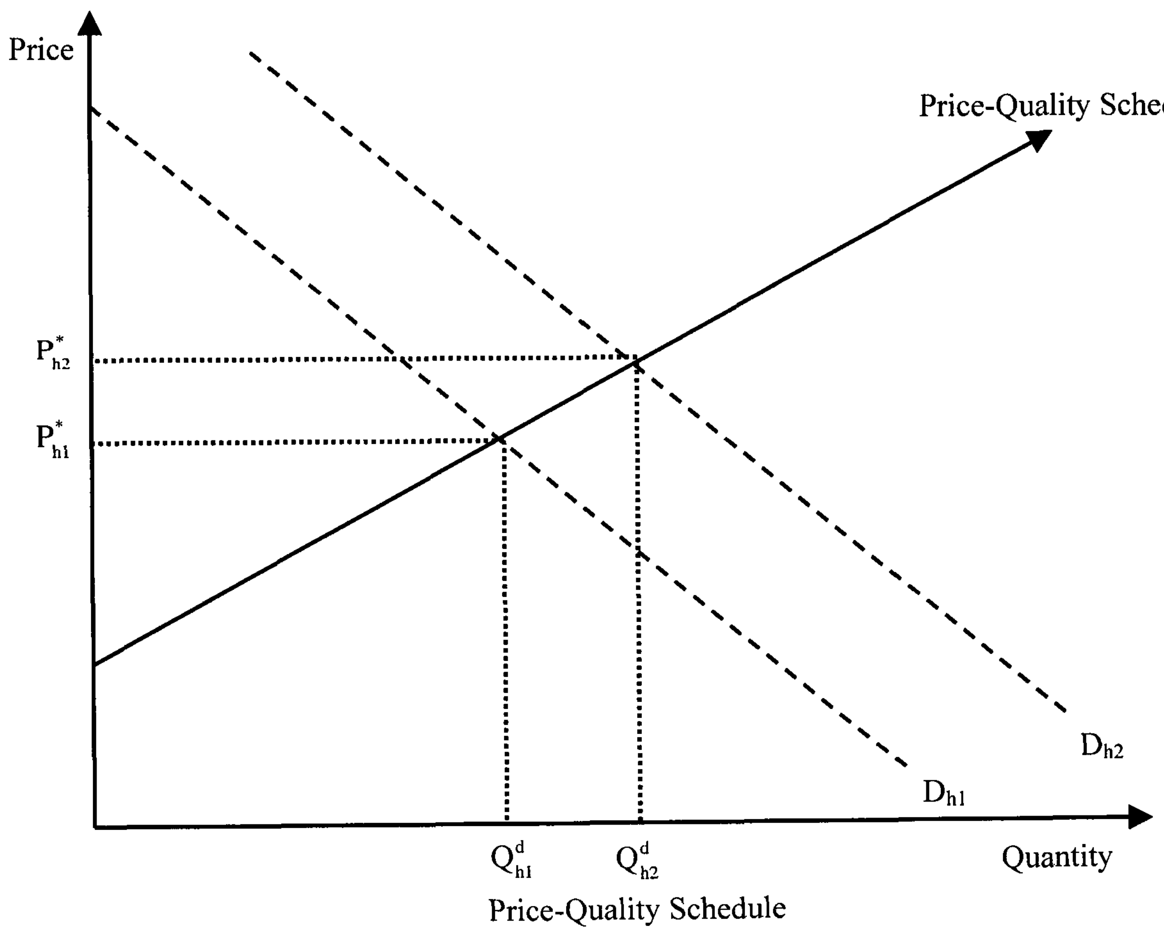
Price Setting Condition

Figure 3



Quality Shift During Season

Figure 4


Price
Price-Quality Schedule
P^*_{h2}
P^*_{h1}
D_{h2}
D_{h1}
Q^d_{h1}
Q^d_{h2}
Quantity
Price-Quality Schedule

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