Applied Economics, 2004, **36**, 2117–2124

Location and attendance in major league baseball

JASON A. WINFREE*, JILL J. MCCLUSKEY‡, RON C. MITTELHAMMER‡ and RODNEY FORT‡

Program in Sports Management, University of Michigan, 401 Washtenaw Ave, Ann Arbor, MI 48109–2214, USA and *‡School of Economic Sciences, Washington State University, Pullman, Washington, USA*

This study uses a travel-cost model to analyse the attendance impacts on Major League Baseball (MLB) of the closest substitute MLB team. It is found that the closer two teams are, the lower attendance is at each team relative to two teams that are farther apart. In addition, when a new team moves into the area of an existing team, there is an additional initial reduction in attendance for the incumbent team. This has implications for actions aimed at changing the number of teams in MLB either by contraction or by possible antitrust approaches that would increase the number of teams, especially in megalopolis markets. Further, and consistent with past demand studies, pricing is in the inelastic portion of gate demand and fan loyalty is a significant contributor to the estimation of gate attendance.

I. INTRODUCTION

It is said that there are three important considerations in business: location, location, and location. In sports economics, distance between teams is a very important consideration for professional sports leagues (and, although not covered in this paper, college sports conferences). In 1968, when the Kansas City Athletics moved to Oakland, the attendance of the San Francisco Giants dropped over 32%. The Colorado Rockies have no other Major League Baseball teams within a 600-mile radius and enjoy large crowds for every home game. A systematic assessment of this type of attendance impact is the aim of this paper.

Currently, Major League Baseball (MLB) argues that many owners face uncertain financial futures due to competitive imbalance problems. One of the recommendations made by Levin *et al.* (2000) is that MLB should allow owners to move their teams, especially to larger revenue markets, to reduce the imbalance. Incumbent owners have made it clear that new teams in their market area are substitutes that will reduce attendance at the incumbent team. Indeed, this sensitivity to attendance impacts helps explain the limited number of teams in so-called 'megalopolis' markets.

However, measuring attendance impacts also is important from a policy perspective. Another approach to their alleged revenue difficulties has MLB owners and their Commissioner seriously considering a contraction of the league by up to two teams. The policy question concerns fan welfare after contractions. If increases in attendance for teams proximate to those that are eliminated do not impact league-wide competitive balance in any meaningful way, then contraction will make a few owners better off with primarily negative impacts on fan welfare (for those fans losing their teams).

Another example of policy relevance concerns a suggestion originating with Roger Noll and Ira Horowitz in Congressional Hearings (cited in Fort, 2001, and extended by Quirk and Fort, 1999). The original Noll-Horowitz idea is that antitrust laws can be used to create competing

* Corresponding author. E-mail: jwinfree@umich.edu

Applied Economics ISSN 0003–6846 print/ISSN 1466–4283 online © 2004 Taylor & Francis Ltd
http://www.tandf.co.uk/journals
DOI: 10.1080/0003684042000287664

leagues in the hope that entry in megalopolis markets would reduce revenue dispersion and competitive imbalance. The work here suggests that only careful, case-by-case investigation will reveal whether attendance impacts are large enough to reduce revenue imbalance significantly in a given league.

Demand and support for baseball teams are not only important to baseball owners and fans, but to state and local governments. This study also has implications for taxpayers, who have paid large sums for stadiums and team subsidies. The public has paid about 64% of professional sports facilities, which accounts for almost $6 billion from 1999 to 2003 (Fort, 2002). Local politicians count on high demand for these professional sports. This study finds that a given MLB team's attendance is affected by its substitute's location and stadium. An implication of this finding is that investing in a new stadium might not be a net gain for the community if it detracts from another team in the same metropolitan area. For example, it is estimated that the public will pay $390 million for a new stadium for the New York Mets that should be completed in 2004. However, if the Mets do not build a new stadium, many fans may choose to attend Yankee games instead. It is important to consider the effect of these stadium-funding decisions on both the team in question and its closest substitute.

The principal importance of the attendance demand analysis in this paper is its examination of how team attendance is affected by neighbouring teams or the appearance of a new team close by. Theoretically, the closer the team, the more fans will be lost to the substitute. In addition, since one is estimating the demand for attendance at the gate, there will be findings relevant to past demand observations, mainly concerning the elasticity of gate pricing and fan loyalty. At the level of annual observations on teams used in this paper, one cannot contribute to the analysis of the uncertainty of outcome hypothesis.

The paper is organized as follows. First, previous studies of location and baseball demand are briefly reviewed. Second, the travel-cost model is presented. Third, the empirical specification is developed and the data are described. Fourth, the empirical results are presented and discussed. Conclusions, with applications of the findings to the policy issues of contraction and competition policy, complete the study.

II. PREVIOUS STUDIES

A principal tenet of Hotelling's (1929) location model is that, all else constant, people will choose to purchase goods or services from the closest seller. A travel-cost model (McConnell, 1985) is used to apply Hotelling's idea to MLB attendance. The main cost for many baseball fans is travel cost. Consequently, if there are two teams that provide essentially the same utility for certain fans, all else constant, they will attend the game that is closest. This implies that attendance lost to a substitute team should be a function of the distance to that substitute. To the authors' knowledge, the current study is the first to use a travel-cost model to explain attendance for professional sporting events, and no studies examine directly how baseball attendance is related to substitute possibilities.

Previous demand studies have generated engaging hypotheses and some interesting findings. One is the recurring empirical observation that owners set ticket prices in the inelastic portion of gate demand. Fort (2004) shows a variety of circumstances where this choice is consistent with profit maximization and that the conditions hold for MLB in the late 1980s. It will be of interest to see if this also is true on the current data.

Another interesting hypothesis is that fan loyalty impacts attendance. Kahane and Shmanske (1997) show that roster stability engenders loyalty (higher attendance is observed for stable rosters, all else constant). Depken (2001) uses stochastic frontier estimation and interprets teams closest to the attendance frontier as having the most loyal fans. Under this interpretation, he finds teams that relocated had low fan loyalty. It will be noted how the work contributes to both the inelastic pricing and loyalty issues.

III. THE MODEL

The utility of a baseball fan is a function of the number of visits to baseball stadiums, the quality of the teams, the quality of those stadiums, as well as all other goods consumed. Of course, a fan's utility can be different for different teams. It is also reasonable to assume that baseball fans may desire a variety of stadiums and teams, so that the home games of all accessible stadiums and teams are included in the utility function. Fan i faces the following utility maximization problem:

$$\text{Max}\ U_i(X_i, V_{i1}, \ldots, V_{im}, q_1, \ldots, q_m), \tag{1}$$

subject to a monetary constraint:

$$M_i + w_i t_{w_i} = X_i + \sum_{j=1}^{m} c_{ij} V_{ij}, \tag{2}$$

and a time constraint:

$$t_i^* = t_{w_i} + \sum_{j=1}^{m} (t_{t_{ij}} + t_v) V_{ij}, \tag{3}$$

where X_i is the quantity of the numeraire, V_{ij} is the number of visits by the ith individual to the jth stadium, q_j is the quality of going to stadium j, M_i is the exogenous income of individual i, w_i is the wage rate of individual i, t_{w_i} is the hours worked by individual i, c_{ij} is the monetary cost of going to the jth stadium for the ith individual, t_i^* is the total discretionary time for individual i, $t_{t_{ij}}$ is the total travel time for the ith individual going to stadium j, t_v is the time spent during the visit and assumed constant, and m is the number of major league baseball stadiums.

It is assumed that the number of visits and quality are complements if they are for the same team (e.g. a baseball game is more enjoyable if one is familiar with the players), while everything else in the utility function are substitutes. For the large majority of fans who go to see the home team, the quality variable, q, would be a function of both the quality of the home team and the quality of the stadium. It is expected that this quality is effected by variables such as winning percentage, pennant chances, and the age of the stadium. The model also assumes that the individual chooses the amount of time that he or she works at a constant wage rate. Combining the constraints yields the following relationship:

$$M_i + w_i t_i^* = X_i + \sum_{j=1}^{m} (c_{ij} + w_i(t_{t_{ij}} + t_v))V_{ij}, \qquad (4)$$

or

$$M_i + w_i t_i^* = X_i + \sum_{j=1}^{m} (p_{t_j} + p_{c_j} + p_{d_i} d_{ij} + w_i(t_{t_{ij}} + t_v))V_{ij}. \qquad (5)$$

The monetary cost may also be disaggregated into ticket price, p_{t_j}, price of concessions, p_{c_j}, and travel cost per mile multiplied by the round trip mileage, $p_{d_i} d_{ij}$. To find the total cost of the visit, one must consider the monetary cost and the opportunity cost per visit, which is equal to the wage rate multiplied by the sum of the travel time and time spent at the game.

This model implies that if wages or exogenous income increase, the number of visits should increase. However, if any of the prices increase, one would expect the number of visits to decrease. Since a greater distance would increase the price for the consumer, an increase in distance should decrease visits. Therefore, if another team moves close by it should increase visits to the new team, possibly decreasing visits to the old team.

Maximizing utility (1) subject to constraint (5) yields a demand equation for the visits to stadium j by individual i:

$$V_{ij} = V_{ij}(q_j, p_{ij}, M_i, d_{ij}, Z_i), \qquad (6)$$

where demand is a function of quality of the site, prices, income, and distance to the site among other variables represented generically by Z_i. If quality increases, then so should the number of visits. Then the aggregate attendance demand for the team is the sum of all individual demand equations, as:

$$V_j = \sum_{i=1}^{n} V_{ij}(q_j, p_{ij}, M_i, d_{ij}, Z_i). \qquad (7)$$

IV. EMPIRICAL SPECIFICATION AND THE DATA

The empirical specification of the model in (7) is given below (descriptive statistics for all variables are presented in Table 1):

$$\begin{aligned}\text{ATTENDANCE} &= \beta_0 + \beta_1\text{DISTANCE} + \beta_2\text{NEWTEAM} + \beta_3\text{PRICE} \\ &+ \beta_4\text{INCOME} + \beta_5\text{POPULATION} + \beta_6\text{WIN\%} \\ &+ \beta_7\text{CHANGEWIN\%} + \beta_8\text{RUNS}^{\beta_9} + \beta_{10}\text{DIVCHAMP} \\ &+ \beta_{11}\text{LOYALTY} + \beta_{12}\text{STADIUM} + \beta_{13}\text{STRIKE} \\ &+ \beta_{14}\text{ATTENDGROWTH} + \beta_{15}\text{TREND} \\ &+ \beta_{16}\text{ANGELS} + \beta_{17}\text{BLUEJAYS} + \beta_{18}\text{CUBS} \\ &+ \beta_{19}\text{DODGERS} + \beta_{20}\text{CARDINALS} + \varepsilon. \end{aligned} \qquad (8)$$

The dependent variable is annual ATTENDANCE, in hundreds of thousands, for a particular team and ε is a residual term. The observations cover teams over the years 1963 to 1998, with the number of teams varying from 20 in 1963 to 30 in 1998. The attendance data are for the regular season, yielding 884 observations.

Two variables novel to this study capture the impacts of distance between teams (the availability of very close substitutes). DISTANCE equals the inverse of the distance in miles to the nearest alternative MLB stadium. The value of DISTANCE only changes over time for a team if a team moved or a different team moved close by. For example, when the Senators left Washington, DC at the end of the 1971 season to become the Texas Rangers, the Baltimore Orioles DISTANCE variable changed from 0.0222 to 0.0097

Table 1. *Summary statistics*

Variable	Min	Max	Mean	SD
ATTENDANCE	3.0676	40.5795	16.4907	7.2151
DISTANCE	0.0012	0.1	0.0264	0.0337
NEW TEAM	0	1	0.0362	0.1869
PRICE	2.5728	12.2638	5.9819	1.0735
INCOME	7.0425	20.4951	13.4349	2.4054
POP	0.1317	7.8949	1.5573	1.9581
WIN%	0.3086	0.704	0.5016	0.0686
CHANGEWIN%	−0.2349	0.2016	0.0013	0.0699
RUNS	3.29	9.93	6.7775	0.9897
DIVCHAMP	0	1	0.1448	0.3521
LOYALTY	3.0676	44.8335	16.1775	7.1543
STADIUM	0	1	0.0192	0.1374
STRIKE	0	44.8335	1.2813	5.4275
ATTENDGROWTH	−0.4065	0.7214	0.0429	0.1637
TREND	1	1296	486.063	399.494
ANGELS		1	0.0407	0.1978
BLUEJAYS	0	1	0.0238	0.1524
CUBS	0	1	0.0407	0.1978
DODGERS	0	1	0.0407	0.1978
CARDINALS	0	1	0.0407	0.1978

since the Philadelphia Phillies became their closest substitute MLB team. In this sample, the only simultaneous single-stadium occupation was the Angels and Dodgers in Dodger Stadium (1961–1965). The denominator of the DISTANCE variable was constrained to 0.1 for this special case, which represented the largest empirical value of the DISTANCE variable.

NEWTEAM is the second variable used to capture the impact of distance between teams. NEWTEAM equals one for the first year a new team moves within 500 miles of an existing stadium in a given year. A new team might generate more excitement and be a better substitute for many people than an existing substitute team. NEWTEAM could capture an additional initial loss of attendance from league expansion or relocation. This variable includes teams moving and expansion years, which includes 1969, 1977, 1993, and 1998.

Other demand parameters follow a typical demand function specification (price, income, population and preferences). PRICE denotes the own team's price of baseball tickets in real (regional CPI-adjusted) terms. Prices have been obtained from four different sources – American League Red Book (1963), Bruce Domazlicky (1969–1980), Roger Noll (1975–1988), and the Society for American Baseball Research (1991–1998). National League Green Books were not used since older years do not have ticket price data. Missing data were replaced by interpolation using the historical rate of growth over the period 1969–1988. Since there are a variety of seats with different prices for each baseball game, averaging of seat prices is a difficult issue to resolve. Coffin (1996) discusses the problems of estimating an average price. Each data source used its own system for averaging,[1] and when different prices for the same team and year were available, a simple mean across all sources was used. Note that ticket prices that overlapped were very similar in value.

INCOME denotes real (regional CPI-adjusted) state-level per capita personal income (in thousands of dollars). Per capita personal income was obtained from the Bureau of Economic Analysis website for all US states. Canadian per capita personal income was used for Montreal and Toronto. State level data is used to allow for the fact that people attend baseball games from a variety of geographical locations.

POP is the population of the city in which a stadium resides (in millions). City populations are available from the US Census Bureau website, <www.census.gov> and Canadian city population was found at <www.demographia.com>. For years between censuses, a constant growth rate was applied to interpolate population. The same method was used for Canadian cities; however, the censuses were a year later. This variable is used as an instrumental variable related to the size of market for sports entertainment.

Preference controls are included for team performance (winning, run production, championships), loyalty, stadium quality and work stoppages. WIN% is the team's regular season winning percentage. In general, fans prefer to see teams that win. CHANGEWIN% is the change in winning percentage for the team from year to year. It is the difference between the current year's winning percentage and the previous (lagged) year's winning percentage. It is hypothesized that both winning percentage and its changes affect the quality of a fan's experience. If a city has not had a successful baseball team in quite some time, then attendance can be relatively more exciting and enjoyable when the team begins winning more games. However, if a team wins consistently from year to year, fans may take winning for granted and become disgruntled when a team loses.

RUNS is the number of runs that were scored by a team during a year. Fans have a tendency not only to prefer a winning team, but also to prefer more rather than fewer runs scored. However, it was not necessarily assumed that runs affect attendance linearly. Therefore, in a manner akin to a Box-Cox transformation, a nonlinear power function of runs scored was used and was found to be more effective in explaining attendance.

DIVCHAMP is an indicator variable that equals one when a team wins a division championship. The DIVCHAMP variable includes information not necessarily captured in WIN% since a team can have a high winning percentage but still not win its division. Prior to 1969, there were no divisions, so only the two teams that won their respective leagues are included as the DIVCHAMPs.

The LOYALTY variable is the lagged attendance for the team (in hundreds of thousands) and is intended to proxy the fans' attendance habit persistence. This variable is lagged one year. For example, Montreal does not seem to be a 'baseball town' and suffers from very low attendance that persists year in and year out, while attendance in other cities seems to flourish regardless of how the team plays. Lagged attendance proxies, both affects. The present version of 'loyalty' varies from that used in other studies (Kahane and Shmanske, 1997; Depken, 2001), providing a different dimension for comparison with those works.

STADIUM is an indicator variable used to proxy for the effect of a new stadium on attendance. New stadiums tend to increase attendance dramatically, at least for a short time (and possibly a longer period if new stadium revenues translate into an increase in team quality). The effect may be largely captured by the LOYALTY variable, so the STADIUM variable is used only for the year in which the new stadium is first opened.

[1] Contact the authors for a detailed description of the averaging for each data source.

STRIKE is an indicator variable equal to one multiplied by the previous year's attendance in years of work stoppages. This specification assumes that, while strike effects can vary across teams, they effectively are proportional to typical team attendance. There were two years in the sample when work stoppages had any significant consequence on season length, namely the players' strikes of 1981 and 1994 (Fort, 2002). Obviously, attendance will fall if a team is not playing as many games. About 50 to 60 games were cancelled for each team during the 1981 and 1994 strikes.

Additional controls also seemed appropriate. ATTENDGROWTH controls for overall growth in attendance, league wide. It is measured by the growth rate of league attendance, omitting the particular team's attendance being measured by the ATTENDANCE observation. The variable is used as a proxy measure for the overall popularity of baseball. The TREND variable proxies secular shifts that can occur from a number of different sources, such as increases in population beyond city limits, increased availability of leisure time, or shifts in preferences in favour of people desiring to attend more baseball games. Examining attendance over time graphically, there appeared to be an underlying quadratic trend, and to investigate this systematically, a quadratic time variable is used, equal to the year squared, so that 1963 equals 1, 1964 equals 4, 1965 equals 9, and so on. The reason that including both the TREND and ATTENDGROWTH variables is particularly useful is that ATTENDGROWTH can account for large and/or irregular increases or decreases in attendance that TREND cannot. Individual team indicator variables were also included. These represent fixed effects for these particular teams that are not otherwise captured by the model.

It is important to note that other demand variables relating to the closest substitute may affect a team's attendance. For example, the price of a Yankees ticket may affect the Mets' attendance. The variables PRICE, WIN%, CHANGEWIN%, RUNS, DIVCHAMP, and STADIUM for the nearest team were all initially included in the demand model and the variables were then weighted by the variables interacting with the DISTANCE variable. However, none of these variables was statistically significant, and they were excluded from the final demand model.

Table 2. *Non-linear generalised least squares estimates*

Variable	Estimate	T-statistic
INTERCEPT	−5.7752	−4.9094
Distance to substitute		
DISTANCE	−19.535	−4.4309
NEW TEAM	−1.2655	−3.1238
Demand parameters		
PRICES	−0.151	−1.882
INCOME	0.2153	3.3477
POP	0.3364	4.7727
WIN%	12.557	7.2012
CHANGEWIN%	12.3747	8.6802
RUNS	4.25E−09	0.184
RUNS (EXPONENT)	9.1546	3.7676
DIVCHAMP	1.2524	4.5994
LOYALTY	0.7789	41.8821
STADIUM	5.9454	10.1191
STRIKE	−0.1873	−10.072
Other controls		
ATTENDGROWTH	6.5982	11.49
TREND	0.0009	2.3855
ANGELS	1.2692	2.9994
BLUEJAYS	1.4641	2.5348
CUBS	1.2692	2.9795
DODGERS	1.7346	3.5833
CARDINALS	1.3459	3.1935
Diagnostics		
R^2	0.888	
MAPE	12.21	
MPE	−2.213	
RMSE	2.29	

V. EMPIRICAL RESULTS

The results of non-linear least squares estimation (available by request) were tested for autocorrelation and heteroscedasticity. No problem was indicated for the former (the hypothesis of no autocorrelation could not be rejected at any typical level of type I error following Mittelhammer *et al.* 2000, p. 548). However, heteroscedasticity was present in that the residual variance was dependent on the level of expected attendance. In order to accommodate heteroscedasticity, the model was re-estimated via non-linear generalized least squares (GLS) with the residual variance modelled as dependent on the expected level of attendance. The non-linear GLS results are reported in Table 2 (the coefficient estimates were not substantially impacted by the non-linear GLS heteroscedasticity transformation). The table results show that most of the variance in attendance is explained by the model, $R^2 = 0.888$, and the predictive fit of the model was quite good, as evidenced by the mean absolute percent error (MAPE), mean percent error (MPE), and root mean square error (RMSE) statistics.

Focusing on the innovation in this paper, the sign of the DISTANCE and NEWTEAM variables are consistent with the predictions in Equation 7. As the distance between two teams increases, the DISTANCE variable (measured as the inverse distance) between two teams decreases. The magnitudes seem to be reasonable as well. Compared to a team with a substitute that is at the sample average 38 miles away, a team with a substitute that is 28 miles away loses $0.0094 \times 1\,953\,500 = 18\,363$ additional fans per year, and there is an additional decrease of 126 550 fans in the first year that a NEWTEAM substitute appears.

It is instructive to analyze the implications of the model for a hypothetical team. If we assume a team that is characterized by all of its continuous variables valued at the sample means in Table 1, is in the first year of enduring its new close substitute team (NEWTEAM = 1), has managed a division championship the first year in a new stadium (DIVCHAMP = STADIUM = 1), in a year without a work stoppage (STRIKE = 0), and that the team is not one with additional fixed effects, the model predicts attendance at 2 191 861. We will refer to this as our 'comparison' team.

The elasticity of attendance with respect to the distance variable, evaluated at the sample average values of ATTENDANCE and DISTANCE, is 0.031, so that a 1% increase in DISTANCE leads to a 0.031% decrease in attendance. In terms of physical miles, the sample average DISTANCE is 0.0264, for an average of 38 miles. A one-mile decrease in miles between stadiums to 37 miles gives a DISTANCE of 0.0270, an increase of 2.3% in the distance variable. Thus, a one-mile decrease in the number of miles between teams, evaluated around the sample average, will decrease attendance by $2.3 \times 0.031 = 0.070\%$. For the 'comparison' team, each mile below the sample average distance decreases attendance by $0.00070 \times 2\,191\,861 = 1544$. Since this 'comparison' team construct would be charging the average ticket price of $5.98, this translates to ticket revenue losses of $9235 per mile.

The estimation results for insight into two episodes from MLB's past are also used. The American League expanded to include play by the LA Angels beginning in 1961. The Angels shared Dodger Stadium from 1961–1965, when the Angels moved to their stadium in Anaheim, 31 miles away. Recall that the DISTANCE variable was set to 0.1 in this special case of cohabitation. According to the model, the owner of the Dodgers could have generated the following expectation. Relative to the situation that eventually would prevail for the 1966 season, when the Angels moved into their new stadium, the first year of cohabitation would reduce Dodger attendance by $0.0677 \times 1\,953\,500 = 132\,252$ per year, plus the first year loss of 126 550, for a total 258 802 lost attendance. In actuality, in 1961, Dodger attendance fell 440 422 and then immediately bounced back, but the model suggests that subsequent attendance would have been even higher without the presence of the Angels. In the remaining four years of cohabitation, Dodger attendance would be 132 252 less than it would be from the 1966 season on. In total, then, over the five years of cohabitation, the Dodgers could have expected to lose $258\,802 + (4 \times 132\,252) = 787\,810$ in attendance. With the estimated average ticket price for the Dodgers from 1961–1965 being $2.23, the lost attendance represents about $1.76 million in lost revenue over the period of cohabitation. Recall that this is at a time when Dodger star pitchers Don Drysdale and Sandy Koufax were earning about $60 000 each.

Our second historical episode occurred when the Senators left Washington, DC at the end of the 1971 season to become the Texas Rangers. When the Senators left, the Baltimore Orioles DISTANCE variable changed from 0.0222 to 0.0097. In terms of miles, the new Philadelphia Phillies substitute was 103 miles away compared to the Senators at 45 miles. Again, resorting to the evaluations at the sample means, Orioles' attendance would be expected to increase by $0.0125 \times 1\,953\,500 = 24\,419$ per year. With an estimated Orioles ticket in 1972 being $2.24, that is an increase of $54 699 for ticket sales alone. Of course, over time, the effect would accumulate at higher ticket prices (indeed, the Senators have been gone for 30 years). The logic of these two examples will be used in the next section to discuss the implications for contraction and competition policy aimed at increasing the number of MLB teams.

Two other outcomes in Table 2 are of interest to those studying attendance demand. First, calculated at the means, the price elasticity of attendance demand is −0.055. This is considerably inelastic and consistent with the rest of the extant work on attendance demand. Apparently, over the lengthy sample, owners set ticket prices in the inelastic portion of attendance demand. The usual explanation is that attendance-related revenue (parking, concessions, memorabilia) or the pursuit of subsidies lead to pricing beyond the maximum of total revenue at the gate. Second, loyalty as measured by last year's attendance significantly affects this year's attendance. The elasticity of attendance with respect to last year's winning percentage is 0.764. Judging from the relative elasticity estimates, loyalty has about 14 times the impact that price has on attendance. This result adds to the growing literature suggesting that future studies of attendance demand should account for the effect of fan loyalty.

The effects of the rest of the variables are largely as expected. Over the sample period, baseball is an income normal good (elasticity = 0.175) and population effects are significantly positive. Turning to preferences, performance (winning percentage, the change in winning percentage, runs and a division championship) significantly and positively affects attendance. The year a new stadium is occupied, attendance increases by 594 500. Strike years reduce attendance, all else constant, by about 19 000. Interestingly, team indicator variables for Anaheim, Toronto, the Chicago Cubs, LA and St Louis all are significantly positive. Since these are meant to capture unspecified fixed effects, it should come as no surprise that we have no specific explanation for this outcome. However, we do note that Depken (2001) ranked fan loyalty for each of these teams as relatively strong.

VI CONCLUSIONS

A travel cost model is used to explain attendance for MLB teams, 1963–1998. At the sample average variable values, a one-mile increase in distance to a substitute MLB team increases attendance by about 1544 fans. The first appearance of a new substitute team reduces attendance by an additional 126 500 fans. In two interesting examples, sharing Dodger Stadium with the expansion Angels probably cost the Dodgers about $1.76 million (1963 dollars) over a five-year period and the Orioles are better off by about $54 699 (1972 dollars) per year after the Senators left for Texas.

In addition, we find evidence of ticket pricing in the inelastic region of attendance demand, consistent with past studies. This indicates that attendance-related revenues and the pursuit of state and local subsidies are important to MLB owners over the sample period. It also appears that the fan loyalty is an idea worthy of inclusion in future studies of attendance demand.

Occasionally, MLB owners desire to expand the market for baseball and new rivalries can follow the introduction of a team into a currently occupied territory. However, even though there are markets that may be able to sustain additional MLB teams, such an occurrence would have detrimental attendance effects on the incumbent team. This leads us to some conclusions on current policy considerations.

First, consider MLB's call for contraction. One of the current candidates, the Minnesota Twins, is largely insulated from the distance effects analysed in this paper. The nearest MLB city to Minneapolis/St Paul is Milwaukee, which is well over 300 miles away. Elimination of the Florida Marlins is a similar situation, where currently, Miami is Tampa Bay's closest MLB substitute, about 281 miles away. If the Marlins are eliminated, Tampa Bay's closest MLB substitute becomes the Atlanta Braves, about 457 miles away. The difference is worth $0.0015 \times 1\,953\,500 = 2930$ fans. For current consideration, the Fan Cost Index (produced by Team Marketing Reports) allows a fuller appreciation of attendance impacts by estimating all attendance-related revenues for a family of four. At Tampa Bay's Fan Cost Index of $141.60, the additional 2930 fans are worth about $103 722 per year in additional revenue for the owner of the Devil Rays.

It is difficult to believe that eliminating the Twins or Montreal Expos will result in any attendance gains at all for other MLB teams. Since attendance at Expos games is less than 8000 fans per game, the people of Montreal will likely not be yearning for baseball if the Expos leave. The gains derived from contracting either of these teams can only be in terms of reduced revenue sharing by remaining teams. Contracting the Marlins would not be very different, with only a marginal gain for the Devil Rays. For example, at their 2001 attendance of 1 298 365, and using the same $141.60 Fan Cost Index, the increase in attendance in the absence of the Marlins would increase Tampa Bay attendance-related revenues by only 0.21%.

Finally, consider competition policy that would increase the number of teams in larger revenue markets, and in particular, consider meeting the current desire for another team in the Northern Virginia area. The impact would be to reverse the attendance gains enjoyed by the Orioles when the Senators left for Texas (adjusted for all other variables as in Equation 7). In the first year, the new substitute would reduce Oriole attendance by 24 419 fans, plus the first year loss 126 550. At a Fan Cost Index of $141.12 in Baltimore, first-year losses would be about $5.33 million. In subsequent years, the annual 24 419 lost fans would cost the Orioles about $861 502 per year. Competition policy that would put a team back in the Northern Virginia area would cost the Orioles (with 2001 attendance of 2 951 371) about 5% of 2001 attendance-related revenue in the first year and about 1% of 2001 attendance-related revenue thereafter. By the foregoing examples, ongoing attendance impacts are small, even when a team might be placed fairly close to another (the Orioles example). It would seem that a look at local TV revenue in the presence of substitute teams would be required in order to assess the impact on competitive balance in MLB and in the analysis of policy considerations, to either reduce or increase the number of teams.

ACKNOWLEDGEMENTS

The authors thank Bruce Domazlicky and Roger Noll for portions of the ticket price data.

REFERENCES

Coffin, D. (1996) If you build it, will they come?, in *Baseball Economics: Current Research* (Eds) J. Fizel, E. Gustafson and L. Hadley, Praeger, Westport, CT.

Depken, C. A., III (2001) Fan loyalty in professional sports: an extension to the National Football League, *Journal of Sports Economics*, **2**, 275–84.

Fort, R. (2001) Revenue disparity and competitive balance in Major League Baseball, in *Baseball's Revenue Gap: Pennant for Sale?: Hearing before the Subcommittee on Antitrust, Business Rights, and Competition of the Committee on the Judiciary, United States Senate, 106th Congress, 2nd Session*, 21 November 2000, Government Printing Office, pp. 42–52.

Fort, R. (2002) *Sports Economics*, Prentice Hall, Englewood Cliffs, NJ.

Fort, R. (2004) Inelastic sports pricing, *Managerial and Decision Economics*, **25**, 87–94.

Hotelling, H. (1929) Stability in competition, *Economic Journal*, **39**, 41–57.

Kahane, L. and Shmanske, S. (1997) Team roster turnover and attendance in Major League Baseball, *Applied Economics*, **29**, 425–31.

Levin, R. C., Mitchell, G. J., Volcker, P. A. and Will, G. F. (2000) *The Report of the Independent Members of the Commissioner's Blue Ribbon Panel on Baseball Economics*, Major League Baseball, New York.

McConnell, K. E. (1985) The economics of outdoor recreation, in *Handbook of Natural Resource and Energy Economics*, Vol. 1, North Holland, Amsterdam.

Mittelhammer, R. C., Judge, G. G. and Miller, D. J. (2000) *Econometric Foundations*, Cambridge University Press, Cambridge, UK.

Quirk, J. and Fort, R. (1999) *Hard Ball: The Abuse of Power in Pro Team Sports*, Princeton University Press, Princeton, NJ.