Determinants of Minor League Baseball Attendance

Seth R. Gitter[1] and Thomas A. Rhoads[1]

Abstract

Like Major League Baseball (MLB), minor league baseball attendance may be influenced by the quality of the team. We use a data set encompassing all A, AA, and AAA minor league teams from 1992 to 2006 and find a positive relationship between a minor league team's winning percentage and attendance. We also find evidence that minor and MLB are substitutes as increased ticket prices for the nearest MLB team lead to higher minor league attendance if that team is within 100 miles. Similarly, we find that during the MLB strike, minor league attendance increased. Finally, we find that a local or regional MLB team's winning percentage only has a positive impact on minor league attendance when they are affiliated clubs.

1. Introduction

Prevailing industry wisdom seems to be in agreement with empirical evidence presented by Siegfried and Eisenberg (1980) suggesting that attendance at minor league baseball games is not dependent on the quality of the team on the field. Because minor league baseball teams serve mostly as player development grounds for their Major League Baseball (MLB) affiliate, player development often takes precedence over winning at the minor league level. As a result, minor league attendance trends are generally ignored. In fact, minor league baseball teams are often noted most for

[1] Department of Economics, Towson University, MD, USA

Corresponding Author:
Thomas A. Rhoads, Department of Economics, Towson University, MD 21252, USA.
Email: trhoads@towson.edu

the creativity of their promotions department in attracting fans to the game. However, evidence is beginning to emerge in related arenas, such as minor and junior league hockey (see Winfree & Fort, 2008) to suggest that minor league baseball fans may be responsive to more than just special promotions. In this article, we explore some key determinants of minor league baseball attendance and find that team quality can matter. We also find that fans seem to treat MLB and minor league baseball as substitutes and geographic proximity to an MLB team can additionally affect attendance.

We use data for minor league baseball attendance for 2,076 team/year observations from 1992 to 2006, which includes every minor league team at the A level and above in existence during this time period. Earlier studies of minor league baseball attendance suffered from potentially unreliable or insufficient data to draw reliable conclusions, so this data set allows us to carefully measure the effect of success of minor league baseball teams on attendance in a way that was not possible before. We are able to test the robustness of these findings by probing the impact that the 1994-1995 MLB strike and proximity to and success of MLB affiliates and nonaffiliates have on the demand for minor league baseball. Doing so, we can present a fairly full picture of the typical minor league baseball fan, which is responsive to MLB ticket prices and does not appear to ignore the presence of the major league affiliate as a substitute.

Not surprisingly, our finding that baseball fans treat MLB and minor league baseball games as substitutes is in line with the suggestion of Fort and Quirk (1999) that National Football League (NFL) and big-time college football are substitutes and the findings of Winfree and Fort (2008) that National Hockey League (NHL) and minor and junior hockey league teams are close substitutes. We find that both team success and a strike in the major leagues increased minor league attendance. In fact, in both cases, our results are not substantially different in magnitude than the estimates of Winfree and Fort for minor league hockey. Using a similar basic regression framework to Winfree and Fort, our article examines additional relationships including the impacts of the nearest local or regional MLB team ticket prices and winning percentage. Finally, due to the addition of four expansion teams during our sample period and the movement of another MLB team, we can also measure the impact of the distance of the nearest MLB team.

Because our model suggests that fans treat MLB and minor league baseball as substitutes, the association between a minor league team and an MLB team can be optimally designed to generate gains in attendance for some minor league teams. In providing detailed insight into the behavior of minor league baseball fans using a rich data set, our article gives useful information that can aid baseball executives in deciding where to locate minor league affiliates and could suggest some marketing strategies that are consistent with revealed fan behavior. The remainder of this article is structured as follows. The remainder of this paper is structured as follows. Section 2 provides a link to the literature, noting the strong connection between minor league and MLB fan behavior. Section 3 describes the data and presents a

simple model of minor league baseball attendance. Section 4 provides the estimation equation and empirical results and a discussion of these results are given in section 5. Section 6 concludes.

2. Literature Review

Starting with Rottenberg (1956) and Noll (1974), demand estimation, labor issues and stadium funding, and location decisions have attracted a lot of attention in MLB research; the same is true in the minor league baseball literature. Siegfried and Eisenberg (1980) model demand for minor league baseball, Gifis and Sommers (2006) determine the impact of promotions on minor league baseball attendance, Krautmann, Gustafson, and Hadley (2000) examine minor league training costs of MLB players, Davis (2006, 2007) looks at location decisions of minor league baseball teams, and Colclough, Daellenbach, and Sherony (1994) estimate the economic impact of building a minor league baseball stadium.

A casual observation of MLB's ticket prices, number of teams, and length of season together suggest that minor league baseball and MLB baseball may be substitutes (Bradbury, 2007). Winfree, McCluskey, Mittelhammer, and Fort (2004) note that new MLB teams that move close to an incumbent MLB team are a substitute and take fans away from the incumbent, and Noll (1974) finds evidence that more sports teams in a city will serve as substitutes for an MLB team. Generally, the evidence seems to suggest the presence of an MLB team close to a minor league team may serve as a substitute for the minor league team.

We focus on estimating attendance for minor league baseball in this article. Horowitz (2007) provides a lengthy inventory of many of the things that have been found to affect MLB attendance. Beginning with Rottenberg's (1956) modeling of attendance at MLB games and Noll's (1974) more general modeling of attendance at professional sporting events, winning is among the first items found to bring more fans to MLB games. Although less attention has been placed on estimating attendance for minor league baseball, the emerging story in describing attendance for minor league baseball is that fan demand does not appear to be driven by the same things in MLB as in the minor leagues. Other than an affinity for seeing more home runs in both leagues (Greenstein & Marcum, 1981; Siegfried & Eisenberg, 1980), prior research has identified very little overlap in the direction and magnitude of attendance factors for MLB and minor league baseball (Gifis & Sommers, 2006).

Perhaps expecting to see characteristics mirroring that found in MLB, Siegfried and Eisenberg (1980) note, "surprisingly, winning has no effect on attendance" in minor league baseball. However, this result contrasts with Noll's (1974) finding for all the major North American professional sports leagues. Their model is estimated using sample survey data that include only 86 team/year observations from 27 different minor league teams over the 1973-1977 period, and we suspect there is selection bias in the data, as some of the teams in the sample were not in existence for very

long before the time period studied. For example, Elizabethton began operations in 1974, Midland in 1972, and Asheville disbanded from 1972 to 1975. A honeymoon effect may be at work for each of these teams, suggesting that attendance and winning for these teams are unrelated for at least a part of the 1973-1977 time period. Perhaps the richer and longer data set we have could more precisely tease out those characteristics affecting attendance for minor league baseball without running into problems of selection bias.

MLB fans are noted for positively responding to winning a pennant (Baade & Tiehen, 1990; Noll, 1974) and to winning regular season games (Horowitz, 2007). For minor league baseball fans to behave in a significantly different way than fans of MLB suggests they have different underlying characteristics driving their behavior. We contend this is not likely. In Moneyball, Lewis (2003) offers that fans of a low-payroll, star-deprived MLB team such as the Oakland A's can respond positively to winning, suggesting the same may hold for minor league baseball teams. The finding of Winfree and Fort (2008) that minor and junior league hockey fans respond positively to increasing team quality suggests something similar may be going on in minor league baseball. We use their model as the foundation for our analysis as we estimate minor league baseball attendance. We now move to the next section that describes the data and sets up our model.

3. Data Description and Econometric Model

If minor league baseball fans have the same preferences as MLB fans, then minor league baseball per game attendance should rely on the quality of the minor league baseball team. Additionally, if these fans are from the same fan base, minor league baseball attendance may also depend on the availability, quality, and price of MLB substitutes (Winfree et al., 2004). However, there may also be complementarities between MLB and their minor league baseball clubs if fan loyalty increases demand for minor league baseball through success of the MLB team. We follow the framework established in Rottenberg (1956) and Noll (1974) and reinforced in Winfree and Fort (2008) in setting up our model of minor league baseball per game attendance. The model takes all three of the aspects noted above into account and incorporates team-specific characteristics such as minor league ticket prices, income, and population in a minor league team fixed effect (see Winfree & Fort, 2008):

$$\text{MiLB Attend} = F\left(\begin{array}{l}\text{MiLB Team Characteristics, MiLB Quality, MLB Quality,} \\ \text{MLB Price, MLB Availablity, Complementarities}\end{array}\right)$$

We use data from two sources. The first source provides attendance data for minor league baseball and MLB teams from the years 1992 to 2006 (Sports Reference LLC, 2007). In the data set, there are 2,076 minor league baseball team/year observations. Previous studies of minor league baseball attendance have used survey data
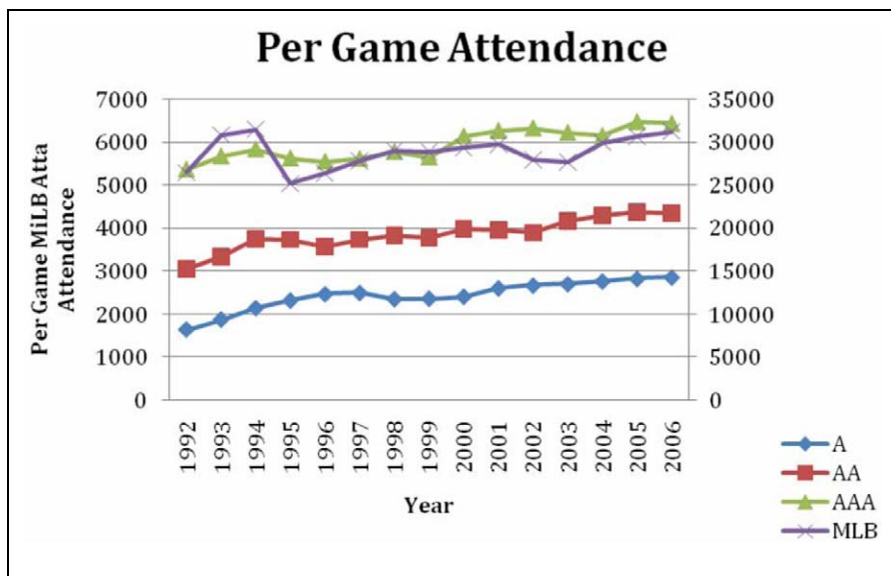
Figure 1. Minor League Baseball and MLB Per Game Attendance by Year.

or single team attendance. This data set is extremely robust as it includes data on all minor league teams from A to AAA for every year in the sample. The second source of data is the average ticket price of MLB teams collected by Team Marketing Report (TMR) as part of the Fan Cost Index (FCI), which is a basket of goods that a typical family of four might purchase while attending a game.[1] The FCI data are available for every MLB team from 1992 to 2006 but is limited to only 63 team/year observations in 2005 and 2006 for minor league teams. Because the minor league ticket price data are only available for 3% of the observations, we cannot include ticket prices for the minor league teams. Instead, like Winfree and Fort (2008), we include team fixed effects to capture minor league baseball ticket prices.

The dependent variable of interest is average per game (APG) home attendance for a minor league baseball team.[2] At this point, it is worth noting that there are four levels of minor league baseball: Rookie, A, AA, and AAA. As players improve, they generally move up levels from Rookie to A, AA, and AAA in that order. Therefore, player quality generally is better at higher levels of minor league baseball. Because of the relationship between location and level (Davis, 2006), we note that there is a chance key variables across leagues will differ. Accordingly, we estimate the effects on winning by league in addition to pooling the data.

We use data from the three highest levels (A–AAA), as data on Rookie league attendance are only partially available.[3] Figure 1 above shows the average home attendance for three levels of minor league baseball and MLB by year. The figure shows that attendance is increasing with the league quality and Table 1 shows APG

Table 1. Descriptive Statistics

	Mean	Standard Deviation	Min	Max
Minor league team per game home attendance (full sample)	3,476	2,214	235	15,526
Minor league team per game home attendance (AAA)	5,959	2,130	1,714	15,526
Minor league team per game home attendance (AA)	3,883	1,537	353	9,846
Minor league team per game home attendance (A)	2,450	1,601	235	8,495
Minor league team winning percentage	0.50	0.07	0.25	0.76
Minor league team home runs	92.40	38.73	11	231
NewTeam (1 if new minor league team)	0.04	0.19	0	1
Average MLB ticket price (real prices in 1982-84 dollars)	8.92	2.92	5.00	23.00
Local (1 if distance to MLB team < 100 miles)	0.31	0.47	0.00	1.00
Affillate100 (1 if distance to MLB affiliate < 100 miles)	0.17	0.37	0	1
Regional (1 if distance to MLB team < 250 miles and more than 100 miles)	0.43	0.49	0	1.00
Affiliate250 (1 if distance to MLB affiliate < 250 miles and more than 100 miles)	0.14	0.35	0	1
Observations = 2,076				

Note: MLB = Major League Baseball.

of 2,450, 3,883, and 5,959 for A, AA, and AAA, respectively. A few other trends of note emerge. First, in general, minor league baseball attendance has risen over the examined period in all three levels. In the sample period (1992-2006), per game attendance has increased 75%, 40%, and 20% in levels A, AA, and AAA, respectively. MLB attendance has returned to its 1994 peak, the year of the baseball players' strike, which cancelled the end of the 1994 season and beginning of 1995 season. For the first year of the strike (1994), this graph suggests that minor league attendance rose during the MLB strike and this result is confirmed below; however, attendance fell between 1994 and 1995 at the AAA level. Additionally, we include a trend term to control for the rising attendance in all levels of minor league baseball and MLB through the time period studied.[4]

We now turn to a discussion of the independent variables. The descriptive statistics for all of the independent variables are listed in Table 1. As previous works have shown, MLB team performance is a strong indicator of attendance for MLB teams. Therefore, it is likely minor league baseball team attendance is tied to winning of the minor league baseball team. To control for this possibility, we include minor league baseball team winning percentage (Win%). Because each game is a zero-sum game, the average winning percentage is 50%.[5] The *Standard Deviation* is about .07. Winning percentage varies more at the A level with a *Standard Deviation* of winning percentage of .075, while the *Standard Deviation* of winning percentage is closer to .06 for both AA and AAA. For comparison, the MLB standard deviation of

winning percentage was .07. Additionally, Siegfried and Eisenberg (1980) and Greenstein and Marcum (1981) suggest that fans not only like to see their team win but also enjoy home runs. To account for this, we include minor league baseball team home runs (Home runs) as an independent variable.[6] The average for the sample was 92 home runs. Like MLB, the number of minor league baseball home runs has increased over the observation period, although there was some decline in 2006, the final year of the observation period.

To control for the impact of distance to the closest MLB team, we include two binary dummy variables. The first (Local) is equal to 1 if a minor league team is less than 100 miles from the closest MLB team. The second (Regional) is equal to 1 if the minor league team is less than 250 miles and more than 100 miles from the closest MLB team. The reasoning for the two variables is that a fan within 100 miles (Local = 1) might be able to leave work at 5 p.m. and attend a night game on a week night starting at 7 p.m. and still return home by midnight. This would be less feasible for a fan over 100 miles away. However, fans within 250 miles would be able to attend a game as a day trip. About 31% of the sample minor league baseball teams are less than 100 (Local = 1) miles away from an MLB team, with minimal variation between the levels. Another 43% are less than 250 miles and more than 100 miles (Regional = 1). To test the substitutability for minor league baseball and MLB based on different distances between minor league baseball and MLB clubs, we interact the local and regional variables with measures of MLB prices and team quality. The impact of a local or regional MLB team may also be enhanced if the two teams are affiliated. In the sample, 17% of the sample is within 100 miles of their affiliate (Affiliate100 = 1) and 14% is between 101 and 250 miles (Affiliate250 = 1). We include additional measures of affiliated teams interacted with prices and team quality to test the potential for affiliates to have greater influence on their farm clubs.

4. Econometric Model

To estimate influencing factors on minor league baseball attendance, we build our model from the analysis of Winfree and Fort (2008) on minor league hockey attendance. Their model predicts the demand for minor league hockey based on team quality, an NHL strike, and controls for team fixed effects. To directly compare our estimates to Winfree and Fort, we use a dual-log functional form. This functional form has the advantage of easing calculations of elasticities and magnitudes of attendance increase by level.[7] A linear specification yields results that are not substantially different.

Equation 1.1 below presents a basic model, which measures equivalent variables to predict APG attendance for a sample of minor league baseball teams. The model is estimated separately by level. Equation 1.2 pools the three levels and adds additional terms to examine heterogeneity in the effect of wins on attendance. We extend the model in Equation 2 to examine the impacts of the MLB team located closest to the minor league team and the additional effects of the close team being the MLB affiliate.

We use team fixed and random effects and a trend term to control for income, prices, population, and demand for minor league baseball. These effects will also include other team characteristics such as consistent team quality. Each minor league team is represented by a binary indicator, which equals 1 for team n; for all other teams it is 0. As baseball attendance has been growing across leagues, we include a trend term, which equals 1 in the first sample year (1992) and increases one per year. The next two variables control for the minor league team's quality. Winning attracts fans at the MLB level, and as shown by Winfree and Fort (2008) at the minor league level for hockey, we include Win% as a control.[8] Fans also like home runs and we include an additional term for team home runs, which is the number of home runs hit by team n in year t.

Similar to the 2004-2005 NHL lockout, MLB experienced a players' strike that caused the cancellation of games. The work stoppages differ in that the MLB players' strike of the 1994 and 1995 season caused cancellation over two seasons. In 1994, about 30% of the 162-game MLB season was canceled and the World Series and play-offs in 1994 were not played. However, minor league baseball games continued. The strike was settled in late March 1995, causing the MLB season to be shortened to 144 games. The variables Year94 and Year95 measure the strike's impact.

Finally, as with expansion major league teams, new minor league teams may see higher attendance in the team's first year of existence than in subsequent years. To test for this possible team honeymoon effect, we include an additional term (New-Team), which equals 1 if it is the first year the team has played in that city.

$$\ln(\mathrm{APG})_{it} = \beta_0 + \sum_{i=1}^{n} \beta_N \mathrm{Team}_{it} + \beta_{N+1}\ln\mathrm{Win\%}_{it} + \beta_{N+2}\ln\mathrm{Homeruns}_{it}$$
$$+ \beta_{N+3}T_t + \beta_{N+4}\mathrm{Year94}_t + \beta_{N+5}\mathrm{Year95}_t + \beta_{N+6}\mathrm{NewTeam}_{it} + \varepsilon_{it}. \tag{1.1}$$

Equation 1.2 extends model 1.1 by adding four additional terms to examine differences between leagues. Two additional binary dummies (AA, AAA) are added to control for the impact of being in a higher level with level A being the omitted category. The final two variables are interactions between the binary dummies and team win percentage (AA $\times$ lnWin% and AAA $\times$ Win%) that measure the additional impact of winning percentage for AA and AAA teams, respectively.

$$\ln(\mathrm{APG})_{it} = \beta_0 + \sum_{i=1}^{n} \beta_N \mathrm{Team}_{it} + \beta_{N+1}\ln\mathrm{Win\%}_{it} + \beta_{N+2}\ln\mathrm{Homeruns}_{it}$$
$$+ \beta_{N+3}T_t + \beta_{N+4}\mathrm{Year94}_t + \beta_{N+5}\mathrm{Year95}_t + \beta_{N+6}\mathrm{NewTeam}_{it} + \beta_{N+7}\mathrm{AA}_{it}$$
$$+ \beta_{N+8}\mathrm{AAA}_{it} + \beta_{N+9}\mathrm{AA}_{it} \times \ln\mathrm{Win\%} + \beta_{N+10}\mathrm{AAA}_{it} \times \ln\mathrm{Win\%} + \varepsilon_{it}. \tag{1.2}$$

One feature of our data is that there were expansion teams that came into existence during the sample period. This includes four expansion teams during the period (Arizona, Colorado, Florida, and Tampa Bay) and an additional team that moved (Montreal to Washington). When a new MLB team is created, the closest MLB team

may change for several minor league teams. This creates variation in the closest MLB team, which allows us to test the impact of having a major league team close to the minor league team. Two variables measure the impact of having a team within 100 miles (Local) and within 101–250 miles (Regional).

We now turn our attention to the relationship between the closest MLB team and the quality and price of attending games at the home stadium for that MLB team. The classical definition of substitutes would suggest that as MLB prices increase in areas close to minor league teams, minor league attendance should increase, all else equal. We therefore, include a measure of MLB ticket prices. For each team's closest MLB market, we include a measure of real average ticket prices (MLBcost × Local and MLBcost × Regional). For markets with two teams (New York, Chicago, Los Angeles, and San Francisco/Oakland), we take an average of the two (see Winfree et al., 2004). This variable is then interacted with the Local and Regional indicators to determine the impact of MLB price on teams in local or regional markets.

To measure the quality of the MLB team, we use the closest MLB team's winning percentage (MLBWin% × Local and MLBWin% × Regional). Again, in markets with two MLB teams, an average is taken. This variable is interacted with the Local and Regional indicators. Finally, given the potentially strong ties between MLB affiliates and the minor league teams, we include a final variable that examines the additional impact of MLB ticket prices and quality for affiliated teams that are close to their minor league farm clubs. Equation 2 below outlines this model. In this case, the measure of ticket prices is only for the MLB affiliate (MLBcost × Affiliate100 and MLBcost × Affiliate250) and the win percentage is that of the affiliate (MLBWin% × Affiliate100 and MLBWin% × Affiliate250). Because the variables are included for the nearest team, the affiliate variables can be seen as the additional impact of the MLB team for affiliated teams compared to nonaffiliated local and regional teams.

$$
\begin{aligned}
\ln(\text{APG})_{it} = {} & \beta_0 + \sum_{i=1}^{n} \beta_N \text{Team}_{it} + \beta_{N+1}\ln\text{Win\%}_{it} + \beta_{N+2}\ln\text{Homeruns}_{it} \\
& + \beta_{N+3}T_t + \beta_{N+4}\text{Year94}_t + \beta_{N+5}\text{Year95}_t + \beta_{N+6}\text{NewTeam}_{it} \\
& + \beta_{N+7}\text{AA}_{it} + \beta_{N+8}\text{AAA}_{it} + \beta_{N+9}\text{AA} \times \ln\text{Win\%}_{it} \\
& + \beta_{N+10}\text{AAA} \times \ln\text{Win\%}_{it} + \beta_{N+11}\text{Local} + \beta_{N+12}\text{Regional} + \beta_{N+13} \\
& \text{Affillate100} + \beta_{N+14}\text{Affillate250} \\
& + \beta_{N+15}\ln(\text{MLBcost} \times \text{Local}) + \beta_{N+16}\ln(\text{MLBcost} \times \text{Regional}) \\
& + \beta_{N+17}\ln(\text{MLBWin\%} \times \text{Local}) \\
& + \beta_{N+18}\ln(\text{MLBWin\%} \times \text{Regional}) + \beta_{N+19}\ln(\text{MLBcost} \times \text{Affillate100}) \\
& + \beta_{N+20}\ln(\text{MLBcost} \times \text{Affillate250}) \\
& + \beta_{N+21}\ln(\text{MLBWin\%} \times \text{Affillate100}) \\
& + \beta_{N+22}\ln(\text{MLBWin\%} \times \text{Affillate250}) + \varepsilon_{it}.
\end{aligned}
\tag{2}
$$

5. Results

Table 2 below presents the estimated impacts on minor league average game attendance of winning, home runs, the MLB strike, and the performance and cost of MLB substitutes. The models are estimated using natural logs, so that coefficients can be interpreted as elasticities. Additionally, we performed a Woolridge (2002) test for autocorrelation and rejected the null hypothesis that the errors are not correlated. Therefore, we use robust standard errors throughout. Some clear results emerge, which are consistent with the findings in minor league hockey estimations by Winfree and Fort (2008). First, winning increases minor league team attendance at the A and AA, although not significantly at the AAA level. Second, the MLB players' strike increased attendance at the minor league level at the AA level and possibly at all levels. Both coefficients are similar in magnitude to the hockey study. Additionally, local MLB teams within 100 miles appear to be substitutes for minor league games and association with a winning MLB franchise weakly improves attendance.

The first variable of interest is minor league team winning percentage. For all three leagues, the sign is the expected positive relationship, however, it is only statistically significant at the A and AA levels. In model 1.1, we find that a 10% increase in winning percentage is associated with about a 1.9% and 2.3% increase in attendance for A and AA levels, respectively. This coefficient is not substantially different from the Winfree and Fort (2008) estimates of between 1.5% and 2.2%. For a team with average attendance for its level, this would represent an increase of 46 fans per game at the A level and 89 fans at the AA level. Over the course of a 140-game season, this would be an increase of about 3,250 fans and 6,250 for the A and AA, respectively. We present several different models; however, the coefficient on winning percentage does not change substantially with the addition of more variables.

Next, we measure the impact of home runs. At the AA level, home runs are positively associated with attendance, but at the A and AAA levels, the relationship is not statistically significant. The average team hit 105 home runs in AA over the sample with a *Standard Deviation* of 26, so a team that increased its home run production by 25% (about 1 *Standard Deviation*) would see about a 3% increase in attendance. This is about 116 fans per game or over 8,100 fans in a season. Models that omit team fixed effects show positive and significant signs for home runs. This suggests that fans may not respond to year-to-year changes in home runs but might be influenced by parks that are conducive to home runs.

Similar to the article of Winfree and Fort, we measure the impact of the MLB players strike in 1994 and 1995 using two binary year dummies for 1994 (Year94) and 1995 (Year95). A trend term (T) controls for growing attendance over the sample period. At the AA level, attendance increased 10% and 8% in the first and second years of the strike. Although positive, the impact of the strike was not statistically significant for A and AAA. The magnitude of the coefficient suggests attendance

Table 2. Regression Results

	A	AA	AAA	Pooled	Random Effects Pooled	Fixed Effects Pooled
lnWin%	0.189 (0.046)**	0.233 (0.083)**	0.135 (0.100)	0.186 (0.047)**	0.188 (0.045)**	0.179 (0.043)**
lnHrs	−0.031 (0.025)	0.124 (0.052)**	0.008 (0.054)	−0.023 (0.021)	−0.027 (0.020)	−0.026 (0.020)
Trend	0.004 (0.002)*	−0.004 (0.003)	0.007 (0.003)*	0.003 (0.002)*	0.001 (0.002)	−0.001 (0.002)
Year94	0.038 (0.028)	0.1 (0.047)*	0.055 (0.053)	0.046 (0.023)*	0.043 (0.023)*	0.042 (0.023)
Year95	0.029 (0.030)	0.084 (0.034)**	0.017 (0.051)	0.037 (0.023)	0.039 (0.023)*	0.032 (0.022)
NewTeam	0.071 (0.037)*	0.035 (0.062)	0.142 (0.183)	0.073 (0.034)*	0.081 (0.035)**	0.073 (0.033)*
AA				0.075 (0.133)	0.06 (0.134)	−0.339 (0.168)*
AAA				0.75 (0.125)**	0.773 (0.124)**	0.451 (0.130)**
AA × lnWin%				0.213 (0.196)	0.22 (0.200)	0.161 (0.190)
AAA × lnWin%				−0.31 (0.220)	−0.344 (0.217)	−0.317 (0.213)
Local					−0.273 (0.220)	−0.481 (0.257)
Regional					−0.029 (0.055)	−0.001 (0.060)
Affiliate100					−0.304 (0.453)	−0.178 (0.490)
Affiliate250					0.677 (0.376)*	0.657 (0.369)
ln(Local × Cost)					0.191 (0.066)**	0.194 (0.076)*
ln(Regional × Cost)					0.03 (0.042)	0.018 (0.047)
ln(Local × MLBWin%)					−0.317 (0.358)	−0.271 (0.334)
ln(Regional × MLBWin%)					−0.259 (0.221)	−0.066 (0.228)
ln(Local × Affcost)					0.123 (0.102)	0.081 (0.112)
ln(Regional × Affcost)					−0.084 (0.079)	−0.082 (0.079)
ln(Local × Aff_Win%)					0.223 (0.116)*	0.222 (0.112)*
ln(Regional × Aff_Win%)					0.224 (0.105)*	0.248 (0.107)*
Constant	7.754 (0.121)**	7.769 (0.260)**	8.63 (0.301)**	7.898 (0.108)**	7.913 (0.112)**	8.191 (0.108)**
Observations	1,209	429	436	2,074	2,067	2,067
Number of cities	133	47	37	208	208	208
R-squared	0.03	0.03	0.07	0.36	0.39	0.91

Note: MLB = Major League Baseball. Standard errors in parentheses.
* Significant at 5% level.
** Significant at 1% level.

increased in attendances in line with the estimates of Winfree and Fort (2008) for minor league hockey. The final variable of interest is the impact of having a new team (NewTeam = 1). As predicted, cities with new minor league teams had higher attendance. At the A level, attendance was 7% greater in the first year, and while not statistically significant, the coefficient on NewTeam was also positive at the AA and AAA levels.

We extend the basic model to include several measures of impact of local and regional MLB teams. This extension includes the impact of local (within 100 miles) and regional (101–250 miles) MLB teams and the closest MLB team's average ticket price and winning percentage on minor league attendance. It also compares differences in the additional impacts of these measures on affiliate clubs. We present both random and fixed effects results for the pooled model. With the exception of distance variables, the results do not substantially change, even though a Hausman test between the random and fixed effects models yields a Chi-square of 482 and *p* value of .000, suggesting systemic differences between the models. Overall, the results show that the closest MLB team is a substitute for local minor league baseball teams.

We begin by discussing the distance variables. By themselves, binary indicators for minor league teams within 250 miles of a MLB team show no significant effects in both the random and fixed effects models. However, this is not the total effect on attendance because interaction terms must be considered as well. The fixed effects models show a sharp increase in attendance when there is a new team in the region. However, due to the limited number of teams in the sample that changed status of having a team within 100 or 250 miles, these estimates have large ranges.

In both the fixed and random effects models, the impact of local MLB team's ticket prices is positive on minor league team attendance. The *Standard Deviation* of real MLB ticket prices is nearly one third of the mean, so we examine the marginal impact on APG of a one third increase in ticket prices. With the elasticity estimate of about 0.19, this suggests that a 1 *Standard Deviation* increase in ticket prices increases attendance by about 6%. This impact would result in an increase of about 350, 230, and 150 fans per game at the AAA, AA, and A levels, respectively. These results are consistent with the hypothesis that MLB and minor league baseball are substitutes. However, there do not appear to be additional substitution impacts of affiliates as the interactions of affiliate and cost are not statistically significant.

Unlike costs, winning appears to affect affiliated and nonaffiliated clubs differently. We would expect that having an MLB team affiliate with a higher winning percentage may improve attendance if it increases fans' interest in that team. Conversely, MLB team quality could draw fans away from the minor league team. A comparison of affiliates and nonaffiliates shows that both local and regional affiliated clubs show an increase in attendance when their MLB affiliate has a higher winning percentage. Our results show negative but nonstatistically significant results for the impacts of MLB team quality, when the team is unaffiliated.

6. Conclusions

Fans of minor league baseball appear to respond to winning the same as fans of other sports—more winning leads to higher attendance. Although the impacts are limited on the order of only a few percent increase for successful teams, they are consistent in magnitude with estimations on minor league hockey from Winfree and Fort (2008). Like the results of Winfree and Fort with the 2004-2005 NHL lockout, we find some evidence that minor league attendance increased during the MLB strike. We also show that teams have higher attendance in their first year of play, which is consistent with expansion franchises in MLB baseball. Minor league baseball is a substitute for MLB when teams are within 100 miles of each other. Fans of minor league baseball seem to behave in a predictable manner when treating them as fans of the game of baseball. When the cost of attending an MLB game increases, fans respond by attending more minor league baseball games. Treating minor league baseball as a substitute for MLB baseball is consistent with the suggestion of Gifis and Sommers (2006) that minor league baseball fans have an interest in baseball's roots. They seem to be saying, in effect, that fans of minor league baseball are primarily fans of the game of baseball. To treat minor league baseball and MLB as substitutes, then is consistent with this observation.

Finally, because proximity to the closest MLB team affects minor league baseball attendance, baseball executives would do well to not ignore this factor when considering any alterations in location or MLB affiliation. Maximizing organization revenues likely includes optimizing proximity to MLB affiliate for teams at each level of the organization. A future research agenda should include estimating more precisely the effect of proximity to MLB affiliate. Using actual distance to MLB affiliate instead of one of a few categories of proximity can provide useful information to baseball executives.

Notes

1. Team Marketing Report's (TMR) Fan Cost Index (FCI) tracks the cost of attendance for a family of four. In the analysis, we use only the MLB ticket price data, but using the FCI yields results that are not substantially different. The FCI includes four average-price tickets, four small soft drinks, two small beers, four hot dogs, two game programs, parking, and two adult-size caps.
2. Average per game attendance is calculated by total attendance/(.5 × total games). The data set has home attendance data and while it has total (home and away) games, we do not know the exact number of home games, but barring cancelled games, half of all games should be played on the road and half at home.
3. Level "A" is divided into high A and low A. An examination of attendance between these divisions does not show a substantial difference between the variation of A level minor league baseball. We therefore group them into one level.
4. A separate model not reported here, which replaces year fixed effects with MLB team fixed effects yields results that are not substantially different, with the exception of the relationship between the cost of attending an MLB game and minor league attendance, which have both been increasing over time.
5. Minor league baseball also uses first- and second-half champions, so the highest winning percentage team might not make the playoffs. However, playoff berths and winning are likely highly correlated, so we elect to use only winning percentage.
6. The home runs variable measures both home runs hit at home and on the road. Although fans may care more about home runs hit at home than total home runs, our data set contains only total home runs. Total home runs should be highly correlated with home runs hit at home.
7. Key results do not substantially change in magnitude, significance, or sign when the functional form is changed. Additionally, a comparison of R-squared of models with dual-log and linear specifications shows difference of about 0.1–0.2%.
8. Winfree and Fort (2008) use points per game where teams gain 2 points for a victory and 1 point for a tie and 0 for a loss. This measure is roughly equivalent to win percentage in baseball.

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Bios

Seth R. Gitter is an assistant professor of economics at Towson University. His teaching and research interests focus on baseball and development economics. Thomas A. Rhoads is an associate professor of economics at Towson University. His teaching and research interests focus on professional golf and baseball.

Thomas A. Rhoads is an associate professor of economics at Towson University. His teaching and research interests focus on professional golf and baseball.