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The effectiveness of promotions in minor league baseball : a study of the Eastern League

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by

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1. Introduction

Minor League Baseball (MiLB) is comprised of 247 teams playing in 17 leagues at six different levels. Every team in these leagues is an affiliate of a Major League Baseball (MLB) team, but many are privately owned and are therefore financially independent. While MiLB primarily serves as a development environment for future MLB players, profit maximization is still a goal of various front offices. Minor League Baseball has existed for over a century but only recently have teams been regarded as profitable investments. In Forbes' "Most Valuable Minor League Teams" list published in 2016, the average value of the top 30 teams was $37.5 million, an increase of 35% since 2013 (Klebnikov, 2016). While these valuations dwarf those of even the least valuable Major League team, they should not be ignored. Most of the top 30 teams also boast top attendance figures and eighteen teams on were also a top 25 merchandise seller (Klebnikov, 2016). The main source of revenue for teams comes from getting fans to the ballpark, such as tickets, parking, concessions, and merchandise sales. For this reason, figuring out the best strategy for increasing attendance is a top priority of MiLB executives.

Modeling attendance has been a popular topic in sports economics for over half a century. Most studies focus on the top sports leagues and use the robust data available to quantify the many factors that affect attendance. Because of the rapid roster turnover in MiLB, carrying out studies on popular sports economics topics, such as star player effects and competitive balance measures, is difficult. One area of analysis that has been examined at both the major and minor leagues is promotional activity. Many sports economists have differentiated MiLB from MLB by calling the former more of an entertainment experience rather than a sporting event. For this reason, understanding the specific effect of promotions on attendance is vitally important to MiLB. Those who attend MiLB games have been found to be less concerned

with the quality of the baseball game than other types of baseball fans, and more concerned with the value and overall entertainment experience (Bernthal and Graham, 2013). While promotional efforts are effective in the MLB and other top sports leagues, winning teams and player quality have been found to be the most effective stimulants of attendance (McDonald and Rascher, 2000, Paul and Weinbach, 2011a). Front offices of MiLB teams now recognize that, "Fans…have come to expect the added value of a giveaway," and thus it has been a chief goal to, "provide fans with more than just a baseball game" (Hixson, 2005).

In Major League Baseball, as well as the other top professional sports leagues, promotions are rare. However, most minor league teams provide at least one promotion for every home game of the season. Promotions can take many different forms, from food discounts, to shirt giveaways, to a concert after the game. If the goal of a team is profit maximization, it is important to know which promotions yield the greatest increase in attendance.

This paper examines the attendance of six teams who play in the AA-level Eastern League, during the 2015-2017 seasons. Various factors that affect attendance are included in the model, but promotional efforts are the key variables of interest. To determine which promotions are the most effective, various dummy variables are created for each category of promotion. Team fixed effects are also utilized to account for differing features between the teams such as size of the market, sustained success, and distance to their Major League affiliate. A pooled regression is run on the entire league, and a regression is run just on the Richmond Flying Squirrels.

I hypothesize that promotions will be one of the largest determinants of additional attendants for Eastern League teams studied. Every promotion should have a positive effect relative to a game without a promotion, though the magnitudes will certainly differ.

Hypothesizing such magnitudes is tricky, as there is no obvious answer to which promotion fans most prefer. Based on previous research, however, I hypothesize that fireworks, concerts, and merchandise giveaways will have the most positive coefficients, and thus draw the greatest additional amount of fans.

Besides promotions, particular interest will be paid to the effect of winning and runs scored on attendance. Past literature has been very mixed on these effects, although intuition says that both should be very positive and significant. Fans of sports should prefer more winning and more scoring (which can be thought of as a proxy for excitement). Therefore, I hypothesize both coefficients to be positive and significant. The influence on game setting, which includes month, day, time of day, and weather, will also be estimated.

2. Literature Review

After Quirk and El Hodiri first modeled a professional sports league in 1971, the field of sports economics took off in many different directions. The first paper studying attendance was published by Roger Noll in 1974, and focused on price-setting. The literature on attendance in top-level professional sports is vast, with the majority focusing attention in Major League Baseball. It was not until 1980 that Siegfried and Eisenberg published the seminal paper on the demand for minor league baseball. Their dataset is a panel consisting of 27 teams from varying levels from 1973 to 1977. Their measure of demand, total season attendance, is estimated using a log-linear model on several demographic and team-related variables. The authors find that the demand for minor league baseball is very price inelastic, specifically -.25. They also find that attendance increases with league level. Additionally, they account for promotions in their model by including variables of the percent of games with reduced price promotions and percent of

games with merchandise promotions. Both of these variables are positive and statistically significant factors, with merchandise promotions attracting almost double the amount of fans throughout the season than price promotions (Siegfried and Eisenberg, 1980).

Later studies have improved this initial model while addressing similar topics, specifically the income elasticity of minor league baseball, if winning matters, and the effects of promotions. Siegfried and Eisenberg obtain a positive, but statistically insignificant, coefficient on their income per capita variable, opening up the debate for whether minor league baseball is a normal good, which is an attribute of most entertainment events. Recent studies have obtained mixed results on this relationship. Using an OLS model on the NY-Penn League, Paul et al. (2007) obtain a positive coefficient on their income per capita variable. Cebula (2013) also observes that minor league baseball is a normal good, using panel least-squares model on five seasons of Carolina League baseball. Two studies, however, obtain contradictory results. In their study analyzing three different leagues in the Southeast, Anthony et al. (2011) obtain negative coefficients on their per capita income variable in all three OLS regressions. A study that focuses on just the A-level league in this region, the South Atlantic League, confirms that there is a negative relationship between per capita income and attendance, at least in the Southeast region (Paul et al., 2009). In a study examining two of the lowest level leagues in the Pacific Northwest, Paul and Weinbach (2011b) claim that the Pioneer League is an inferior good as well, while the coefficient on per-capita income for the Northwest League is positive, but statistically insignificant. McDonald and Rascher (2000) surprisingly find that MLB is an inferior good, using unemployment rate as a proxy for income. This opens up a larger debate on whether baseball games, overall, are normal or inferior goods.

Siegfried and Eisenberg's finding that winning does not affect attendance in the minor leagues is the result that differs most from studies of other sports leagues (1980). Good team performance should be the main driver of attendance, and this has been confirmed in a number of studies on major sports leagues, as well as lower-level leagues. McDonald and Rascher (2000) determine that win percentage in the current season and wins from the previous season both positively affect attendance in MLB. Winning and player quality also drive attendance, as determined in papers about collegiate baseball (Bernthal and Graham, 2013) and the Quebec Major Junior Hockey League (Paul and Weinbach, 2011a).

More recent studies on minor league baseball have almost unanimously confirmed that winning actually does matter to fans, using different measures of attendance and time periods. The single-year, per-game attendance study by Paul et al. on the NY-Penn League (2007) finds that a win percentage increase of .100 increases attendance by about 100 fans. The study done by Anthony et al. (2011) obtains an even stronger relationship between winning and attendance for two out of the three leagues in their study, as well as in the pooled regression of all three leagues in the 2009 season. They find that an increase in win percentage of .100 leads to an additional 188 fans. A panel least squares estimation using the natural log of per game attendance as the dependent variable produces a coefficient that signifies a 4.1% increase in fans for a 10% increase in win percentage (Cebula, 2013). One study that does not use per-game attendance is the panel study done by Gitter and Rhoads (2010). They employ a dataset that includes season – level data for all minor league teams between the years 1992-2006. They first run three separate regressions, using only data from each of the three levels of play studied (A, AA, and AAA), and then a fixed-effects pooled regression. They find win percentage to be positive and statistically significant for A and AA levels. Surprisingly, they do not find a statistically significant

relationship at the AAA level. Once the data are pooled, win percentage once again has a positive and statistically significant effect on attendance.

One shortcoming of Siegfried and Eisenberg's results about promotional effects is that their definition of promotions is too broad, as promotions offered today can be categorized beyond simply reduced-price tickets and merchandise giveaways. More recent studies include at least six promotional categories, some using as many as 20 (Paul and Weinbach, 2011b). The most common finding is that fireworks are the most effective promotion, as found in Anthony et al. (2011), Cebula (2013), Paul et al. (2007), Paul et al. (2009) and Paul and Weinbach (2011b). Other successful promotions are concerts (Paul et al., 2007, Paul et al., 2009, Anthony et al., 2011) and merchandise giveaways (Anthony et al. 2011, Cebula, 2013).

There are mixed results in regard to the effectiveness of group or theme nights as well as food/drink specials. The recent research done on price vs. non-price promotions in MiLB helps explain this result. Price promotions are found to have a significantly negative effect on minor league attendance. Specifically, mean attendance of price promotion games were 20% lower compared to games with no promotion (Hixson, 2005). A similar relationship is found in both the major and minor leagues by Browning and DeBolt (2008). Price promotions across the levels of baseball cause the smallest increase in attendance, compared to just non-price promotions or a combination of the two. Group or theme nights, may offer lower pricing to a particular group or adherence to theme, and can, in some circumstances, be regarded as price promotions. Food and drink specials are considered price promotions in all literature. Thus, it is not surprising some research has found negative effects for group/theme nights and food/drink specials.

Anthony et al. (2011) and Paul and Weinbach (2011b) both find group and themed nights to have a net negative effect on attendance. One explanation for this result is that while the teams

may gain some fans from the group that is encouraged to attend, fans who are not a part of that group stay home. Conversely, some studies have found that group nights actually raise attendance, though at a smaller magnitude than other promotions listed above (Paul et al., 2009, Cebula, 2013). Beer specials or happy hours are found to be statistically insignificant in many studies (Paul et al., 2007, Anthony et al., 2011, Paul and Weinbach, 2011b). However, it is a significant driver of attendance in the Carolina League (Cebula, 2013) and the South Atlantic League (Paul et al., 2009), drawing almost 500 more fans on average. Other food/drink specials are also found to attract fans in the Carolina League but deter fans of the South Atlantic League, indicating some differing preferences within the same region. (Cebula, 2013, Anthony et al., 2011, Paul et al., 2009).

As mentioned above, MiLB teams use at least one promotion every home game, with some rare exceptions. Some sports economists have defined a "watering down effect" to be a decrease in the marginal effect a promotion has each additional game it is offered. This effect has been studied for both MLB and MiLB teams, and important distinctions have been found between price and non-price promotions. McDonald and Rascher (2000) find that a slight watering down effect exists in the MLB, but did not break out promotions into specific categories. In MiLB, a watering down effect is only found for price promotions (Hixson, 2005, Browning and DeBolt, 2008). The front offices in MiLB must be aware of this, because price promotions (which includes reduced-priced ticket or concessions) are not common, as most of the promotions are giveaways or attractions. While this study is not concerned with a watering down effect, it is valuable to see which promotions have been the most successful, and thus least prone to being viewed as overused.

While the types of attendance studies are less robust for MiLB than MLB, many different leagues within the minor league system have been studied, and thus have captured many different types of baseball fans. The current literature, however, has paid no attention to the Eastern League. This is a very interesting league, as the teams are geographically diverse and the league sits in the middle of the MiLB quality spectrum, being at the AA-level. A full list of the teams studied, and the others in the Eastern League, can be viewed on Table 1. This study also includes the most recent data available, as it focuses on the last three full seasons.

Most of the literature utilizes Ordinary Least Squares or Panel Least Squares models to examine the factors affecting attendance. This study will take a slightly different approach, as a Tobit model (combined with both fixed and time effects) is used to account for the fact that about 10% of the sample is right-censored.[1] The Eastern League, overall, has very good attendance in comparison to other leagues, so other economists may not have run into this issue before. It is important for executives of Eastern League teams to know whether historical attendance trends have continued, and in particular, whether results found in other leagues hold for their league.

3. Theoretical Framework

Demmert (1973) developed one of the first theoretical models of a professional sports team, which defines demand-side and supply-side equations of a hypothetical team. Given that this study revolves around attendance, his model of demand for a sports team is of most importance. The total season demand for team i can be expressed as:

$$q_i = f(p_i, x_i, m_i) = \sum_{i \neq j} q_{ij}$$

[1] I define right-censored to be games at which the stadium is at or above stated capacity (some teams may offer a couple hundred additional standing room only tickets for the very popular games).

Where p_i is the price charged (determined at the beginning of the season), x_i are the qualities of team i (team roster), and m_i are the market characteristics for the team i.[2]

Demmert notes that a team in a sports league does not act like a normal firm because there is limited price competition, given that a team has a monopoly in its locale. However, the athletic inputs of team i (which I assume to be the home team) affects demand for both team i and team j, leading to more competitive behavior. Thus, the demand for each individual game between teams i and j, q_{ij}, is a function of the price of the game and the qualities of *both* team i and team j. In variable form, this is written as:

$$q_{ij} = f(p_{ij}, x_{ij})$$

Demmert notes that the team qualities of the particular teams determine a lot of drivers of demand, such as the uncertainty of outcome, the association with the winning team, and the entertainment value (Neale, 1964).

If there are other aspects of the game that affect the entertainment value, say promotions, I can extend Demmert's model to account for this. Specifically, I introduce g_{ij}, a game setting variable, which includes drivers of demand such as day of the week and the weather, but also accounts for the promotion offered for the individual game, which certainly drives the "entertainment value" that Demmert mentions. Additionally, prices for individual MiLB games are set at the beginning of the season, and there is a negligible secondary market. Thus, price can

[2] It is important to note that, in Minor League Baseball, the teams have no influence over the players they inherit and lose, as those decisions are made in the draft and throughout the season by the parent club. The minor league team itself really only has influence over player training of those players they inherit for a given season.

be assumed to be exogenous in the model, and removed from Demmert's expression of an individual game. Therefore, demand for a single game in a season can be expressed as:

$$q_{ij} = f(x_{ij}, g_{ij})$$

The problem for a front office becomes maximizing the increase in demand for each individual game constrained to the increased cost of doing so. We expect the derivatives of the utility to follow the following relationships:

$$\frac{\partial q_{ij}}{\partial x_{ij}} = f_x(x_{ij}) > 0$$
$$f_{xx}(x_{ij}) < 0$$
$$\frac{\partial q_{ij}}{\partial g_{ij}} = f_g = g(g_{ij}) > 0$$
$$f_{gg}(g_{ij}) < 0$$

Furthermore, we can set up a relationship of the marginal increases in demand per price due to improving team qualities and improving the game experience:

$$\frac{f_x}{P_x} = \frac{f_g}{P_g}$$

A couple of interesting subtleties about the Minor League Baseball market can now be explored using this equation. As expressed above, minor league teams do not really have much choice as to which players they inherit from season to season. Their roster is mainly determined by the drafts and the needs of their parent club. For that reason, P_x will not vary much year to year. Looking at the right side of the equation, if one takes account of what is included in the g_{ij} function, it is clear to see that the only decision a club really has control over is the promotions, which naturally will affect the P_g term. It is because of these factors that estimating the marginal

demand of the game setting improvements is extremely important to front offices of Minor League Baseball.

4. Econometric Models and Methods

Kappe et al. (2014) identify eight factors that affect attendance in professional sports, which is the basis of how the model discussed later is constructed. These factors are promotions, opponent, team performance, weather, venue, media coverage, demographic and socioeconomic factors, and pricing.

Variables that capture demographic differences have mainly been included in studies that collect season-level data for all teams in a league (Siegfried and Eisenberg, 1980, Gitter and Rhoads, 2010). The focus of this study is not to determine whether minor league baseball is a normal good or not, so demographic characteristics will not be included. Some studies, when analyzing multiple leagues (Siegfried and Eisenberg, 1980, Gitter and Rhoads, 2010) or a panel (Cebula, 2013), have included ticket prices in the analysis. However, the majority of studies have not included ticket prices, due to the fact that teams set these prices before the season starts, and the secondary market is extremely limited (Anthony et al. 2011, Paul et al. 2007, Paul et al. 2009, Paul and Weinbach, 2011b). As this is the case for the Eastern League, and ticket prices between the teams studied do not vary much, I opt to not include ticket prices in the models.

Media coverage and opponent effects will also not be included in the model. MiLB games are only available based on a yearly subscription to MiLBTV. Thus no data would be available to study such effects. It has also been determined that minor league fans do not care about the opponent as much as the standard sports fans (Bernthal and Graham, 2003). Given that there are also few rivalries in MiLB, opponent effects were left out of the model.

Given those exclusions, I am left with promotions, team performance, weather, and venue. The measures of team performance used in past studies are also used in this study. Win percentage is the most intuitive performance statistic, and is used in virtually all sports economics papers. Another team performance statistic that may positively affect attendance is runs scored. Home runs per game was used by Siegfried and Eisenberg (1980), but has since been replaced in most studies by a total runs per game. This variable is the sum of runs scored and runs allowed, divided by home games played. The reason why runs allowed is included is to minimize multicollinearity issues that may arise between win percentage and a runs scored per game. The total runs per game variable will answer the simple question of whether fans prefer more scoring or less. Most studies have observed that fans respond positively to more winning and scoring, and that relationship should hold in this study.

Game scheduling factors are needed for complete controls in the model. Such variables are month of the year, day of the week, whether the game is a make-up, and whether the game was opening day or fell on a holiday. Fans are expected to attend more games on the weekends, in the summer, and on holidays, all reflecting the decreased opportunity cost of missed school or work. It is possible that the coefficients on April and September may be positive as well. There may be heightened excitement at the start of the season or during a potential playoff push. The effect that doubleheaders will have on attendance is unclear. On one hand, a baseball fan may relish the opportunity to go see two games for one price. However, the opportunity cost of spending around six hours at the stadium may deter fans from even showing up.

This study includes both continuous and binary weather variables. Temperature and wind speed are included in the model, along with the squared values, so a quadratic can be solved to find the optimal temperature and wind speed. It is expected that fans will respond more

positively to warmer weather and less wind. The model will also account for the effect that "bad weather" has on attendance, which is accounted for using a binary variable.[3]The equation for estimating attendance in the Eastern League thus takes the following form:

$$\begin{aligned} ATT_{it} = {} & \alpha + \beta_1 wpct_{i,t-1} + \beta_2 rpg_{i,t-1} + \sum \gamma Month_{it} + \sum \lambda Day_{it} \\ & + \beta_3 Sat * day_{it} + \beta_4 Sat * night_{it} + \beta_5 Sun * day_{it} + \beta_6 Sun * night_{it} \\ & + \beta_7 HomeOpener_{it} + \beta_8 Holiday_{it} + \beta_9 Temp_{it} + \beta_{10} Temp_{it}^2 \\ & + \beta_{11} Wind_{it} + \beta_{12} Wind_{it}^2 + \beta_{13} BadWeather_{it} + \beta_{14} DoubleHeader_{it} \\ & + \sum \rho Promotion_{it} + \nu_t + \delta_i + \mu_{it} \end{aligned} \quad (1)$$

Where ATT_{it} represents the attendance for team i in game t. $Wpct_{i,t-1}$ and $rpg_{,t-1}$ represent the winning percentage and total runs per game for team i up to game t. The reason for lagging these variables is because those are the statistics fans can observe before making the decision to attend game t. Dummy variables for the months in the season and days of the week are used to account for scheduling factors.[4] An additional point to note about Equation 1 is that I have interacted Saturday and Sunday with day and night binary variables.[5] Assuming games Monday – Friday are played at night leaves the most scheduling flexibility on the weekends. I hypothesize there will be a significant difference between the two start times for both Saturday and Sunday. The term ν_t represents time effects, which will be accomplished using dummy variables. The term δ_i represents the team fixed effects, and μ_{it} represents the random error term.

Binary variables are also used to control for promotions, the focus of the study. This study builds on the literature that breaks out the category of promotions into specific dummy variables for each category of promotion. After viewing the promotions offered by the teams in this analysis, 17 categories were established. While this may seem like a lot, this is a similar amount of categories to other studies that have taken specific interest in promotions (Anthony et

[3] The categories for weather included in the box scores are clear, partly cloudy, cloudy, overcast, and rainy. The variable bad weather is the final three categories combined.
[4] Wednesday is the reference day of the week and May is the reference month.
[5] I have assumed day games to be those with the first pitch before 6pm. It was considered to have three categories, day, afternoon, and night, but having three arbitrary cut-offs did not seem wise, given various assumptions were already being made in the model.

al., 2011, Paul et al. 2007). Table 2 lists the promotion categories, along with a brief description. It is expected that most, if not all, of the coefficients on promotional variables will be positive, with the significance varied.

Most prior studies have used OLS or Panel Least Squares to estimate a similar equation to the one above. In the sample, 10% of the games are at or over the listed capacities of the various stadiums. In an attendance study about college football study by Falls and Natke (2016), an upper-bound Tobit model is used to account for the capacity constraint found in their data. In their sample, only 7% of the games were at or over capacity. For this reason, a right-censored Tobit model is used to estimate the above equation. The equation is estimated in log-linear form, as well as in linear form, using a Normal distribution for both estimations.

In order to compare one of the fan bases to the rest of the league, a separate equation is created for the Richmond Flying Squirrels. This is a modified equation from Equation 1, given that there are fewer observations when the regression is restricted to one team. The equation of attendance for the Richmond Flying Squirrels takes the following form:

$$ATT_t = \alpha + \beta_1 wpct_{t-1} + \beta_2 rpg_{t-1} + \sum \gamma Month_t + \beta_3 MidWeek_t + \beta_4 Weekend_t + \beta_5 Temp_{it} + \beta_6 Temp_{it}^2 + \beta_7 BadWeather_{it} + \sum \rho Promotion_{it} + \mu_t \quad (2)$$

Where $MidWeek_t$ represents games that fall on Wednesday and Thursday, and $Weekend_t$ represents games that fall on Friday, Saturday, and Sunday.[6] The variables for holiday, double header, and opening day were taken out because the standard errors would have been far too high. The other major change in this regression is the promotions categories are made slightly broader. The promotions are now broken out into fireworks, giveaways, theme nights, group

[6] An "early week" variable is the reference category, which represents Monday and Tuesday games.

nights, community nights, education nights, concert/event, deals, and other.[7] This equation is estimated using the right-censored Tobit model with the Normal distribution as well.

In order to make sure the added promotional categories contribute positively to predicting attendance, a Likelihood Ratio Test is used. This test allows two identical models to be run, however in one, the promotion variables are excluded. By comparing the log likelihoods of the two models, it is possible to reject the null hypothesis that the additional promotion variables do not affect attendance. The Likelihood Ratio test statistic is:

$$LR = 2[logL(\theta) - logL(\sigma)] \sim \chi^2(k)$$

Where θ represents the complete regression equation and σ represents the restricted equation. The Likelihood ratio statistic follows a chi-squared distribution with the degrees of freedom equal to the amount of restrictions (Buse, 1982).

5. Data

The data for this study is collected from two different sources. The individual box scores on team websites include the attendance, time of first pitch, temperature, wind speed, weather category, whether the game was delayed, cancelled, or a makeup game, and the final score of the game. After compiling three seasons of game-level data for the six teams in the league, there are 1,218 games in the dataset. Game-by-game promotion info is acquired through pocket calendars distributed by the teams at the beginning of each season. The descriptive statistics for relevant variables can be viewed on Table 3.

[7] Fireworks and concerts have been found to be very successful promotions, so those were left alone. Low/high-value merchandise and bobbleheads were combined into "giveaways", as did happy hours and food specials into "deals." Theme, group, community, and education nights were left alone due to the fact that they all seemed to try and draw different types of crowds. The rest of the promotions are in "other."

The average attendance for the six teams is 4,823 during this time (which corresponds to a mean capacity of 66%), though there is a wide range. The minimum attendance is very disheartening: a game in which the Bowie Baysox only drew 912 fans to their stadium, on a rainy Tuesday night. With a mean win percentage of .478, it is clear that this is a sample of teams that played slightly below average during this time. The teams studied played games in which an average of 8 runs were scored.

The distribution of games throughout the week is fairly even, with Friday, Saturday, and Sunday games being slightly more popular for scheduling. Night games are clearly the most popular option, consisting 73% of the sample. Unsurprisingly, the average temperature during the season is about 75 degrees. However, throughout the season, there is are lows of 39 degrees in Trenton and highs of 97 in Richmond. Only 4% of games were cancelled and thus had to be played as doubleheaders. The weather during these years is very hospitable to baseball games, with over 70% of games occurring on "good weather" days.

As far as promotions go, fireworks are a popular choice for the directors of entertainment, with displays occurring in over 25% of games in this sample. Merchandise giveaways are also popular, happening in 20% of games, regardless of value. Games with some sort of theme also capture about 25% of the sample. Group nights and promotions centered on education capture about 10% of the sample each.[8] The other promotions are used much less frequently, but nonetheless need to be controlled for in the model.

[8] The percentages of all the promotions add up to over 100%, due to the fact that many teams held multiple types of promotions on one night. For example, pairing a themed night with a giveaway.

6. Results

Table 4 displays the results of the Tobit regression on Equation 1. The first column displays the results of estimating the equation using attendance is the dependent variable. The second column displays the results of the equation estimated in log-linear form. Both equations are estimated using a normal distribution. Standard errors of each independent variable are in parentheses, and the Log Likelihood and AIC are displayed at the bottom of each column.

Turning attention first to some indicators of being a "true" baseball fans, it appears that Eastern League fans do not care about whether their team wins or not, but do prefer games that have higher scoring overall. This is in line with the treatment of minor league baseball as an entertainment experience, as seeing more runs scored is certainly more entertaining.

All of the month dummy variables are significant, though the magnitudes differ. One interesting conclusion is that April is a significantly less popular month to attend games than May, as seen in both estimations. One would think that April games would be more crowded due to excitement surrounding the new season. However, it could be that school is still in session and fans do not have time to go to games. Attendance increases relative to May as the season goes on, reaching a peak of 792 more fans in August, or an 18% increase from May. However, there is a slight drop-off in September, which again could correspond to the start of school again, reflecting opportunity costs. September may also be less popular than the summer months because the teams in this sample underperformed the rest of the league. As hopes of making the playoffs die, some fans may stop attending games.

There are some interesting insights gained about the popularity of certain days. Monday games draw around 15% less fans than Wednesday games. There is not a significant difference between Tuesday, Wednesday, or Thursday in the first estimation. It is estimated that Thursday

games draw about 6% more fans than a Wednesday game but it is significant only at the 10% level. The interchangeability between Tuesday-Thursday games is a very important, as it gives scheduling committees much more flexibility. As to be expected, there is a large increase of 511 fans relative to Wednesday for a Friday game. For the weekend games, I interacted the day dummy variables with a time of day dummy variable, to further break down the effects of weekend games. One would expect Saturday and Sunday to be the two most popular days to see a game, but the results show there are significant differences between times of day on the weekend. Games played during the day and at night on Saturday are more popular than Friday games, however Saturday games played at night (at or after 6pm) draw about 700 more fans than a Saturday day game. The increase is about 38% from a Wednesday game. Conversely, Sunday day games give an additional increase of 250 fans from a Sunday night game, reflecting that the time of day matters on the weekend. Given the choice of day or night games for the weekend, it is clear Saturday games should be played at night and Sunday games played during the day.

Some "special days" were controlled for, specifically the home opener of each team for each season and games played on holidays. Games played on these days draw a massive crowd. Home openers see an increase of 60% more fans than the average game. Looking at the data, this is the one day a year that most of the teams actually fill the stadium, so the magnitude on this coefficient is not surprising. While there are not a ton of holidays that fall during the season games played on these days experience increases of over 1,300 fans. This is to be expected, because most of the holidays that fall during the season are federal holidays (Memorial Day, July 4^{th}, Labor day).

Turning attention now to the weather variables, the expected signs for the temperature quadratic are observed in both models, with significance at the 99% level. As temperature

increases, attendance increases about 240 fans for every degree. However, the negative sign on the squared temperature term indicates that this effect is only experienced up to a certain temperature. Solving the quadratic obtained in the results of column (1), the optimal temperature for a baseball game is 71.6 degrees. After the categories of weather are grouped into just "good" and "bad" weather, it is determined that days categorized as "bad" experience about 300 less fans, or a 6% decrease from days with good weather.

The main focus of this paper, as stated, is to determine the effects of various promotions on attendance. Many of the coefficients on the promotion dummy variables have expected signs and are statistically significant, leading to some valuable conclusions. Consistent with past literature, fireworks are one of the most popular promotions for Eastern League fans. Such games can experience spikes of about 1,200 fans, or 26% increase from games which include no promotion. Low-value merchandise giveaways do not significantly change attendance, but high-value merchandise giveaways can draw about 7% more fans than games with no promotion. Bobbleheads seem to be the best type of giveaway however, and further increase attendance 6% from the high-value merchandise giveaways, significant at the 99% level. Theme nights increase attendance as well, though only by 250 fans. This is a conclusion other economists have not found, as many have obtained a negative coefficient or one that is statistically insignificant. One of the most surprising conclusions found about the Eastern League that has not been found in other leagues is the importance of both education and community. The effect of promotions centered on education is staggering: they draw almost 1,300 additional fans, significant at the 99% level. The increase is greater than that of the fireworks promotion, as seen in both models. Community nights draw about 950 fans compared to games with no promotions, an increase of 23%. This is one area which could be of large importance to the directors of promotions for the

teams studied and potentially those not studied that play in the Eastern League. Education nights and community nights are not expensive to put on, they are essentially a more targeted theme/group night. However, the effects dwarf those of the average theme or group night.

Celebrity appearances are found to increase attendance about 8.5% in the log-linear model and was not significant in the linear estimation. Many of the other promotions that have been insignificant in past papers are also insignificant here. Promotions like bring your dog to the park or a concert may encourage some fans to go to the game, but do not give a large enough incentive for others to come. A priori, it is hard to predict the sign for those promotions, as well as auctions, sweepstakes, or sleepovers, so it is not a surprise that these coefficients are not significantly different from zero.

I last observe the coefficients on the so-called "price promotions," which in this regression are the coefficients on happy hour promotions and deals on food at the stadium. The coefficients on the happy hour variable are positive and significant at the 99% level for both models. This promotions increases attendance by 855 fans, making it one of the more popular promotions for the Eastern League. The coefficients on the food-deals variable are negative for both regressions, with a smaller magnitude than happy hour. Due to the fact that fans of MiLB have been found to be concerned with value, this result may seem odd. However, because the price of food at minor league games may already be perceived as a bargain, fans may not consider a food promotion to be enough to entice them to take time to come see a game. A concern of endogeneity can also be expressed here. It is possible food deals are offered on days which promotions directors would already perceive as have lower attendance. This would bias that coefficient downwards.

Table 5 displays the results for Equation 2, which is just for the Richmond Flying Squirrels games during the same time period. The equation is estimated using the normal distribution as well, and the columns are analogous to those of the previous table. Standard errors of the variables are displayed in parentheses.

The coefficient on win percentage and runs per game are statistically insignificant, leading to the conclusion that Richmond fans do not care about the actual play of the Squirrels. The significance of the month variables changes a bit compared to the full league pooled regression. Both April and June games are not significantly more popular than games played in May in the first model. In the log-linear model, the coefficient on June signifies a 13.5% increase over May, significant at the 95% level. Games continue to gain popularity as the season progresses from July to August to September. Different from the league as a whole, the largest increase is experienced in September, an increase of 1,383 fans over May, significant at the 99% level. An intuitive explanation for this is unclear, though the fact that the team in question is Richmond may offer an explanation. Richmond is home to two universities, Virginia Commonwealth University and the University of Richmond. These schools are not in session during the summer months of May through August. However, when the students come back in late August, it may be possible they attend Flying Squirrels games for the last couple of series of the season. Otherwise, this result is odd, especially considering Richmond did not contend for the playoffs in any year studied. Games played in the middle of the week do not experience significant changes in attendance compared to games played in the beginning of the week. This is a similar conclusion to the one determined in the pooled regressions. Not surprisingly, weekend games continue to be very popular, drawing over 1,000 more fans than those games played on Monday and Tuesday, significant at the 95% level.

The temperature quadratic again returns the expected signs and significance at the 99% level. Solving the quadratic with the coefficients obtained in column (1) yields an optimal temperature for Richmond fans of 74.46 degrees, slightly higher than the Eastern League fan. Richmond fans are more sensitive to bad weather than the Eastern League fan, as a game played on a day determined to have "bad" weather had 862 less fans at the stadium than a day with "good" weather.

Promotions for the Flying Squirrels follow a similar trend as the rest of the Eastern League, though the magnitudes differ. Fireworks continue to be the most popular promotion offered, drawing almost 3,000 fans, or an increase of 52% fans from the average Squirrels game (both coefficients significant at the 99% level). Community nights and education nights are also very popular for the Squirrels. Community nights increase average attendance by more than 2,200 fans (an increase of 44%), significant at the 99% level. Education nights increase average attendance by 1,579 fans, or 31%, also significant at the 99% level. After happy hour and food discounts are combined into one variable, the coefficient is insignificant in both models. This is not surprising, given the effects of these are opposite in the pooled regression. Other types of promotions also do not significantly alter attendance at Richmond Flying Squirrels games. The behavior of Richmond fans is similar to the rest of the teams in this league that are studied.

To determine whether the inclusion of promotions in the pooled regression significantly improve the explanatory power of the model, a likelihood ratio test is performed. Two regressions are run: Equation 1, and an identical regression with the exclusion of the 17 promotional category variables. The test statistic is then computed:

$$LR = 2(\log L(\theta) - \log L(\sigma))$$

$$LR = 19168.02 - 18956.30 = \mathbf{211.72}$$

The chi-squared critical value for 17 degrees of freedom at the .001 level is 40.79 (Davis). Because the calculated test statistic is greater than the critical value, I can reject the null hypothesis that adding promotions has no effect on the explanatory power of the model. This solidifies the findings of this study.

7. Conclusion

The use of promotions in Minor League Baseball will undeniably continue and become more creative, as it is a surefire way to guarantee fans in the seats, regardless of the play of the team. The structure of the Minor League Baseball is not hospitable to fans that care about getting behind a team and basking in the glory of a pennant chase. The roster turnover is simply too high, and although it was not explored in this paper, there are Major League substitutes in close proximity to many Minor League Teams (Gitter and Rhoads, 2010). Thus, promotions will continue to be one of the main reasons fans choose to attend games and spend money at ballparks across the country.

This study utilized an upper-bound Tobit model to regress game-level attendance on a variety of factors hypothesized to affect attendance, with particular attention to promotions offered, as well as many control variables. A pooled regression was run first, then a reduced regression just on the Richmond Flying Squirrels. It was found that winning teams do not matter to these fans, confirming the earliest work on MiLB but contradicting recent work. Fans however, responded positively to teams whose games include more scoring.

It was determined that, for the league, April, May, and September are the least popular months. Additionally, games held early in the week are least popular, which held for the league

as a whole and specifically Richmond. Thus, practice days (i.e. no game) should be scheduled on these days, and doubleheaders should be avoided on these days as well.

This study confirmed that fireworks are one of the most popular promotion that can be offered by a minor league team. For this selection of Eastern League teams, their fans really care about community and education. Thus, new ways of folding in these ideas into the promotions offered would be very beneficial. Happy hours were determined to be a much more effective "price"-promotion than food deals. It is still unclear the effect that general theme and group nights have on attendance, as the coefficients on these variables were mostly insignificant for the Eastern League and Richmond. The Richmond fan base had very similar promotional preferences to the rest of the league, wildly attending games with fireworks, education, and community-centered promotions.

Marketers for the minor league teams studied, as well as others in the league or broader system, can use this information to try and capture as much revenue as possible throughout a season. More popular promotions, such as fireworks, can be put on early week games, which are historically less popular. More promotions can also be used at the beginning of the season to entice fans to get behind the team and capture the excitement of the new season. The summer months of June-August almost sell themselves, it seems. Much more attention should be paid to nights involving particular communities and education. These can be executed in a low-cost way, which would help teams to maximize profits. Obviously, pairing the results explored in this paper with actual concessions data and costs of promotions would yield the most useful insight.

Additional avenues of studying Minor League Baseball still exist. Data for the rest of the Eastern League could be used to see if the teams not studied in this paper have similar tastes and preferences that have already been quantified. There are also other leagues within the minor

league system that have not yet been studied. In regard to promotional studies, watering down effects can be explored for promotions that are offered a lot more than others (fireworks, theme).

Another question that has not been studied in Minor League Baseball is the effect of rehab starts or "celebrity" players on rosters. A rehab start is when a player from the Major League affiliate is recovering from injury and plays a game (or multiple) in the minors. While it has already been shown in some studies that MiLB fans do not follow the win/loss column of the minor leagues, maybe they follow the MLB closer. It would be valuable to learn if the inclusion of a star MLB player in a MiLB lineup draws more fans to the game, on average.[9] Additionally, the effects of top prospects being in minor league lineups has not been studied and could also be seen as a baseball-related promotion. Additionally, the emergence of ex-NFL star Tim Tebow into the New York Mets system has sparked some debate whether attendance has been artificially high because of his inclusion in the lineup. The effect of a "celebrity" player like him would be interesting to quantify as well. These could be seen as promotions, adding an extra layer of entertainment a fan could not get from just a standard baseball game.

[9] This brings into question how to define a "star" player, which is why a question like this would need a whole paper to answer.

Table 1: Summary of Eastern League Teams

Teams included in study			
Team	*Location*	*Years in League*	*Current MLB Affiliate*
Bowie Baysox	Bowie, MD	25	Baltimore Orioles
Harrisburg Senators	Harrisburg, PA	31	Washington Nationals
New Hampshire Fisher Cats	Manchester, NH	14	Toronto Blue Jays
Portland Sea Dogs	Portland, ME	24	Boston Red Sox
Richmond Flying Squirrels	Richmond, Va	8	San Francisco Giants
Trenton Thunder	Trenton, NJ	24	New York Yankees
Other teams in league			
Team	*Location*	*Years in League*	*Current MLB Affiliate*
Akron RubberDucks	Akron, OH	21	Cleveland Indians
Altoona Curve	Altoon, PA	19	Pittsburgh Pirates
Binghampton Rumble Ponies	Binghampton, NY	26	New York Mets
Erie SeaWolves	Erie, PA	19	Detroit Tigers
Hartford Yard Goats	Hartford, CT	3	Colorado Rockies
Reading Fightin' Phils	Reading, PA	51	Philadelphia Phillies

Table 2: Description of Promotions

Promotion	**Description**
Fireworks	Fireworks display after the game
Low-value merchandise	Giveaways such as posters, watches, plush dolls, baseballs, etc.
High-value merchandise	Giveaways such as t-shirts, blankets, hats, etc.
Bobblehead	Bobblehead giveaways
Theme night	Special nights focusing on a theme such as decades, movies, facioal hair, etc.
Group night	Special nights focusing on a group such as colleges, occupations, Scouts, etc.
Community night	Special nights for a specific area of the city or nearby town
Education	Special nights with a focus on education (book clubs, teacher appreciation, etc.)
Faith	Special nights with activities having to do with religion
Concert/event	Post-game concert or attraction (run the bases, autographs, yoga, etc.)
Dogs	Bring you dog to the ballpark, dog-related giveaway usually included
Celebrity	Appearance by a special guest (ex-baseball player, TV star, local celebrity, etc.)
Giveaways (Sweepstakes)	Large-scale, one winner giveaways (Home renovation, vacation, etc.)
Auctions	Jersey, other memorabilia for a charity, usually
Sleepover	Sleepover after the game on the field
Happy hour	Reduced-price drinks before/during game
Food	Reduced-price on particular food items

Table 3: Descriptive Statistics

Variable	Mean	Std Dev	Minimum	Maximum
Attendance	4828.72	1809.69	912	9884
Ln(Attendance)	8.4	0.428	6.816	9.199
Capacity	0.659	0.257	0.091	1.295
Win Percentage	0.478	0.115	0	1
Runs per game	8.276	1.14	0	12.5
April	0.154	0.361	0	1
June	0.19	0.393	0	1
July	0.203	0.402	0	1
August	0.195	0.397	0	1
September	0.046	0.21	0	1
Holiday	0.039	0.195	0	1
Monday	0.108	0.31	0	1
Tuesday	0.139	0.346	0	1
Thursday	0.144	0.352	0	1
Friday	0.154	0.361	0	1
Saturday	0.153	0.36	0	1
Sunday	0.157	0.364	0	1
Day	0.273	0.445	0	1
Night	0.727	0.445	0	1
Saturday*day	0.021	0.142	0	1
Saturday*night	0.132	0.339	0	1
Sunday*day	0.143	0.35	0	1
Sunday*night	0.014	0.117	0	1
Temperature	74.951	11.484	39	97
Temperature squared	5749.39	1639.59	1521	9409
Wind speed	7.678	3.928	0	23
Wind speed squared	74.371	71.664	0	529
Bad weather	0.276	0.447	0	1
Doubleheader	0.048	0.213	0	1
Fireworks	0.27	0.444	0	1
Low value merchandise	0.118	0.323	0	1
High value merchandise	0.099	0.299	0	1
Bobblehead	0.036	0.187	0	1
Theme	0.277	0.448	0	1
Group	0.099	0.298	0	1
Community	0.028	0.165	0	1
Education	0.102	0.303	0	1
Faith	0.012	0.11	0	1
Concert/event	0.028	0.165	0	1
Dogs	0.042	0.2	0	1
Celebrity	0.039	0.195	0	1
Sweepstakes	0.029	0.167	0	1
Auction	0.012	0.11	0	1
Sleepover	0.015	0.121	0	1
Happy hour	0.035	0.185	0	1
Food	0.072	0.259	0	1
Home opener	0.015	0.121	0	1
Bowie	0.169	0.375	0	1
Harrisburg	0.167	0.374	0	1
New Hampshire	0.163	0.37	0	1
Portland	0.164	0.371	0	1
Richmond	0.166	0.372	0	1
Trenton	0.17	0.376	0	1

Table 4: Tobit Regressions for Eastern League

Independent Variable	Dependent Variable	
	Attendance	ln(Attendance)
Intercept	-7043.70***	5.5226***
	(1348.937)	(0.2988)
Win percentage	167.0556	0.0704
	(388.8529)	(0.086)
Runs per game	132.4524***	0.0315***
	(41.0230)	((0.0091)
April	-582.229***	- 0.1455***
	(132.6222)	(0.0293)
June	245.5284**	0.0699**
	(125.1117)	(0.0277)
July	562.8841***	0.1309***
	(132.3649)	(0.0293)
August	792.2575***	0.1797**
	(130.8779)	(0.029)
September	342.5437*	0.0882*
	(197.6788)	(0.0438)
Monday	-632.697***	-0.1516***
	(162.6939)	0.036)
Tuesday	-115.160	-0.0209
	(148.3590)	(0.0328)
Thursday	234.9659	0.0607*
	(143.6609)	(0.0318)
Friday	591.5887***	0.1681***
	(153.6979)	(0.034)
Saturday*day	979.8664***	0.2478***
	(287.7293)	(0.0638)
Saturday*night	1687.226***	0.3766***
	(164.4286)	(0.0365)
Sunday*day	801.4213***	0.2225***
	(150.8073)	(0.0334)
Sunday*night	5666.7869*	0.1409*
	(337.5291)	(0.0748)
Home opener	2612.340***	0.5994***
	(382.6051)	(0.086)
Holiday	1363.601***	0.3058***
	(207.5944)	(0.0462)
Temperature	236.1196***	0.0535***
	(36.8206)	(0.0081)
Temperature squared	-1.6482***	-0.0004***
	(0.2542)	(0.0001)
Wind speed	-21.7150	-0.0041
	(1.1273)	(0.0071)
Wind speed squared	1.1273	0.0002
	(1.7296)	(0.0004)
Bad weather	-292.481***	-0.0624***
	(91.0510)	(0.0202)
Doubleheader	-618.678***	-0.0624***
	(177.0347)	(0.0392)
Fireworks	1174.367***	0.2584***
	(122.3121)	(0.0271)
Low-value merchandise	-161.364	0.0008
	(130.5866)	(0.0289)
High-value merchandise	244.4647*	0.0722**
	(147.9896)	(0.0328)
Bobblehead	438.6668**	0.1333***
	(208.0676)	(0.046)

Theme	283.0139***	0.0743***
	(94.5711)	(0.0209)
Group	44.3334	-0.018
	(133.3697)	(0.0295)
Community	949.5354***	0.2275***
	(234.7087)	(0.052)
Education	1298.516***	0.3279***
	(138.3128)	(0.0306)
Faith	337.6999	0.0326
	(341.6819)	(0.0756)
Concert/event	160.1022	0.0425
	(228.0226)	(0.0508)
Dogs	74.1487	-0.0516
	(211.1585)	(0.0466)
Celebrity	205.6994	0.0858**
	(191.3536)	(0.0424)
Sweepstakes	-47.2063	0.0152
	(230.2251)	(0.0509)
Auction	62.0552	0.0331
	(335.6288)	(0.0743)
Sleepover	299.2486	0.0931
	(317.3549)	(0.0704)
Happy hour	855.0980***	0.1506***
	(242.6841)	(0.0537)
Food	-373.850**	-0.118***
	(162.780)	(0.0360)
2016	-222.653**	-0.0438**
	(89.7546)	(0.0199)
2017	-267.189***	-0.0642**
	(95.4771)	(0.0211)
Harrisburg	999.5971***	0.3354***
	(141.8167)	(0.0314)
New Hampshire	1364.908***	0.4467***
	(141.7363)	(0.0314)
Portland	2339.307***	0.6462***
	(147.1948)	(0.0326)
Richmond	2538.707***	0.6697***
	(153.2018)	(0.034)
Trenton	2128.219***	0.631***
	(149.9139)	(0.0332)
Log Likelihood	-9478.150	-244.32
AIC	19054.30	586.641

* = p < 0.1, ** = p < 0.05, *** = p < 0.01

Table 5: Tobit Regressions for Richmond Flying Squirrels

Independent Variable	Dependent Variable	
	Attendance	ln(Attendance)
Intercept	-9973.16***	5.4789***
	(5656.125)	(0.9484)
Win percentage	-1594.95	-.2356
	(1062.560)	(0.1781)
Runs per game	-99.6398	-0.0181
	(129.7367)	(0.0218)
April	210.8045	0.0157
	(386.4118)	(0.0647)
June	555.9165	0.1352**
	(399.6266)	(0.067)
July	882.9260**	0.1797**
	(404.7156)	(0.0678)
August	904.5235**	0.1680**
	(441.4665)	(0.074)
September	1382.783***	0.2853***
	(522.1729)	(0.088)
Mid-week	70.0758	0.0427
	(376.3383)	(0.0631)
Weekend	1011.243**	0.1987***
	(394.3269)	(0.0661)
Temperature	413.5489***	0.0808***
	(144.0296)	(0.0241)
Temperature squared	-2.7771***	-0.0005***
	(0.9464)	(0.0002)
Bad weather	-862.283***	-0.1780***
	(260.7721)	(0.0437)
Fireworks	2972.166***	0.5222***
	(370.0816)	(0.062)
Giveaway	321.5664	0.0797
	(321.5617)	(0.0540)
Theme	82.0834	0.0173
	(326.8823)	(0.0549)
Group	37.6532	0.0166
	(283.2299)	(0.0475)
Community	2245.789***	0.4395***
	(494.7118)	(0.083)
Education	1579.183***	0.3096***
	(459.0673)	(0.077)
Concert/event	418.4358	0.0410
	(505.3269)	(0.0852)
Deals	433.8153	0.0714
	(328.1730)	(0.055)
Other	232.8284	0.0431
	(307.9869)	(0.0516)
Log Likelihood	-1641.03	-13.405
AIC	3328.06	72.810

* = p < 0.1, ** = p < 0.05, *** = p < 0.01

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