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Abstract The purpose of this empirical study is to identify the key marketing and scheduling determinants of game attendance at minor league baseball games. Identification of such marketing and scheduling factors can provide the management of minor league teams in similar environments with information to more efficiently pursue the goal of game attendance maximization. To ensure greater comparability of data between teams and hence relevance of results, this study focuses upon a single grouping of teams, the Carolina League, and a single minor league baseball season, 2006. The Carolina League consists of eight teams serving eight metropolitan areas: Lynchburg City, VA; Winston-Salem, NC; Wilmington, DE; Salem City, VA; Myrtle Beach, SC; Prince William County, VA; Lenoir City, NC; and Frederick County, MD.

Keywords Team revenues · Minor league baseball · Marketing · Scheduling · Economic factors

JEL D12 · L25 · L29

Introduction

The operation of major league baseball (MLB) teams is a very complex enterprise involving the marketing of a diverse multi-dimensional entertainment commodity (Quirk and Fort 1992; Burger and Walters 2003; Denaux et al. 2011).[1] At the top tier

[1]Interestingly, a rather sophisticated theoretical as well as empirical literature has evolved, dealing not only with baseball and other professional sports but also with amateur sports, particularly in the U.S. (Koch and Leonard 1978; Grimes and Chressanthis 1994).

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of MLB, as most sports fans are aware, are the franchise teams playing games in either the National League or American League. At a lower level of professional baseball is the multi-tiered "farm" system of minor league teams. Minor league teams have their own economic reality but largely serve as a framework for the development of young or inexperienced players. Due to a combination of talent, hard work, and luck, some portion of these minor league players are called up to the "show" (MLB team) for a chance to gain a spot on an MLB team roster.

General Managers of minor league teams, in theory, seek in part to achieve success by helping players develop their skills to their maximum potential. Within the context of this objective, the most successful minor league team managers develop players though a combination of coaching, guidance, counseling, physical conditioning, and other means, such as challenging players to do better. For example, teaching players to cope with adversity, including game-time distractions, can promote those players' ability to succeed in the major league. Cebula and Belton (1996, p. 151) characterized minor league teams as venues "…where prospective major leaguers are trained and guided into…maturity, and given the playing experience, develop teamwork skills and knowledge necessary to…play ball in the major leagues."

Over time, however, the economic reality of the business of baseball has caused minor league baseball to expand beyond this narrow role to one of also generating revenues (Cousens 1997). Indeed, Cousens (1997, p. 320) observed that the minor leagues have been influenced by "…a new breed of professional general managers who employ innovative marketing strategies and promotional techniques." According to Cousens (1997, pp. 320–1), these general managers "…shifted their marketing strategies to emphasize the entertainment aspects of their business in order to attract a larger segment of the population…for revenue generation…Indeed, revenues from the sale of merchandise by minor league clubs…" can enhance profit measurably.

Thus, in addition to pursuing this fundamental function of player development, minor league teams arguably can be portrayed as seeking ways to enhance team revenues, i.e., total gross revenues inclusive of ticket sales. Clearly, given that ticket sales are the principal component of team revenues and that they permit people to attend games, teams achieving higher total revenues are likely to achieve higher attendance as well. Thus, the goals of revenue enhancement and attendance enhancement can be seen as correlative (Cousens 1997; Cebula et al. 2009).

Arguably, marketing strategies and promotions that enhance team revenues (along with game attendance) would appear to serve at least two purposes. First, marketing and promotions by minor league teams in theory helps attract larger crowds per se at games, with the idea that the bigger the crowd, the noisier and more distracting the environment. This more intense environment provides players the opportunity to experience and adjust to performing in front of larger crowds and more noise, heckling, and other distractions that can interfere with a player's concentration and performance.[2] Second, minor league teams help ensure the security of their very existence, i.e., reduce the probability of their own extinction over the long run, by increasing sales revenues and by attracting larger crowds in the process (Cousens 1997).

[2] In theory, when successful minor league teams attract larger crowds, they can in effect use the roar of the crowds to encourage ("psych") young would-be MLB candidates to respond to the crowd and play to their capacity so as to attract the attention of their host MLB team while becoming more accustomed to playing in front of larger audiences.

Accordingly, the purpose of this study is to identify the key promotions/marketing policies, scheduling, economic, and other determinants of total gross revenues at minor league baseball games. The identification of these kinds of factors can provide the management of minor league teams with valuable information with which to pursue the goals of revenue enhancement. To ensure greater comparability of data between teams and hence greater relevance of the results, this study focuses upon a single grouping of teams, the Carolina League, and a single minor league baseball season, 2006. The Carolina League consists of eight teams serving eight metropolitan areas: Lynchburg City, VA; Winston-Salem, NC; Wilmington, DE; Salem City, VA; Myrtle Beach, SC; Prince William County, VA; Lenoir City, NC; and Frederick County, MD.

The Framework: Enhancing Total Gross Revenues

This framework for the identification of key variables that can influence total gross receipts of minor league teams (including ticket sales and sales of related items like food and souvenirs), TOTALREVENUE, is largely a reflection of factors influencing the demand for home team tickets. To begin this analysis, it is argued that teams having a higher general admission ticket price, where TKTPR represents the price of a general admission ticket on game day for the home team, have higher gross revenues, *ceteris paribus*.[3] In addition, the larger the population (POP) in the environment/metropolitan area where a team plays, the greater the attendance is likely to be, *ceteris paribus*, simply because with a higher population there is a larger potential customer base. Furthermore, it is hypothesized that the greater the percentage of the population in the metropolitan area where a team plays that is at or near the poverty level (PCTPOV), i.e., 125 % of the poverty level or below, the lower will be the demand for minor league tickets and other minor league sale items and hence the lower will be the minor league team revenues in that metropolitan area, *ceteris paribus.*

In theory, minor league team revenues, including the demand for minor league game admission tickets, might reflect various marketing efforts directed at attracting fans by making attendance a more pleasurable experience. Such marketing efforts for each of the teams in the Carolina League can be parsed into the following four forms: LOWVALMERCH (a binary variable reflecting whether low value merchandise was given away upon entrance to the stadium at a game, e.g., key chains, team photos, or magnetized team schedules)[4]; HIGHVALMERCH (a binary variable indicating whether higher value items were given away upon entry into the stadium at a game, e.g., baseball caps, shirts, or baseballs); FIREWKS (a binary variable indicating whether a fireworks show/display occurred following the conclusion of a game); and GROUP (a binary variable indicating whether discounted general admission tickets were available for formal groups, such a church groups, boy scout troops,

[3] Interestingly, it has been found that the price of general admission tickets is not a statistically significant determinant of attendance per se (Cebula et al. 2009).

[4] Also included in this category of promotions are bobble heads, calendars, water bottles, posters, baseball cards, and stadium replicas. Such items can, in theory, tend to generate a degree of spectator loyalty.

girl scout groups, and the like, at a game). In each of these four cases, it is expected that the promotion in question acts to attract fans to minor league games, where they pay for seats, pay for concessions, and purchase merchandise, including merchandise associated with MLB[5]; the hypothesized impact of each of these marketing/promotional activities on total team revenues (TOTALREVENUE) is expected to be positive, *ceteris paribus*.

Next, there are the temporal control variables, i.e., variables that reflect the day or days during the week when a game was played or the month during the baseball season when a game was played. Arguably, such variables are needed to control for the fact that families are more likely to attend games on certain days of the week, especially Friday and Saturday, when the working adults in the family are relatively more available, than other days of the week (Denaux et al. 2011). In addition, families are more likely to attend games during those months of the season when their children are out of school. Accordingly, dummy variables to reflect whether a game was played on Sunday (SUN), Monday (MON), Tuesday (TUE), Friday (FRI), or Saturday (SAT), are included in the model. Thus, it would be expected that TOTALREVENUE would be an increasing function of Friday and Saturday home games and a decreasing function of weekday games such as Mondays and Tuesdays. The argument regarding SUN is unclear because although most working parents are off from work on Sunday, the family often has other family obligations, religious attendance and activities, and preparation for work (or school) to attend to during Sunday evening and/or afternoon. In addition, dummy variables to reflect whether a game was played during the month of May (MAY), June (JUN), July (JUL), or August (AUG), are included in the model. As for the summer months, the expected TOTALREVENUE and attendance impacts for June, July, and August would be positive, based on children typically being off from school. By contrast, May games can be expected to generate lower revenues and attendance because so many students are still attending school (along with their teachers and teachers' aides and other school employees).

Presumably, minor league baseball fans prefer to attend games when the weather is not inclement, *ceteris paribus*. The variable RAIN is a binary variable indicating whether there was precipitation present during the day when a game was scheduled. Similarly, minor league baseball fans might also prefer to attend games when the weather is clear, i.e., not cloudy, *ceteris paribus*. The variable CLDPARTCLD is a binary variable indicating whether the day when a game was scheduled was either cloudy or partly cloudy. The expected sign on the coefficients of each of these weather control variables is negative.

Before proceeding to the empirical findings, it is noteworthy that a variety of team performance variables were investigated, including home runs, winning streaks, and team errors. Although these variables in some cases exercised a modest impact on game attendance, none were found to be statistically significant determinants of total gross minor league team revenues. Furthermore, most of these team performance variables introduced multicollinearity into the analysis. Hence, this category of variables was omitted from the present study.

[5] Such MLB merchandise can be remarkably expensive and hence potentially lead to significant additions to revenues.

The Basic Empirical Model

Based upon the arguments provided above, the following reduced-form equation is to be estimated:

$$\begin{aligned} \text{TOTALREVENUE} = {} & a_0 + a_1\ \text{TKTPR} + a_2\ \text{POP} + a_3\ \text{PCTPOV} + a_4\ \text{LOWVALMERCH} \\ & + a_5\ \text{HIGHVALMERCH} + a_6\ \text{FIREWKS} + a_7\ \text{GROUP} + a_8\ \text{SUN} + a_9\ \text{MON} \\ & + a_{10}\ \text{TUE} + a_{11}\ \text{FRI} + a_{12}\ \text{SAT} + a_{13}\ \text{MAY} + a_{14}\ \text{JUN} + a_{15}\ \text{JUL} + a_{16}\ \text{AUG} \\ & + a_{17}\ \text{RAIN} + a_{18}\ \text{CLDPARTCLD} + u \end{aligned} \tag{1}$$

where: TOTALREVENUE = the total gross revenue at a home game during the 2006 season for all of the games played by the eight teams in the Carolina League; a_0 = constant term; and u = the stochastic error term. TOTALREVENUE includes all revenues from admission tickets for a game (of all categories) plus all ancillary revenues collected for that game. For the 2006 season, 975 games were played. Table 1 provides the data sources for the variables. Table 2 provides the basic descriptive statistics for the variables in the model.

Based on the arguments in the previous section of this study, the following are the expected signs on the coefficients:

Table 1 Data sources

Variable	Source
TOTALREVENUE	Minor League Baseball (2012)
PCTPOV	U.S. Department of Commerce (2008)
POP	U.S. Department of Commerce (2008)
TKTPR	Team Contacts*
RAIN	Team Contacts*
CLDPARTCLD	Team Contacts*
FIREWKS	Team Contacts*
LOWVALMERCH	Team Contacts*
HIGHVALMERCH	Team Contacts*
GROUP	Team Contacts*
MON	Team Contacts*
TUE	Team Contacts*
FRI	Team Contacts*
SAT	Team Contacts*
SUN	Team Contacts*
MAY	Team Contacts*
JUN	Team Contacts*
JUL	Team Contacts*
AUG	Team Contacts*
BEER	Team Contacts*
FOODDRINK	Team Contacts*

Team Contacts*—Frederick Keys, Deanna Davis, Assistant General Manager of Ticket Operations; Kinston Indians, Katrina Carter, Director of Sales and Promotions; Lynchburg Hillcats, Erica Marcum, Ticket Manager; Myrtle Beach Pelicans, Dan Kurland, Director of Ticket Sales and Services; Potomac Nationals, Doug McConnell, Box Office Manager; Salem Avalanche, Jeanne Boester, Director of Ticket Operations; Wilmington Blue Rocks, Jared Forma, Director of Ticket Operations; Winston-Salem Warthogs, Brian Shollenberger, Director of Ticket Operations

Table 2 Descriptive statistics

Variable	Mean	Standard deviation
TOTALREVENUE	$22,915	$14,594
POP	213,049	146,309
PCTPOVt	21.1	10.7
TKTPR	$6.56	$0.88
RAIN	0.08	0.09
CLDPARTCLD	0.496	0.50
LOWVALMERCH	0.21	0.42
HIGHVALMERCH	0.064	0.244
FIREWKS	0.138	0.341
GROUP	0.156	0.363
MON	0.122	0.333
TUE	0.146	0.353
FRI	0.161	0.368
SAT	0.159	0.366
SUN	0.134	0.342
MAY	0.208	0.406
JUN	0.187	0.389
JUL	0.204	0.403
AUG	0.205	0.404
FOODDRINK	0.071	0.257
BEER	0.061	0.221

$$a_1 > 0,\ a_2 > 0,\ a_3 < 0,\ a_4 > 0,\ a_5 > 0,\ a_6 > 0,\ a_7 > 0,\ a_8 \geq 0,\ a_9 < 0,\ a_{10} < 0,\ a_{11} > 0,\ a_{12} > 0, a_{13} \leq 0,\ a_{14} > 0,\ a_{15} > 0,\ a_{16} > 0,\ a_{17} < 0,\ a_{18} < 0 \quad (2)$$

Empirical Results

Estimating Eq. (1) by OLS and adopting the White (1980) heteroskedasticity correction yields the results shown in columns (a) and (b) of Table 3. All seven of the non-control variables exhibit the expected signs, with six statistically significant at the 1 % level and one statistically significant at the 5 % level. Among the temporal and weather control variables, all 11 exhibit the expected signs, with five statistically significant at the 1 % level, two statistically significant at the 5 % level, and one statistically significant at the 10 % level. The coefficient of determination is 0.54, so that the model explains more than half of the variation in the total gross revenue variable. The *F*-statistic is significant at the 1 % level, attesting to the overall strength of the model.

First we consider the impacts of the marketing mechanisms, i.e., promotions. The estimated coefficients on the four marketing variables considered, LOWVALMERCH, HIGHVALMERCH, GROUP, and FIREWKS are positive and statistically significant. Thus, in 2006, when Carolina League home teams offered fans enticements at a game that fell under the rubric of either LOWVALMERCH, HIGHVALMERCH, GROUP, or

Table 3 Empirical results

Dependent variable: TOTALREVENUE Dependent variables:[a]				
	(a) Coefficient	(b) t-value	(c) Coefficient	(d) t-value
Constant	5,401		4,853	
TKTPR	2,979[b]	6.75	2,971[b]	6.66
POP	0.0154[b]	7.41	0.016[b]	7.43
PCTPOV	−490[b]	−15.60	−480[b]	−16.62
LOWVALMERCH	1,583[c]	2.26	1,620[c]	2.32
HIGHVALMERCH	3,937[b]	3.25	3,975[b]	3.31
FIREWKS	13,886[b]	11.02	13,953[b]	11.09
GROUP	2,407[b]	2.90	2,486[b]	3.02
SUN	348	0.33	518	0.50
MON	−2,839[b]	−3.21	−2,951[b]	−3.34
TUE	−3,045[b]	−3.01	−2,902[b]	−2.87
FRI	2,844[b]	2.52	3,071[b]	2.70
SAT	8,138[b]	7.66	8,356[b]	7.88
MAY	1,466	1.46	1,240	1.41
JUN	2,062[d]	1.76	2,031[d]	1.75
JUL	3,978[b]	4.13	3,964[b]	4.11
AUG	2,186[c]	2.45	2,114[c]	2.37
RAIN	−8,971[c]	−2.33	−9,237[c]	−2.43
CLDPARTCLD	−793	−1.18	−851	−1.22
FOODDRINK	–	–	1,382	1.15
BEER	–	–	967	0.51
R^2	0.54		0.55	
adjR^2	0.53		0.53	
F	62.87[b]		56.6[b]	

[a] Terms in parentheses beneath coefficients are signed *t*-values

[b] Indicates statistical significance at 1 % level

[c] Indicates statistical significance at 5 % level

[d] Indicates statistical significance at 10 % level

FIREWKS, total gross revenues on average increased, respectively, by $1,583, $3,937, $2,407, and $13,886, *ceteris paribus*. Clearly, the fireworks displays, which are the most costly of these marketing tools, yield the biggest revenue increases (and, no doubt, attendance increases), followed by high value merchandise promotions. The group rate promotions and low value merchandise promotions both also yield revenue increases, but on a much smaller scale. Of course, the latter two marketing forms are also less costly than the former two.

Next, the results for the three purely economic variables are considered. The estimated coefficients on all three variables exhibit the expected signs and are statistically significant at the 1 % level. Thus, total gross revenues are an increasing function of the

population in the metropolitan area where the home team plays (POP), which is logical since a larger population implies a larger potential customer base. It also seems that those teams in the Carolina League that charge higher prices on general admission tickets experience higher total gross revenues.[6] Finally, it also appears that the higher the percentage of the population in the metropolitan area where the home team plays that is "poor," the lower the team's total gross revenues. Overall, then, economics factors clearly influence minor league team revenues.

Lastly, we consider the temporal and weather dummies. The estimated coefficients on FRI and SAT are both positive and statistically significant at the 1 % level, those on MON and TUE are both negative and statistically significant at the 1 % level, and that on SUN is not statistically significant at the 10 % level, all as hypothesized. The estimated coefficients on variables JUL and AUG are both positive and statistically significant at the 1 % and 2 % levels, respectively. Finally, the estimated coefficient on the RAIN dummy is negative and statistically significant at the 2 % level. Overall, *ceteris paribus*, the results for the control variables suggest that Friday and Saturday games are the most likely to yield higher gross revenues, whereas Monday and Tuesday games are the most likely to yield lower gross revenues. Furthermore, games played in July and August are the most likely to yield higher revenues, although there is modest evidence that June games can be revenue enhancing. Otherwise, games played on Sundays and during May should not be regarded as enhancing revenues appreciably. Finally, there is evidence that rainy days reduce total gross revenues.

Not only as a simple test of robustness, but also in order to provide potential insights into the factors influencing minor league team revenues, the model in Eq. (1) is expanded to include two additional promotion forms, namely, FOODDRINK and BEER. FOODDRINK is a binary variable indicating whether discounts or specials on concession items such as 2-for-1 hotdogs or soft drinks at a game were offered, and BEER is a binary variable indicating whether two-for-one beer prices or some such discount on mugs of beer were offered at a game. In theory, each of these two promotions could act to attract more fans to a game, and these fans potentially pay not only for admission, but also for food and drink and/or beer as well as other items offered for sale at the stadium, including (potentially) MLB merchandise. Hence, the expected signs on these two coefficients are positive.

The estimation of Eq. (1) with these two additional variables included in the model is provided in columns (c) and (d) of Table 3. Of these 20 estimated coefficients and *t*-values, 18 have counterparts in columns (a) and (b). In all 18 of these cases, the coefficients and *t*-values in columns (c) and (d) very closely resemble those in columns (a) and (b). Ergo, there is a degree of confirmation of the conclusions summarized above.

Even the R^2 and adjusted R^2 values are effectively identical in the two estimated models, with only a modest difference found when comparing the two *F*-statistics. In the second estimate, the coefficients on the FOODDRINK and BEER variables, although positive and in line with expectations, both fail to be statistically significant at even the 10 % level; thus, it appears that promotions involving food and drink or beer may not

[6] Presumably, within the price range of these tickets, namely, $6 to $8, demand is not significantly reduced by higher prices. It could be argued that if prices were to be elevated much above the upper end of this range, they potentially might exceed the price of movie tickets and that minor league team revenues could suffer from the competition.

exercise a discernible influence over minor league revenues.[7] In any case, the results obtained in the initial estimate of Eq. (1) appear to be somewhat resilient.

Conclusion

In this empirical study, we find that total revenues at minor league baseball games are influenced by marketing, economic factors, scheduling, and the weather. In particular, total gross revenues are an increasing function of marketing/promotions such as low value merchandise giveaways, high value merchandise giveaways, group discounts, and fireworks displays. Revenues are also an increasing function of the metropolitan area population and a decreasing function of poverty rates. Teams with higher priced general admissions tickets also experience higher revenues. Revenues are generally higher on Fridays and Saturdays and during July and August (and possibly June), while being lower on Mondays and Tuesdays and during May. Finally, inclement weather, especially rain, reduces revenues.

In closing, it would appear that a good "big picture" long term strategy for MLB teams would include not only careful application of promotions but also the choice of higher population metropolitan areas for the minor team location as well as metropolitan areas with lower poverty rates.

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[7] Doubtless, the statistical insignificance of FOODDRINK and BEER are responsible for the moderate decline in the *F*-statistic in the second estimate.