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## Regional Differences in Fan Preferences for Minor League Hockey: The AHL

Rodney J. Paul\* & Robert Chatt\*

### Abstract

Regional differences in fan preferences for minor league hockey in the United States are explored using simple linear regression models. The top-level minor league for the NHL, the American Hockey League (AHL), was studied for the 2008-09 season. Key attributes with respect to attendance are studied for hockey including population, income per capita, promotions, scoring, and winning percentage. In addition, a key socio-economic variable, fighting is also investigated. Major differences are found for fan preferences across geographic regions in relation to population, income per capita, a variety of promotions, and team success. In addition, fan reaction to fighting tends to differ greatly by region, with it having a positive effect in the Mid-Atlantic (East Division) and Western (West Division) regions, but having a negative and significant effect in the New England-area (Atlantic division).

An attendance model for the top minor hockey league in North America, the American Hockey League (AHL), is specified and a variety of factors which may influence fan attendance are studied. Game-by-game attendance figures were gathered from the AHL website, [www.theahl.com](http://www.theahl.com), along with the day of the game, team records, team scoring, and per-game fight data. Demographic data were gathered for the cities which host AHL franchises and, in addition, promotional data from individual team websites and pocket calendars were collected and converted into dummy variables representing different types of promotions. Upon gathering the data, it became apparent that substantial regional differences appeared to exist in fan preferences for certain attributes. Therefore, regressions for the overall league and for each individual division, to account for regional differences, were run and the results are presented.

A focus is placed on a variety of factors to attempt to determine what influences fan decisions to attend AHL hockey games. One key variable examined is the role of fighting, which has been explored in the NHL before in Jones, Stewart, and Sunderman (1996) and Paul (2003). In these papers, fighting was shown to have a positive and significant effect on attendance. The importance of winning, which may or may not be as important at a minor-league level as compared to a major-league level, was also studied on a game-by-game basis throughout the season. A proxy for in-game

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excitement, scoring in these games, was also tested. Promotions were also studied which include events, merchandise giveaways, reduced food and beverage prices, group nights, etc. These data were used to determine how much of an impact, if any, these promotions have on attendance.

Upon gathering and studying the data, it became apparent that there are some key regional differences in fan preferences for AHL games. To illustrate this, the regression model for the AHL as a whole is also run for each of the four divisions. The four divisions consist of the Eastern Division (Mid-Atlantic Region), Atlantic Division (New England), North Division (Canada, Western NY, Ohio), and West Division (Midwest US – both Northern and Southern). A full listing of the team cities and their division is given in Appendix I at the conclusion of this paper. These regional distinctions illustrate where certain performance-based variables and demographic variables differ for AHL Fans in relation to attendance.

The paper proceeds as follows. A simple game-by-game attendance model for the AHL is set up and the dependent and independent variables are explained. The regression results are presented and explained in the context of their relationship with per-game attendance. Regional differences are then explored by division. Discussion of the results and conclusions occur in the final section.

## **II. American Hockey League Attendance Model**

Hockey attendance has not been studied as often as baseball attendance. The literature surrounding hockey attendance has mainly focused on the effects of fighting and rule changes. Past studies of the National Hockey league include Jones (1984), Jones, Ferguson, and Stewart (1993), Jones, Stewart, and Sunderman (1996), and Paul (2003). These studies found that fighting increases attendance at the National Hockey League level. Attendance at minor league games has been studied recently by Hong (2009) and Rascher, Brown, Nagel, and McEvoy (2009).

Per-game attendance is used as the dependent variable for the model for each league. Independent variables are grouped by categories which include timing of the game (days of the week dummies with Wednesday being the omitted day and January being the omitted month), opponent (division rivals), promotions, demographics (population and income per capita), and on-ice team performance (win percentage, total goals scored per game, fights per game average).

Days of the week and months of the year dummy variables are included in the regression to account for daily and monthly effects. Weekends and months later in the season (during the playoff push) are expected to show positive and significant results. Wednesday is the omitted dummy for the days of the week and January is the omitted dummy for the months of the hockey season, with all other daily and monthly results compared to these days. A dummy variable is included for within-division games. This variable accounts for the opponent. If divisional games attract a greater number of fans to the arena, this variable will have a positive and significant coefficient.

Promotional data were taken from the team websites and from pocket schedules which listed game promotions. Promotions can have an important impact on per-game attendance for sports

teams. Promotions may even be more important at the minor-league level, where team winning may not be the most important factor to fans when making the decision to purchase tickets. Promotions have been studied before in the literature for sports such as Major League Baseball (McDonald and Rascher, 2000), where some promotions were found to increase attendance.

The promotional information available from the teams was made into a series of dummy variables representing the different categories promotions could fall into. After observing the data, the promotions were broken into ten categories. These categories included opening night festivities, merchandise giveaways, autographs, fan appreciation nights, group nights, bobble head giveaways, food giveaways or discounts, free or reduced-price ticket nights, and beer nights. If the goal of these promotions is to bring a greater number of fans to the arena, their effects should be positive and significant.

The on-ice performance variables were broken into the effects of winning (win percentage), scoring, and fighting. The AHL uses a point-based standings system, with two points for a win, one point for an overtime loss or shoot-out loss, and no points for a regulation loss. Therefore, win percentage was calculated by the number of points attained by the home team out of the total points possible (two times the number of games played). This variable was calculated as a running average and the value at any given time is the percentage of possible points achieved going into the current home game. If fans value a winning team at the minor league level, instead of only valuing marketing gimmicks or seeing certain players who are approaching the major league level, the win percentage entering the game is expected to have a positive and significant effect on attendance.

Scoring is also calculated as a running average going in the current home game. Originally, the regression was run with goals for average and goals against average (and with just goals for average), but we recognize that teams need to score to win. Therefore, there is likely multicollinearity between winning and goals scored. To avoid these problems, the goals for per game and goals against per game variables are summed to get the total goals in the game each team plays. This allows the goals variable to distinguish teams which play high scoring games as opposed to low scoring games, still allowing for the independent effect of win percentage in the model.

Fighting in hockey is often a hotbed issue for the media, fans, and the leagues in general. Past studies on the effects of fighting have shown that increases in fighting have led to increases in attendance. A positive and significant effect of fighting on attendance was shown for teams based in the United States in Jones, Stewart, and Sunderman (1996). Using data from a decade later, the 1999-2000 season, positive increases in attendance were found in relation to fighting for both U.S. and Canadian based teams (Paul, 2003). The effect of violence in sports, particularly hockey, is of great interest to researchers in many disciplines and determining the importance of fighting for hockey at the minor league level will allow a deeper exploration of this topic. Fighting was calculated on a per-game basis (as were the scoring and winning variables above) and the variable is the average fights per game going into the current home game.

The first table below presents the summary statistics<sup>1</sup> of the non-dummy variables involved in the regression. The second table presents the regression results for the AHL as a whole (first column after the listing of the independent variables) and for each division in the AHL. Overall, each team in the AHL plays 40 home games in an 80-game regular season. Seven teams did not have promotional information listed on their website and did not respond to our requests for promotional information. These teams are Iowa, Rockford, Hamilton, Syracuse, Toronto, Worcester, and Philadelphia. These teams are not included in the regression results in table II below.

Given issues with heteroskedasticity, the regression was run with White's heteroskedasticity-consistent standard errors and co-variances. Those adjusted results are what are presented in the table below. Omitted promotional categories for some divisions signify that none of the teams in that division had those types of promotions during the season. Statistical significance in the regression results is noted with \*-notation as \* represents significance at the 10 percent level, \*\* at the 5 percent level, and \*\*\* at the 1 percent level.

**Table I: Summary Statistics of Non-Binary Variables**

	Population	Income Per Capita	Total Goals Per Game	Fights Per Game	Per Game Attendance
Mean	510,093.207	38,574.966	5.879	1.148	5,111.763
Standard Deviation	757,896.114	6,947.247	0.659	0.377	2,420.939

**Table II: AHL Attendance – Overall and by Division**

Variable	AHL	AHL – East	AHL-Atlantic	AHL-North	AHL- West
Constant	457.2861 (0.5946)	-7096.578*** (-5.5253)	5609.421** (2.2965)	-1145.867 (-0.2463)	11888.40*** (4.5204)
Sunday	838.6949*** (4.2121)	906.9577*** (2.8150)	186.4546 (0.4651)	383.6768 (0.8367)	63.7488 (1.6375)
Monday	-89.2800 (-0.2391)	-1545.590*** (-4.8339)	-262.6466 (-0.2171)	275.5802 (0.3100)	-485.4387 (-0.8187)
Tuesday	-25.7988 (-0.0879)	-523.5714 (-0.9875)	271.7424 (0.2563)	180.3114 (0.2604)	-234.3723 (-0.4470)
Thursday	114.5782 (0.3816)	-237.6598 (-0.4501)		-75.9937 (-0.1612)	-700.4484 (-1.4408)
Friday	1305.860*** (7.2939)	618.7203** (2.4624)	1020.949*** (3.0247)	1510.861*** (3.0242)	1842.626*** (4.5859)
Saturday	2032.642*** (10.7034)	1264.470*** (4.6253)	1687.037*** (4.9706)	2069.043*** (3.4614)	3067.576*** (6.8446)
October	-1530.977*** (-6.8969)	-1308.487*** (-2.7787)	154.3419 (0.2727)	-1190.593* (-1.9556)	-2002.694*** (-5.3413)
November	-667.7743*** (-3.6773)	-530.6127* (-1.8572)	-492.4150 (-1.4572)	-565.3075 (-1.0578)	-1160.448*** (-2.8989)
December	-607.1012*** (-3.3098)	-601.1853** (-2.2005)	-833.1882*** (-2.7139)	-528.6852 (-1.1366)	-662.9456 (-1.8091)
February	48.0064 (0.2422)	228.2428 (0.9099)	-117.2129 (-0.3557)	467.7853 (0.8076)	-439.6132 (-1.0813)

March	303.4990 (1.5602)	222.0875 (0.7840)	-212.3153 (-0.6083)	695.5023 (1.3231)	233.7231 (0.5265)
April	834.7148** (2.4443)	244.8502 (0.8124)	662.0598 (1.5082)	1148.063* (1.7200)	662.4376 (1.2851)
Division Opponent	-66.2989 (-0.5672)	24.2350 (0.1443)	-103.4826 (-0.4659)	-118.6524 (-0.4264)	-67.2631 (-0.2686)
Opening Night	2114.186*** (4.5564)	1708.680 (1.3909)	4702.606*** (4.5638)	3404.619*** (4.0246)	1440.423** (2.1500)
Merchandise	946.8431*** (5.4621)	377.5592* (1.7270)	1550.297*** (5.3141)	86.0713 (0.1539)	555.6066 (1.6254)
Event	809.6809*** (4.8390)	64.6771 (0.3377)	931.8654** (2.3810)	1661.611*** (3.5654)	727.9321** (2.3578)
Auto	-452.1576 (-0.7333)	1727.538* (1.6558)	-1279.894* (-1.8356)	287.2153 (0.4836)	-182.2269 (-0.5875)
Fan Appreciation Group	1500.445** (2.0489)	765.4899 (1.5084)	1129.452 (1.2754)	3833.263 (1.3285)	1595.106** (2.06676)
Bobble Head	-114.9739 (-0.5945)	-492.2404** (-2.2503)	194.3184 (0.4200)	-107.0170 (-0.2096)	324.5036 (0.7352)
Food	-82.8916 (-0.2846)	769.5472** (2.3353)	-972.2449** (-2.5356)	-530.3340 (-0.6369)	-58.0551 (-0.1240)
Free Ticket	924.7972*** (3.0206)	310.6862 (0.6971)	-2302.121*** (-6.5245)	107.3401 (0.1607)	1212.033** (2.0577)
Beer	-591.4992*** (-2.6186)		190.6006 (0.2741)	-802.0791 (-1.7426)	-1020.393 (-1.6248)
Population	-29.1789 (-0.0816)		-115.2712 (-0.2123)	736.3395 (0.7282)	1445.537** (2.0193)
Income	0.0005*** (5.0502)	-0.0092*** (-5.6586)	0.2039*** (3.3811)	0.0028 (1.3505)	0.0014*** (9.3036)
Win Percent	-0.0058 (-0.6292)	0.0952*** (5.8911)	0.0408** (2.1251)	0.2170** (2.3449)	-0.2336*** (-5.6177)
Total Goals	3425.871*** (7.9351)	4214.860*** (3.5248)	1645.213 (1.3769)	2786.686*** (2.6657)	1034.122 (1.1591)
Fights	436.7462*** (4.5030)	727.4128*** (5.8148)	-790.5202** (-2.4737)	-599.9608* (-1.8443)	-189.4496 (-0.9865)
	-802.1457*** (-4.5071)	1539.385*** (3.2995)	-2010.110*** (-3.1018)	199.6766 (0.3618)	592.6106* (1.6844)
R-Squared	0.3867	0.7394	0.5449	0.7037	0.6763

In interpreting the results, we'll first discuss the findings for the AHL overall, then discuss the differences found regionally across divisions. For the overall AHL, the intercept was found not to be significantly different from zero. In relation to the days of the week, which were all compared to the omitted day – Wednesday, weekends were found to be the most popular in terms of attendance. Saturday was found to have the highest attendance, with over 2,000 additional fans in attendance compared to the mid-week omitted dummy variable, and was found to have a significant effect at the 1 percent level. Friday was also found to have a positive (over 1,300) and significant effect (at the 1 percent level). Sunday was also found to have a positive and significant effect (over 800 additional

fans). Mondays generated the lowest attendance (-89 fans compared to Wednesday), but was not found to be statistically significant.

The months of the year dummies revealed that attendance in the AHL generally increased throughout the season. Compared to January, the omitted month, October, November, and December were found to have negative and significant effects at the 1 percent level. April revealed positive and significant (at the 5 percent level) results. The push for the playoffs may contribute to these results, or possibly nicer weather in the spring could bring in larger crowds to the arena.

Various forms of promotions appeared popular across the cities in the American Hockey League. The promotions that brought the largest increases in attendance were found to be opening night festivities, fan appreciation nights (which often feature major lottery giveaways such as trips or game-worn jerseys), free or reduced-price food, merchandise giveaways, or events (such as concerts or special appearances by celebrities or costumed cartoon-characters). Other promotions, however, did not generate positive and significant increases in attendance. Promotions such as bobble-heads, autograph sessions, and group nights did not appear to have an effect on attendance. Free ticket promotions were found to generate negative and significant returns. These free ticket giveaways likely occur on otherwise unpopular games (mid-week games, etc.), which may generate these negative results.

In relation to the demographic fixed-effects, population was found to have a positive and significant effect on attendance, as larger cities attracted more fans. Income per capita was not found to have a significant effect on per-game attendance. The sign on income per capita was negative, suggesting some possibility of the AHL as an inferior good.

As for on-ice play, fans generally appear to enjoy winning teams, higher-scoring games, and fewer fights, although, as discussed in the next section, there seems to be considerable regional differences in fan preferences when examining individual divisions. For the AHL as a whole, the win percentage of the home team entering the game was found to have a positive and significant effect on attendance at the 1 percent level. Fans also seemed to enjoy higher-scoring games as the total goals variable (goals-for-per-game average plus goals-against-per-game average – both computed entering the game), was found to have a positive and significant effect on attendance. If goals are a proxy for excitement in a game, fans appear to respond favorably to more exciting games. In relation to fighting, a negative and significant effect on attendance was found. This is the opposite of the results found for the NHL (Paul, 2003 and Jones, et al., 1990), which could mean that minor-league fans do not enjoy fights as much as major-league fans. There are significant regional differences across the league, when it comes to fighting, as seen in the division regression results and discussed in the next section.

### III. AHL Attendance Regression Results by Division

Table II presents the results by division, in addition to the results for the overall AHL, which were discussed in the previous section. Although there are relative magnitude differences between attendance by division in the AHL due to the day of the week and month of the year dummies, which are interesting and would be important to ascertain why they are different (perhaps due to substitute entertainment activities in regions of the country, existence of local professional sports teams and their success level, weather differences, etc.), the main focus of this section is on the effects on attendance due to promotions, demographics, and the hockey-related game factors of winning, scoring, and fighting.

In relation to the effects of promotions, there were key similarities and differences across divisions and geographic regions. Opening night festivities were shown to have positive and significant effects on attendance in three of the four divisions (Atlantic, North, and West). Merchandise giveaways were found to have a positive and significant effect in two divisions (East and Atlantic). Events were found to have positive and significant effects in three divisions; these divisions were the Atlantic, North, and West. Fan appreciation games and beer-related promotions were only found to have a significant effect (positive) in the West division.

Other interesting results in relation to promotions seemed to be grouped by division. The Atlantic division, mainly in the New England states, appeared to dislike games with autographs and bobble heads. In addition, fans in the Atlantic division seemed to have an extreme aversion to games with food-related promotions. Over 2,000 fewer fans attended Atlantic division games where food promotions were sponsored by the teams. It seems unlikely these fans would dislike lower priced or free food, but they may have turned away due to negative externalities generated by this promotion. In other words, the clientele which attends games for free or reduced price food may deter other fans from attending games, particularly in the Atlantic division (New England region).

Fans of the East Division teams (Mid-Atlantic States region) had distinctly different preferences. While they enjoyed autograph nights and bobble heads (positive and significant effects), they had a dislike for group nights. Group nights led to nearly 500 fewer fans per game in the East division. Fans of these teams may dislike nights aimed at distinct groups and could possibly feel alienated when these fans attend a group night not aimed at them. Therefore, it appears many fans in this region simply do not attend games on group-themed nights.

The demographic variables, population and income per capita, are shown to have different effects across divisions and regions. Higher population within the city area led to increases in attendance in the Atlantic and West divisions. In the East and North divisions, more populous cities actually led to a decrease in overall attendance. The existence of NHL hockey substitutes near cities in the East and North divisions may contribute to this result. Income per capita was found to have a positive and significant effect on attendance in the East, Atlantic, and North divisions, but a negative effect on the West division, which apparently drove the overall results at the AHL level.



The effects of variables related to the play on the ice in AHL hockey were also found to have mixed results across divisions and geographic regions. The importance of winning was mainly seen in the East and North divisions, which were the only divisional regressions where this variable was found to have a significant (positive) result. This could represent differences in the preferences of fans for winning, as opposed to enjoyment from just watching a game. However, given the proximity of these teams to major NHL markets (and the availability of the other minor league hockey cities in the ECHL and others) and the results discussed above relating to the effects of population, having a winning team may be more important here than other divisions.

The effects of scoring were also found to be mixed. Although the overall regression results were shown to be positive and significant, the only positive and significant effect for the individual divisions was again found for the East division. These fans appear to attend more games when they are expected to be higher-scoring. Negative effects of scoring, which could represent a preference for more defensive-oriented hockey, were found in the Atlantic and North divisions as negative and statistically significant effects were found.

Substantial differences were also found with respect to fan interest in hockey fights. As stated previously, the overall effect for the AHL was found to be negative. This result, however, appears to be driven by fans in New England (the Atlantic Division). These fans appeared to have a disdain for fighting, as teams which fought more saw significant decreases in attendance<sup>2</sup>. This anti-violence sentiment (which may be consistent with anti-war sentiment in New England) led to fewer fans at these AHL games.

In contrast, the East and West division fans seemed to appreciate fighting at AHL games, as fights-per-game were found to have a positive and significant effect on attendance (the North division was shown to have a positive effect, but was not significant). Fighting could also be a proxy for more exciting games overall, as more fights may occur when teams are playing a more intense-style game (i.e. a high energy game with many hits which may eventually lead to fights). Alternatively, fighting could emerge as result of games involving clutching-and-grabbing, which may ultimately frustrate the players and the fans in attendance, leading to less interest in these types of games. The positive results on attendance related to fighting in these divisions are consistent with what was found in studies of the NHL (Paul, 2003 and Jones et al., 1990). The negative effects of the Atlantic division, however, dominate at the aggregated AHL level, which is why the overall league regression reveals fighting as having a negative and significant effect.

#### **IV. Conclusions**

The top-level minor league in professional hockey, the American Hockey League (AHL) was studied and the determinants of per-game attendance were analyzed. The data set included demographic information on the cities of the teams, the day and month of the game, team performance on the ice, and promotions at these hockey games. The results for the overall AHL were

explored, but results were also shown by division, to illustrate some significant regional differences in preferences for factors which influence fans' decisions to buy tickets.

For the overall AHL, expected results were found in relation to the timing of games. Weekend games were much more popular than weeknight games and attendance increased later in the season during the playoff push. Per-game attendance was found to increase with the size of the population, but income per capita was not shown to have a significant effect. Some promotions were found to be quite popular with fans of the AHL. Opening night festivities, merchandise giveaways, post-game events, fan appreciation nights, and free or reduced-price food all had positive and significant effects. In relation to on-ice performance, winning teams attracted more fans as the win percentage entering the game was shown to have a positive and significant effect on attendance. Total goals per game, measured as the sum of the average goals for per game and goals against per game of the home team (to avoid multicollinearity problems with win percentage), was also shown to have a positive and significant effect, suggesting fans prefer higher-scoring contests to lower-scoring contests. Fighting (measured as an average of fights-per-game for the home team) was shown to have a negative and significant effect for the AHL, which was the opposite of the result found by Jones, Stewart, and Sunderman (1996) and Paul (2003).

In gathering and observing the data by team, there appeared to be some distinct regional differences, therefore regressions were also run by division. Although promotional effects and timing of game effects existed across the divisions, the key differences for this analysis lie in the demographic data and in the on-ice performance. Population was found to have a positive and significant effect in the Atlantic (New England) and West (Midwest – as the AHL does not extend very far west) divisions, but a negative and significant effect in the East division (Mid-Atlantic States). The West division was the only division found to have a negative (and significant) effect of income per capita on per-game attendance, while the other divisions were found to have positive and significant effects.

In relation to on-ice performance, in the East division (Mid-Atlantic) region of the country, win percentage and total goals per game were found to have large positive and significant effects on attendance. Fans in the North division also appeared to respond favorably to home team win percentage where positive and significant effects from this variable were shown. Total goals were found to have a negative and significant effect in the Atlantic and North divisions, a positive and significant effect in the East division, and non-significant effects in the West division.

In relation to preferences for fighting, there were distinct differences across divisions. The Atlantic division (New England) seemed to have a general disdain for fighting as the fights per game variable was found to have a big negative and significant effect on attendance. Although this division dominated the overall regression results for the league, upon closer inspection of the individual division, the other three divisions showed positive effects related to fighting, with the East and West divisions having statistically significant positive effects.

The results of this study reveal that there are distinct regional differences in preferences for attending hockey games which may have to do with attitudes toward violence, available substitutes for hockey (the NHL, college hockey, other minor-leagues, etc.), or other factors. Although fans of the top minor hockey league, the AHL, appear to generally value teams which win, exciting high-scoring games, and fun and/or valuable promotions, key regional differences may play an important role in attempting to maximize attendance and revenues at the team- or league-level.

#### ENDNOTES

1. Canadian dollars were converted into U.S. dollars at the exchange rate at the conclusion of the season (shortly after the data were gathered).
2. The AHL has seen an overall decline in average penalty minutes per team since the NHL lockout of 2004-05. Teams in the Atlantic Division averaged nearly 2000 penalty minutes per season during the NHL lockout year, but it had declined in the seasons since then to a level of slightly over 1400 penalty minutes per team per season.

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**Appendix I: AHL Cities and Divisions**

**East Division:** Albany (NY), Binghamton (NY), Bridgeport (CT), Hershey (PA), Norfolk (VA), Philadelphia (PA), Wilkes-Barre/Scranton (PA)

**Atlantic Division:** Hartford (CT), Lowell (MA), Manchester (NH), Portland (ME), Providence (RI), Springfield (MA), Worcester (MA)

**North Division:** Grand Rapids (MI), Hamilton (ONT, Canada), Lake Erie (Cleveland), Manitoba (Winnipeg, Canada), Rochester (NY), Syracuse (NY), Toronto (ONT, Canada)

**West Division:** Chicago (IL), Houston (TX), Iowa (Des Moines), Milwaukee (WI), Peoria (IL), Quad City (Moline, IL), Rockford (IL), San Antonio (TX)