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Attendance in the Canadian Hockey League: The Impact of Winning, Fighting, Uncertainty of Outcome, and Weather on Junior Hockey Attendance

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Abstract: An attendance model is specified for the Canadian Hockey League (CHL), the top level of junior hockey in Canada with some teams located in the United States. The natural log of attendance is used as the dependent variable, with explanatory variables consisting of the timing of the game, team performance characteristics, uncertainty of outcome measures, and weather-related variables. Weekends and Mondays were the most popular days for games. Winning and fighting were shown to be popular team characteristics that drive attendance. Uncertainty of outcome plays little role, if any, in fan interest at this level, while precipitation significantly reduces attendance.

Keywords: attendance; hockey; fighting; uncertainty of outcome

JEL Classification: Z20; D12

1. Introduction

In sports, an important component of financial performance of a franchise is attendance. Attendance as a key factor of financial performance has been shown in sports such as soccer in France (Andreff 2018; Scelles et al. 2018) and in England (Szymanski 2017). Even in leagues with major television deals, attendance has a significant positive impact on the financial value of sports firms (i.e., Scelles et al. 2013c, 2016a, 2017).

This article focuses on the determinants of attendance in the Canadian Hockey League (CHL), which is the top-tier of junior hockey in Canada (with some franchises located in the United States as well). In recent years, two variables have been explored and debated as it relates to their role in hockey attendance. These two variables are fighting and uncertainty of outcome. Fighting has seemingly always been a hot topic as it relates to its implications on the sport. Recent examples of the study of the role of fighting in hockey include Burdekin and Morton (2015) and Rockerbie (2016). One argument on the business-side of hockey, as it relates to fighting, is that fisticuffs[1] between the players is an aspect of the game that is enjoyed by fans. Various studies have linked the frequency of fighting to attendance, but these studies have mostly focused on older players as professionals. About uncertainty of outcome in relation to game competitive balance[2], measured directly from game odds in the betting market, the

[1] Fisticuffs refers to fighting with the fists, which occurs in hockey fights when players discard their gloves and fight with each other.
[2] This study focuses on uncertainty of outcome related to the individual game. Other elements of uncertainty of outcome relate to seasonal factors such as a team being in contention for the playoffs or for a qualification in continental competitions.

traditional theory that fans enjoy games between evenly matched-teams (resulting in a high level of uncertainty of outcome) has been challenged by an alternative theory based upon reference-dependent preferences, loss aversion, and a desire to witness upsets (Coates et al. 2014). While these issues have been studied at the professional level for adults playing the sport, it is informative to ascertain how these factors, and others, affect fan decisions at the junior hockey level, where players are much younger than those participating in the professional ranks.

The CHL consists of three leagues, the Ontario Hockey League (OHL), the Quebec Major Junior Hockey League (QMJHL), and the Western Hockey League (WHL). Each league has their own regional restrictions in Canada and the United States from which they draw players and there are limited allowances for players from Europe and other places in the world through the CHL Import Draft. The CHL Import Draft allows CHL teams to draft players whose parents are not residents of Canada or the United States. These imports can only be obtained through the draft and each team may only have a maximum of two imports on their roster. The three leagues play their own individual seasons, followed by playoffs. In the two seasons (2016–17 and 2017–18) studied, the Ontario Hockey League had twenty teams, the Quebec Major Junior Hockey League had eighteen teams, and the Western Hockey League had twenty-two teams. In each league, sixteen teams qualified for the playoffs each season. The winner of each league's playoff, combined with the team from the host city (chosen in advance), played for the championship of the CHL in the MasterCard Memorial Cup at the conclusion of the hockey season.

To compete in the CHL, players must be at least sixteen years of age, with exemptions granted for players of "exceptional status", who may begin playing at the age of fifteen. Some players who were granted "exceptional status" include current National Hockey League (NHL) (the top hockey league in North America and the world) stars John Tavares, Aaron Ekblad, and Connor McDavid. Players in the CHL may play until they reach the age of twenty. Teams can have three "overage" (20-year old) players and up to four sixteen-year-old players (or fifteen with "exceptional status") on their rosters. The rules of the game mimic those of the NHL, including the allowance of fighting in the sport, which earns each player a five-minute penalty for this infraction. As a side note, from the perspective of the National Collegiate Athletic Association (NCAA) (a non-profit organization that regulates collegiate athletics), players who play in the CHL are considered professionals and lose their eligibility to play college hockey in the United States.

As mentioned at the start of the introduction, this study investigates the determinants of attendance for teams in the CHL. Using an ordinary least squares regression model, factors related to game timing, weather conditions, team performance, and outcome uncertainty are tested to determine their significance and influence on individual game attendance for each of the teams in the three leagues that comprise the Canadian Hockey League. Specifically, the main null hypotheses tested include the implications of the uncertainty of outcome hypothesis, the role of winning (measured as a points-per-game running average), and the role of fighting as it relates to fan interest. The uncertainty of outcome hypothesis has been shown to have mixed results across sports and it is informative to ascertain if this factor plays any role (and if so, what role) in fan decisions for junior hockey. Logically, winning would be expected to influence fan decisions and fighting has been shown in the past to be a significant factor in fan decisions. However, this league is for young players (twenty years of age and under) and is a key developmental level in the training of many young players. These factors may lead to fans having different preferences for junior hockey compared to professional hockey. Therefore, this research explicitly models and tests these null hypotheses for a sample of two complete regular seasons (playoff games were not included) in the CHL (2016–17 and 2017–18 seasons).

Studies related to this aspect of outcome uncertainty include Fort and Maxcy (2003), Garcia and Rodriguez (2002), Andreff and Scelles (2015), Scelles (2017), and Scelles et al. (2013a, 2013b, 2016b).

The paper is structured as follows. Section 2 provides a brief literature review on attendance studies as it relates to the sport of hockey. Section 3 describes the empirical model and presents the regression model results. The final section discusses the findings and concludes the paper.

2. Literature Review

Recent literature on hockey attendance has focused on the role of structural breaks in time-series data over many seasons. Using data on teams in existence for over forty seasons (29 in Major League Baseball, 13 in the National Basketball Association, and 11 in the National Hockey League), Mills and Fort (2018) extended the study of structural break points to the team level. They found mixed evidence of the role of outcome uncertainty on attendance through empirical testing of game uncertainty, playoff uncertainty, and consecutive season uncertainty. They also found considerable differences in their team-level analysis compared to league-level analysis as it relates to break points in the data.

Treber et al. (2018) examined the NHL lockouts in 1994–95, 2004–05, and 2012–13. They found evidence of a decrease in attendance following the lockout of 1994–95 and a decrease in revenue for the league following the lockouts of 2004–05 and 2012–13. Although the lockouts had a negative influence on fan demand for NHL games, the authors suggest that the cost savings generated by the lockouts could be enough to offset the reduction in attendance and revenue, leading to the lockouts still being an optimal strategy for the league.

One of the key components of the economic research surrounding game-to-game hockey attendance is an investigation into fighting. The role of fighting in the NHL has been studied previously in Jones (1984), Jones et al. (1993), Jones et al. (1996) and Paul (2003). Fighting was shown to have a positive and significant effect on attendance in each study. Although there were differences in magnitude as it relates to the country where NHL games were played, the impact of fighting on attendance was seen in both Canadian and American cities. Rockerbie (2012) found that NHL fans respond positively to greater violence, with hitting having a greater effect on attendance than fighting.

In most European leagues, fighting is met with immediate rejection from the match, not a 5-min penalty as it is in the NHL and other leagues in North America. Although fighting is not allowed in the DEL league in Germany, evidence was found that penalty minutes, a proxy for physical play, increased attendance in this league (Coates et al. 2012). Physical play (using penalty minutes as a proxy) was not found to significantly impact attendance in the SM-Liiga in Finland (Coates et al. 2012). Fighting was not shown to have a statistically significant impact on attendance in junior hockey in the Quebec Major Junior Hockey League (Paul and Weinbach 2011).

Fighting and physicality may play a role in attendance in some leagues, but studies have also investigated if fighting tends to contribute to game outcome success. Leard and Doyle (2011) studied fighting, determining winners and losers of individual fights in the NHL, and did not find a statistically significant relationship between winning fights and winning games. Coates et al. (2012) found a negative relationship between fighting and team success in the NHL.

In terms of the North American minor hockey leagues, fighting has been shown to increase attendance in both the American Hockey League (Paul et al. 2013) and in the ECHL[3] (Paul et al. 2015). At both levels, fighting had a positive and statistically significant effect on attendance. Further details, developed in research by Rockerbie (2017), describe fighting as a profit-maximizing strategy for American Hockey League teams. Fighting was also shown to have a positive and statistically significant impact on attendance in a lower-level minor league, the Southern Professional Hockey League (SPHL)

[3] ECHL used to stand for the East Coast Hockey League. As the league expanded, the abbreviation was no longer geographically accurate and the league name was shortened to just "ECHL" in 2003. ECHL still exists as the name, but each letter no longer stands for anything.

(Paul 2018). Other factors that were found to influence attendance in these studies of minor league hockey were days and months of the season, city-specific demographics, and promotions.

Attendance at minor league games has also been studied in various capacities by Rascher et al. (2009) and Hong (2009). Rascher et al. (2009) discovered increases in attendance for minor league hockey during the NHL lockout of 2004–05. Hong (2009) performed research on the marketing of minor league hockey games and found that teams that successfully drew fans to the arena had higher win percentages, star players, good fan relations, affordable prices, and substantial community involvement.

Another method of research surrounding interest in hockey is with surveys of fans at games. Zhang et al. (1996) found that familiarity with the sport, i.e., hockey knowledge, was important in forecasting game attendance and the level of ticket purchases for International Hockey League games. Zhang et al. (2001) studied social factors influencing minor league hockey attendance and found that health-promoting, achievement seeking, and stress and entertainment factors should be part of the marketing strategies of minor league teams. In a survey of Southern Professional Hockey League (SPHL) fans, violence was found to be important in explaining why fans attended games, although results differed by both gender and the level of ticket purchase (Andrew et al. 2009).

A separate key angle of this study relates to outcome uncertainty. A game expected to be uncertain could be an important consideration in the minds of fans when considering attending a game. The uncertainty of outcome hypothesis (UOH) was first stipulated by Rottenberg (1956) and stated that fans would prefer to attend games where teams were evenly matched. Coates and Humphreys (2012) rejected the uncertainty of outcome hypothesis for the NHL. An alternative hypothesis has been suggested in the literature by Coates et al. (2014) that incorporates reference-dependent preferences and loss aversion. Although this research focuses on individual game level uncertainty of outcome, other uncertainty of outcome measures have been developed as it relates to season-long outcome uncertainty. Studies such as Fort and Maxcy (2003), Garcia and Rodriguez (2002), Andreff and Scelles (2015), Scelles (2017), and Scelles et al. (2013a, 2013b, 2016b) refer and/or examine the role of playoff or qualification for continental competition contention for seasonal outcome uncertainty.

Although outcome uncertainty and similar related theories are important for game-to-game attendance studies, such as the research in this paper, it is closely related to season-to-season studies of attendance that include estimates for competitive balance. Competitive balance is the concept of how evenly balanced a particular sports league is within a season and across seasons. Different measures include the use of the idealized standard deviation of win percentage (i.e., Scully 1989; Quirk and Fort 1997), the CB Ratio statistic (Humphreys 2002), and the use of Herfindahl Indices related to championships (i.e., Kringstad and Gerrard 2004). Another recent innovation as it relates to studies of competitive balance is the Hope Statistic (Kaplan et al. 2011; O'Reilly et al. 2008), which uses statistics related to how far out of a playoff spot a team finished (and has finished over a span of different seasons) to estimate "hope" for a franchise to turn into competitors for a playoff spot and championships in the coming season.

Although this research focuses on the determinants of game-to-game attendance for CHL teams, attendance is only part of the equation as it relates to team profitability. Nadeau and O'Reilly (2006) gathered data from NHL franchises for three NHL seasons and estimated a model to establish the determinants of NHL franchise profitability. They found that team success is important, but influences profits indirectly through the overall level of market support in the city. Other key components to franchise profitability they identified include historical performance, team playing style, team composition, arena location, local market characteristics and competition, and television, among others.

3. Attendance Model and Results

The dependent variable in the regression model is the log of attendance. Attendance figures were taken from the box scores of CHL games on the league websites. As box score figures, they suffer from the well-known fact that teams may not report the actual turnstile attendance for each game, perhaps

including sold tickets for season ticket holders who were "no-shows" or other similar activities. Given that we did not have access to the true attendance figures from the team/leagues, we used the publicly available figures on team attendance. That said, there is considerable variation from game-to-game on attendance figures for each team that logically makes sense (i.e., higher attendance on weekends, with considerable variation across those weekend games throughout the season) which is revealed in the study. Until teams are forced to report actual attendance figures, this will always be a limitation of studies by researchers using publicly available figures.

The independent variables consist of controls for the timing of the game, on-ice performance variables, home win probability measures, and weather variables. The controls for the timing of the game include a dummy for the home opener in the sample where all games are included (specifications I and II). Home openers are typically popular with fans due to the festivities surrounding the start of the hockey season. We would expect the home opener dummy to have a positive and statistically significant effect on the log of attendance. The days between games variable (days between) is the number of days between the current home game and the last home game played. This measure is capped at 14 days (any period of longer than 14 days is listed as 14 days) across the sample. Home games played in rapid succession may suffer from a decline in fan interest due to the availability of attending another game in a short timeframe. If this variable impacts the decisions of fans, it should have a positive and significant effect on the log of attendance.

Dummy variables for the days of the week (with the excluded reference category of Wednesday), the months of the season (with the excluded reference category of January), and season (with the reference category of 2016–17) are included in the model to control for the differences in likely fan interest due to the chronological timing of the game. In terms of the days of the week, weekends are likely to be much more popular for fans due to the opportunity cost of their time on weekends compared to weekdays. Therefore, Fridays, Saturdays, and Sundays are likely to have positive and significant effects on attendance in the model. In terms of the months of the season, early season games (other than opening night) typically are tougher draws for fans, while late season games represent a push toward the playoffs. Therefore, we would expect the early months to have a negative effect on attendance and the late season months to have a positive impact. The season dummy is included to account for any structural difference between the two seasons in the sample.

The on-ice team performance variables include team success and fighting as it relates to game attendance. Team success is measured by points earned (on a per-game basis) during the season, which is a function of how often teams won games. In the CHL, teams receive two points for a win, one point for an overtime or shootout loss, and zero points for a regulation loss. These points are computed as a running average of points earned per game throughout the season. Fans have been shown to prefer successful teams to poorly performing teams across many sports and we would expect this variable to have a positive and significant effect on attendance.

Fighting is a controversial topic in hockey, but previous research has shown that fighting tends to attract fans in different North American hockey leagues. If fans of junior hockey in Canada prefer to see teams that fight more often, this variable should have a positive and significant effect on attendance. If, on the other hand, these players are deemed to be too young to be involved in fighting or fans do not want to see this as part of the game, the coefficient could be negative. Both points per game (PPG) and fights per game (FPG) are quite noisy at the start of the season as they are computed as running averages. Therefore, an alternative specification was run that did not include early-season games (September and early October) with the sample starting after October 15 (around a month into the season). These are shown as specifications III and IV in the table of results.

Home team win probabilities are computed to test the uncertainty of outcome hypothesis at the game level. Rottenberg (1956) first suggested that fans prefer to see games between evenly matched teams, which would result in an uncertain outcome. Various studies have shown conflicting results as it relates to outcome uncertainty across a wide range of sports. For the NHL, Coates and Humphreys (2012) rejected outcome uncertainty as games expected to be close

showed lower in-person attendance figures. Recently, Coates et al. (2014) theoretically modelled outcome uncertainty and showed the possibility of a convex relationship (as opposed to a traditional concave relationship under the traditional uncertainty of outcome hypothesis) due to factors such as reference-dependent preferences and loss aversion on the part of fans. To measure home team win probability, we used betting market data for the CHL available from www.oddsportal.com and computed the implied home team win probability from the odds adjusting for the over round. To test for outcome uncertainty, we include two specifications. The first is a linear model that only includes the home team win probability. The other model is quadratic in nature and includes the home team win probability and home team win probability squared. If fans prefer outcome uncertainty, the home team win probability term should be positive and its square should be negative. If fans have loss aversion, preferences to see upsets, or other types of reference-dependent preferences, the signs on the coefficients could be reversed. If fans do not care about any of these factors when attending games, the results will be statistically insignificant.

The odds from www.oddsportal.com used in constructing the home team win probability include wagering market data for a home win, draw, or road win. There are not draws in hockey, but the draw bet represents a wager on the game being tied at the end of regulation. An alternative measure of home win probability which sums the home win probability and one-half of the draw probability of the game was also tried using the betting data. The results did not deviate much from the main results shown in the body of the paper, nor did it impact the statistical significance of the hypothesis tests. Results of this measure are available upon request from the authors.

The last category of independent variables included in the model relates to game day weather. Weather data for each city in the CHL was gathered from www.weatherunderground.com. Temperature, measured as degrees Fahrenheit, and precipitation level (in inches) were included in the model. These weather-related variables do not relate to conditions while fans are sitting at a game, as games are held indoors in arenas in the CHL, but to the transaction costs to fans of actually getting to and from the game from home or work. Cold weather, rain, and especially ice and snow could discourage fans from leaving the house to brave the elements to attend a game in person. If cold temperatures and rain or snow keep fans from attending junior hockey games, these variables should have negative and significant effects on the log of attendance.

Summary statistics of the non-binary variables in the model are shown in Table 1 below for the full sample of games.

Table 1. Summary statistics.

Variable	Mean	Median	Standard Deviation
Attendance	3950.02	3454.00	2049.89
PPG	1.13	1.14	0.313
FPG	0.38	0.36	0.22
Temperature	29.82	32	18.06
Precipitation	0.05	0	0.15
Home Win Probability	0.45	0.44	0.13
Days Between	5.11	4	4.15

The regression model results are shown in Table 2. Models I and II use the full season, while models III and IV omit the first month of the season (data starts on October 15) to allow for the points-per-game and fights-per-game running averages to stabilize. The coefficients and their respective *t*-values are shown for each specification. Due to heteroskedasticity and autocorrelation issues with the original results, HAC (heteroskedasticity- and autocorrelation-consistent)-consistent standard errors and covariances were used and reported in Table 2 with the Newey–West estimator.

Table 2. Regression results for Canadian Hockey League (CHL) attendance model 2016–17 to 2017–18 seasons.

Dependent Variable:	**Full Season Results**		**Results without Early Season Games**	
Log(Attendance)	**(n = 4163)**		**(n = 3707)**	
Independent Variable	(I) Linear	(II) Quadratic	(III) Linear	(IV) Quadratic
Intercept	7.3140 *** (155.0427)	7.2733 *** (131.7108)	7.2563 *** (180.4596)	7.2123 *** (149.8318)
Home Open	0.2721 *** (11.1604)	0.2724 *** (11.1742)		
Days Between	0.0049 *** (6.6067)	0.0049 *** (6.6002)	0.0058 *** (5.9985)	0.0058 *** (5.9897)
Sunday	0.1262 *** (8.8796)	0.1265 *** (8.8884)	0.1351 *** (8.1790)	0.1352 *** (8.1683)
Monday	0.2024 *** (6.1314)	0.2023 *** (6.1281)	0.2185 *** (5.1458)	0.2185 *** (5.1433)
Tuesday	−0.0289 * (−1.8330)	−0.0289 * (−1.8281)	−0.0242 (−1.2239)	−0.0242 (−1.2214)
Thursday	0.0584 *** (3.4758)	0.0583 *** (3.4770)	0.0622 *** (2.7770)	0.0622 *** (2.7726)
Friday	0.1402 *** (11.9616)	0.1400 *** (11.9489)	0.1450 *** (10.1132)	0.1446 *** (10.0548)
Saturday	0.2117 *** (14.5227)	0.2117 *** (14.5172)	0.2254 *** (14.9650)	0.2253 *** (14.9418)
September	−0.1350 *** (−6.5388)	−0.1375 *** (−6.6472)		
October	−0.1211 *** (−9.0090)	−0.1235 *** (−9.1110)	−0.1097 *** (−7.5897)	−0.1120 *** (−7.7294)
November	−0.0378 *** (−3.4465)	−0.0394 *** (−3.5651)	−0.0390 *** (−3.0714)	−0.0406 *** (−3.1905)
December	−0.0049 (−0.5069)	−0.0064 (−0.6494)	−0.0056 (−0.3789)	−0.0071 (−0.4823)
February	0.0531 *** (5.2573)	0.0538 *** (5.3455)	0.0528 *** (4.6666)	0.0537 *** (4.7437)
March	0.1483 *** (12.6849)	0.1499 *** (12.7717)	0.1477 *** (10.8667)	0.1495 *** (10.8252)
17–18 Season	0.0021 (0.2726)	0.0007 (0.0954)	0.0016 (0.1887)	−0.0001 (−0.0144)
Points Per Game Average	0.0326 *** (3.1352)	0.0406 *** (3.1009)	0.0665 *** (3.9883)	0.0656 *** (3.9435)
Fights Per Game Average	0.0327 (1.4727)	0.0321 (1.4517)	0.0690 *** (2.5987)	0.0677 ** (2.5630)
Home Win Probability	−0.0087 (−0.0088)	0.1834 (1.2858)	−0.0248 (−0.8837)	0.1872 (1.4447)
Home Win Probability^2		−0.2019 (−1.3976)		−0.2225 * (−1.6840)
Precipitation (in)	−0.0445 *** (−2.2474)	−0.0451 ** (−2.2734)	−0.0580 ** (−2.3236)	−0.0589 ** (−2.3496)
Temperature (F°)	−0.0003 (−1.0381)	−0.0003 (−0.9913)	−4.30e−05 (−0.1420)	−2.60e−05 (−0.0857)
Home Team Dummies	Yes	Yes	Yes	Yes
R-squared	0.8436	0.8437	0.8341	0.8342
Adj. *R*-squared	0.8404	0.8405	0.8304	0.8305

Statistical significance is noted by *-notation. Rejection of the null hypothesis that the coefficient is equal to zero is noted at the 10% (*), 5% (**), and 1% (***) levels.

In summarizing the results, we will discuss the findings, in order, by category of independent variables. In terms of the control variables for the day, calendar date, and related variables, positive and statistically significant results at the 1% level were shown for teams' home openers in both specifications for the full sample of data (not included in the restricted sample due to the early season being eliminated from the data set). The number of days between home games (days between) was shown to have a positive and statistically significant effect on attendance across the four model specifications shown. Saturation of home games across a short period of time appear to be a detriment to attendance when it comes to the decision of fans to attend major Canadian junior hockey games.

The dummy variables for the days of the week revealed anticipated results as it related to weekend games. Friday, Saturday, and Sunday variables each had positive and statistically significant results at the 1% level, compared to the reference category day of Wednesday. Saturday had the highest attended weekend games in the CHL, followed by Friday and Sunday. A surprising result showed that the dummy variable for Monday had one of the largest effects on attendance. It was positive and statistically significant at the 1% level. Monday games are relatively infrequent in the CHL, but these games attracted larger crowds than other days. This could be due to scarcity of hockey on Mondays, due to a typically lighter NHL schedule on this day of the week as well. A word of caution on the Monday results is warranted, however, as the Monday result could be a direct effect of its relative infrequency on the schedule. The other days of the week were not shown to have statistically significant results across each of the model specifications shown.

Month of the season dummy variables (compared to January as the reference category) revealed distinct results about the importance of the timing of the season to CHL attendance. Dummy variables for September and October were shown to be negative and statistically significant at the 1% level across the relevant model specifications. November was also shown to have negative and significant effects on the log of attendance, but at the 5% or 10% level. On the other hand, games played late in the season in February and March were shown to have a positive and significant effect at the 1% level on attendance. During the late season push for the playoffs, more fans were shown to attend CHL games. A dummy for the 2017–18 Season, to distinguish the two seasons of attendance in our sample, was not shown to be statistically significant. Structurally, very little appeared to differ between the two seasons when it came to fan preferences for attending games across the three leagues of the CHL.

In terms of the on-ice performance variables of interest, the results revealed that fans preferred teams that both win and fight more often. The points-per-game variable was shown to have a positive and significant effect on the log of attendance at the 5% level and at the 1% level for all four models. Fans are sensitive to the win percentage of their local team. In addition, the other on-ice performance variable, fights-per-game, was also shown to have a positive and significant effect on attendance. As with the points-per-game variable, fights-per-game was not significant in the whole sample, but significant at the 5% and at the 1% levels in the restricted sample. Despite negative publicity about fighting in hockey, hockey fans attended games of teams that have players who fight more often. Even with the majority of the players in the CHL being under twenty years of age, with some as young as fifteen, the prospect of seeing fighting on the ice was shown to have a positive effect on attendance.

The regression results as it relates to outcome uncertainty revealed fans did not appear to care much about uncertainty of outcome. In both samples, the linear model showed that the home team win probability was statistically insignificant. In the quadratic specification, the probability of a home team win (and its square) were not found to be statistically significant in the overall sample and only the squared term was statistically significant (negative coefficient) in the sample, not including the beginning of the season. An f-test of the joint significance of both the home team win probability and its square could not reject the null that both coefficients simultaneously are equal to zero (f-stat of 1.8563 with a probability value of 0.1564). Fans of the CHL did not appear to be concerned with outcome uncertainty, nor did they appear to exhibit any of the preferences described by the model of Coates et al. (2014) as it relates to reference-dependent preferences or loss aversion.

Precipitation, measured on game day in inches, was shown to have a negative impact on the log of attendance and was statistically significant at the 5% level. Temperature was not found to be statistically significant. CHL fans preferred to attend games on days with less (or no) precipitation. Even though the games occur indoors, precipitation appears to play a role in terms of the transaction costs in attending games in the rain or snow.

4. Discussion and Conclusions

This study investigated attendance in the CHL through an ordinary least squares regression model with the natural log of the attendance as the dependent variable. The CHL is the top tier of junior hockey in Canada, with some teams located in the United States. The three leagues in the CHL, the Ontario Hockey League (OHL), the Quebec Major Junior Hockey League (QMJHL), and the Western Hockey League (WHL) are proving grounds for many players who aspire to play in the NHL and are relatively popular leagues in Canada and the United States. The independent variables in the model consisted of variables representing the timing of the game, on-ice performance measures, uncertainty of outcome, and weather-related variables.

Overall, fans of the CHL appear to mimic other fans of hockey in North America. They prefer successful home teams that tend to fight more often. This is despite the negative press associated with fighting in the game and the fact that most of these players are under twenty years of age. Fans prefer to go to games on weekends, rather than weekdays, are more interested in attending games late in the season during the playoff push, and the more recent the last home game, the lower the attendance. Uncertainty of outcome is not a major concern for the fans, while rain and snow tends to decrease attendance figures. The only real surprising finding for the league, outside of perhaps the influence of fighting, was the popularity of the few Monday games on the schedule. Due to a general scarcity of hockey in North America on Mondays, perhaps a more regular schedule of Monday contests could benefit the league if these games could replace less popular mid-week contests. In general, fans of junior hockey appear to value the same characteristics as professional hockey fans, just with younger players and smaller arenas.

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References

Andrew, Damon P. S., Gi-Yong Koo, Rob Hardin, and T. Christopher Greenwell. 2009. Analyzing Motives of Minor League Hockey Fans: The Introduction of Violence as a Spectator Motive. *International Journal of Sport Management and Marketing* 5: 73–89. [CrossRef]

Andreff, Wladamir. 2018. Financial and sporting performance in French football Ligue 1: Influence on the players' market. *International Journal of Financial Studies* 6: 91. [CrossRef]

Andreff, Wladimir, and Nicholas Scelles. 2015. Walter C. Neale fifty years after: Beyond competitive balance, the league standing effect tested with French football data. *Journal of Sports Economics* 16: 819–34. [CrossRef]

Burdekin, Richard C. K., and Matthew G. Morton. 2015. Blood money: Violence for hire in the National Hockey League. *International Journal of Sport Finance* 10: 328–56.

Coates, Dennis, and Brad Humphreys. 2012. Game Attendance and Competitive Balance in the National Hockey League. *Journal of Sports Economics* 13: 364–77. [CrossRef]

Coates, Dennis, Marcel Battre, and Christian Deutscher. 2012. Does Violence in Professional Ice Hockey Pay? Cross Country Evidence from Three Leagues. *Sports Economics: Management and Policy* 4: 47–63.

Coates, Dennis, Brad Humphreys, and Li Zhou. 2014. Reference-Dependent Preferences, Loss Aversion, and Live Game Attendance. *Economic Inquiry* 52: 959–73. [CrossRef]

Fort, Rodney, and Joel Maxcy. 2003. Comment: Competitive balance in sports leagues: An introduction. *Journal of Sports Economics* 4: 154–60. [CrossRef]

Garcia, Jaume, and Placido Rodriguez. 2002. The determinants of football match attendance revisited: Empirical evidence from the Spanish football league. *Journal of Sports Economics* 3: 18–38. [CrossRef]

Hong, Jinbae. 2009. A comparison of Motivational Factors Affecting Attendance between Avid and Casual Fans at Minor League Hockey Games. *International Journal of Sport Management and Marketing* 5: 115–31. [CrossRef]

Humphreys, Brad R. 2002. Alternative Measures of Competitive Balance in Sports Leagues. *Journal of Sports Economics* 3: 133–48. [CrossRef]

Jones, J. Colin H. 1984. Winners, Losers, and Hosers: Demand and Survival in the National Hockey League. *Atlantic Economic Journal* 12: 54–63. [CrossRef]

Jones, J. Colin H., Donald G. Ferguson, and Kenneth G. Stewart. 1993. Blood Sports and Cherry Pie: Some Economics of Violence in the National Hockey League. *American Journal of Economics and Sociology* 52: 87–101. [CrossRef]

Jones, J. Colin H., Kenneth G. Stewart, and R. Sunderman. 1996. From the Arena into the Streets: Hockey Violence, Economic Incentives, and Public Policy. *American Journal of Economics and Sociology* 55: 231–49. [CrossRef]

Kaplan, Alan, John Nadeau, and Norm O'Reilly. 2011. The Hope Statistic as an Alternative Measure of Competitive Balance. *International Journal of Sport Finance* 6: 170–84.

Kringstad, Morten, and Bill Gerrard. 2004. The Concepts of Competitive Balance and Uncertainty of Outcome. *IASE Conference Papers*, 0412. International Association of Sports Economists.

Leard, Benjamin, and Joanne Doyle. 2011. The Effect of Home Advantage, Momentum, and Fighting on Winning in the National Hockey League. *Journal of Sports Economics* 12: 538–60. [CrossRef]

Mills, Brian M., and Rodney Fort. 2018. Team-level time series analysis in MLB, the NBA, and the NHL: Attendance and outcome uncertainty. *Journal of Sports Economics* 19: 911–33. [CrossRef]

Nadeau, John, and Norm O'Reilly. 2006. Developing a Profitability Model for Professional Sport Leagues: The Case of the National Hockey League. *International Journal of Sport Finance* 1: 46–62.

O'Reilly, Norm, Alan Kaplan, Ryan Rahinel, and John Nadeau. 2008. If You Can't Win, Why Should I Buy a Ticket? Hope, Fan Welfare, and Competitive Balance. *International Journal of Sport Finance* 3: 106–18.

Paul, Rodney J. 2003. Variations in NHL Attendance: The Impact of Violence, Scoring, and Regional Rivalries. *American Journal of Economics and Sociology* 62: 345–64. [CrossRef]

Paul, Rodney J. 2018. The Role of Team Success, Fighting, and Other Factors in Southern Professional Hockey League Attendance. *Southern Business and Economic Journal*.

Paul, Rodney J., and Andrew P. Weinbach. 2011. Determinants of Attendance in the Quebec Major Junior Hockey League. *Atlantic Economic Journal* 39: 303–11. [CrossRef]

Paul, Rodney J., Andrew P. Weinbach, and Daniel Robbins. 2013. American Hockey League Attendance: A Study of Fan Preferences for Fighting, Team Performance, and Promotions. *International Journal of Sport Finance* 7: 21–38.

Paul, Rodney J., Andrew P. Weinbach, and Daniel Robbins. 2015. Fighting, Winning, Promotions, and Attendance in the ECHL. *Sport, Business, and Management: An International Journal* 5: 139–56. [CrossRef]

Quirk, James, and Rodney D. Fort. 1997. *Pay Dirt: The Business of Professional Team Sports*. Princeton: Princeton University Press.

Rascher, Daniel, Matthew Brown, Mark Nagel, and Chad McEvoy. 2009. Where did National Hockey League fans go during the 2004–05 Lockout? An Analysis of Economic Competition between Leagues. *International Journal of Sport Management and Marketing* 5: 183–95. [CrossRef]

Rockerbie, Duane W. 2012. The Demand for Violence in Hockey. In *The Oxford Handbook of Sports Economics*. Edited by L. Kahane and S. Shmanske. New York: Oxford University Press, vol. 1, pp. 159–76.

Rockerbie, Duane W. 2016. Fighting as a profit maximizing strategy in the National Hockey League: More evidence. *Applied Economics* 48: 292–99. [CrossRef]

Rockerbie, Duane W. 2017. Fighting as a Profit-Maximizing Strategy: The American Hockey League. In *Breaking the Ice*. Edited by B. Frick. New York: Springer, pp. 17–40.

Rottenberg, Simon. 1956. The Baseball Players' Labor Market. *Journal of Political Economy* 64: 242–58. [CrossRef]

Scelles, Nicholas. 2017. Star quality and competitive balance? Television audience demand for English Premier League football reconsidered. *Applied Economics Letters* 24: 1399–402. [CrossRef]

Scelles, Nicholas, Christophe Durand, Lillane Bonnal, Daniel Goyeau, and Wladimir Andreff. 2013a. Competitive balance versus competitive intensity before a match: Is one of these two concepts more relevant in explaining attendance? The case of the French football Ligue 1 over the period 2008–2011. *Applied Economics* 45: 4184–92. [CrossRef]

Scelles, Nicholas, Christophe Durand, Lillane Bonnal, Daniel Goyeau, and Wladimr Andreff. 2013b. My team is in contention? Nice, I go to the stadium! Competitive intensity in the French football Ligue 1. *Economics Bulletin* 33: 2365–78.

Scelles, Nicholas, Boris Helleu, Christophe Durand, and Lillanne Bonnal. 2013c. Determinants of professional sports firm values in the United States and Europe: A comparison between sports over the period 2004–2011. *International Journal of Sport Finance* 8: 280–93.

Scelles, Nicholas, Boris Helleu, Christophe Durand, and Lillane Bonnal. 2016a. Professional sports firm values: Bringing new determinants to the foreground? A study of European soccer, 2005–2013. *Journal of Sports Economics* 17: 688–715. [CrossRef]

Scelles, Nicholas, Christophe Durand, Lillane Bonnal, Daniel Goyeau, and Wladimir Andreff. 2016b. Do All Sporting Prizes Have a Significant Positive Impact on Attendance in a European National Football League? Competitive Intensity in the French Ligue 1. *Ekonomicheskaya Politika/Economic Policy* 11: 82–107, English Version. Available online: https://mpra.ub.uni-muenchen.de/73844/ (accessed on 1 February 2019). (In Russian)

Scelles, Nicholas, Boris Helleu, Christophe Durand, Lillane Bonnal, and Stephen Morrow. 2017. Explaining the number of social media fans for North American and European professional clubs with determinants of their financial value. *International Journal of Financial Studies* 5: 25. [CrossRef]

Scelles, Nicholas, Stefan Szymanski, and Nadine Dermit-Richard. 2018. Insolvency in French soccer: The case of payment failure. *Journal of Sports Economics* 19: 603–24. [CrossRef]

Scully, Gerald W. 1989. *The Business of Major League Baseball*. Chicago: University of Chicago Press.

Szymanski, Stefan. 2017. Entry into exit: Insolvency in English professional football. *Scottish Journal of Political Economy* 64: 419–44. [CrossRef]

Treber, Jaret, Lawrence Mulcahy, and Manjul B. Sharma. 2018. Empty seats or empty threats? Examining the effects of the 1994–1995 and 2004–2005 lockouts on attendance and revenue in the National Hockey League. *Journal of Sports Economics* 19: 677–95. [CrossRef]

Zhang, James J., Dennis W. Smith, Dale G. Pease, and Matthew. T. Mahar. 1996. Spectator Knowledge of Hockey as a Significant Predictor of Game Attendance. *Sport Marketing Quarterly* 5: 41–48.

Zhang, James J., Dale G. Pease, Eddie T. Lam, U. L. Pham, L. M. Bellerive, J. T. Lee, D. P. Williamson, and K. A. Wall. 2001. Sociomotivational Factors Affecting Spectator Attendance at Minor League Hockey Games. *Sport Marketing Quarterly* 10: 43–56.

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