

Fighting as a Profit-Maximizing Strategy: the American Hockey League

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“I'd like the folks to come down and watch us cream them punks from Syracuse.

Anything new on the sale of the Chiefs?

I think the negotiations are... you know, goin' pretty good. I have a personal announcement, though. I am placing a personal bounty on the head of Tim McCracken. He's the coach and chief punk on that Syracuse team.”

Reggie Dunlop (Paul Newman) in the movie Slap Shot (1977)

The 1977 movie Slap Shot is arguably the most comedic yet accurate portrayal of life for minor league hockey players in the United States. The Charlestown Chiefs play in the fictional Federal League, a minor hockey league one tier below the National Hockey League (NHL). The mill in the town has closed down, the team is performing badly on the ice and attendance is waning. An aging ex-NHL player, Reggie Dunlop, is the player-coach for the Chiefs in what is likely his final season of hockey. To insure jobs for the other younger players on the team, Dunlop needs a quick and effective strategy to bolster the value of the team so that it can find a new owner to keep the team in Charleston or move the team to a better location. The team acquires the three Hansen brothers from a lower-tier league to fill out the roster. Dunlop initially doubts they can play hockey but discovers that their aggressive play is infectious for the other members of the team.

Frequent bloody fights bring fans back to the games and interest in the Chiefs moves outside of small-town Charleston. The team's owner is not impressed with the change in the fortunes of the Chiefs and intends to fold the team at the end of the season to receive a tax write-off that is more profitable than selling the team. The team tries to revert to a clean style of hockey in the league championship game, puzzling and disappointing their fans, but finds this to be a losing strategy and the game ends with a large brawl and the Chiefs are awarded the championship by forfeit.

Slap Shot was a movie that reflected a particularly violent period in professional hockey. The NHL's Philadelphia Flyers won the Stanley Cup championship in the 1975-76 season by adopting an intimidating, physical style of play that complemented its core of highly skilled players. The most notorious of the Flyers players included Andre ("Moose") Dupont, Bob ("Mad Dog") Kelly, Don Saleski and Dave ("The Hammer") Schultz.¹ The 1974-75 Flyers team participated in 105 recorded fights on the ice and 106 in the 1975-76 season, but set an NHL record with 145 recorded fights in the 1977-78 campaign, only to be eclipsed by the Boston Bruins 150 fights in the 1979-80 season.² The Bruins impressive feat still stands as an all-time NHL record.

The director George Roy Hill (Butch Cassidy and the Sundance Kid, The Sting) intended Slap Shot to be a comedy but the business premise of the movie is very intriguing: encouraging violent play as a means to attract fans to hockey games that might not otherwise pay to attend. In

¹ Dave Schultz accumulated an astounding 472 penalty minutes to lead the team, an all-time NHL single season record. The league average number of penalty minutes per player was just 40 and only 37.9 minutes excluding the Flyers. Schultz nearly repeated the feat in the 1977-78 season with 405 penalty minutes, however injuries prevented him from breaking his own record. Taken from www.hockey-reference.com accessed on September 12, 2014

² Taken from www.droptourgloves.com accessed on September 12, 2014.

order for the strategy to work, the benefits to violence must outweigh the costs. Back in the 1970's and 1980's, very few professional sports featured the sort of speed and physical contact of hockey. Professional boxing matches drew tremendous interest with the likes of Muhammad Ali, Larry Holmes and Mike Tyson, but these matches were infrequent and often not easily accessible to fans due to their locations and limited television coverage.³ Other violent television sports that are popular today (particularly mixed martial arts fighting) were not yet invented. NHL hockey was televised by the NBC network in the United States and the CBC network in Canada so North American viewers could enjoy the fights interspersed with skilled hockey play.

Slap Shot portrayed the benefits to hockey violence as largely economic: fighting resulted in higher attendance at the gate that increased revenue, while replacing more highly paid skill players with lower paid "goons" cut payroll costs. The Charleston Chiefs won more games after becoming a fighting team, but movies are not real and more fighting could just as easily cause a team to lose more games by putting more of its players in the penalty box.

This paper extends the work of Rickerbie (2012) for the NHL to test the argument that fighting in minor league hockey is a profit-maximizing strategy, using the American Hockey League (AHL) as a representative example. It could be that hockey players in the AHL have differing motivations for aggressive play than players in the senior NHL. Players in the AHL earn much lower salaries than their NHL cousins, so being promoted to the NHL results in significant

³ Most heavyweight championship fights were not televised on national cable networks, instead they were sold as "closed circuit" broadcasts that were shown in movie theaters or other venues. Some of the larger closed-circuit television networks included MSG, TVS and Sports Network Incorporated.

financial rewards. Some AHL players might use an aggressive style of play as the ticket to the NHL, believing that there is a role in the NHL for tough players to protect the more skilled players from intimidation by other teams. Alternatively, fighting in the AHL could be the result of owners and management encouraging aggressive, physical play to attract fans to games. This paper attempts to determine why fighting is more commonplace in the AHL than the NHL using an econometric model.

Fighting in Ice Hockey

The official tolerance of players engaging in fighting during a game is a distinguishing feature of ice hockey compared to other team sports. Typically players who fight are immediately ejected from the match in professional and semi-professional sports leagues around the world, yet organized ice hockey leagues impose lesser penalties for fighting that typically remove the guilty players from the ice for a short period of time during the game. Ice hockey is played with five skaters and a goaltender on the ice for each team at any time in the game. If both of the guilty players are penalized for fighting, the number of skaters for each team is not reduced from five, providing only a minor deterrent effect if the penalized players are not the most skilled players on offense or defense. If only one player is penalized, his team must play with only four skaters for the duration of the penalty time (typically five minutes of clock time), placing his team at a disadvantage and potentially negatively affecting the outcome of the game for his team. In other sports, ejection of a player from the game for fighting results in no reduction in the number of

players on the field or court (basketball, American football, baseball) or can result in the inability to replace the player on the pitch (football) meaning the team must play a man short.

While fighting is not overtly encouraged in ice hockey, it is tolerated based on the fact that the fighting players are not immediately ejected from the game. The speed of the game and the smaller ice surface in comparison to other sports results in frequent player contact, some of which can be quite violent. Lesser minor penalties for interference, roughing, boarding, tripping and cross-checking occur due to the natural flow of the game and are sometimes unavoidable. Players usually come to fighting as the result of one of two distinct situations. In the first, one player may believe that the physical contact initiated by another player is excessive and an intent to injure one of the players on his team. The unwritten code of behavior in ice hockey is to take matters into your own fists in order to send the message that excessive contact and intimidation will not be tolerated. Other players on the ice and on the bench respect this code and maintain a safe distance from the fight to allow the issue to be settled. The second situation is less frequent. Two combatants agree to fight to settle a score from a fight or hit that may have occurred earlier in the game or in a previous game. Again the unwritten code of behavior is to allow the combatants some time to fight without interference from any other players.

Sports fans who do not understand the unwritten code of fighting in ice hockey sometimes view fighting in hockey as a primitive method to injure an opponent and advocate that it should be banned. Hockey players do not share this position, despite suffering the possible injuries from fighting. In fact, in a 2011 poll of NHL players, 98 percent opposed a ban on fighting arguing

that fighting makes the game safer by deterring other types of injury-causing violence (hitting with the stick, hits to the head, violent boarding and so on).⁴ Other sports have unwritten codes of behavior as well that are accepted by players and officials but can serve to make the game less attractive to viewers. The practice of feigning challenges and injuries is very common in European football (soccer). The objective is either to be rewarded a penalty kick, having an opposing player ejected from the game, or hopefully both. Players who can achieve both objectives by faking fouls and injuries are often congratulated by teammates, knowing that there are no negative consequences to their deception. The term “simulation” is used in soccer to legitimize this tactic. North American sports fans view simulation as unsportsmanlike and cowardly, just as soccer fans view fighting in hockey as brutal and barbaric.

Ice hockey leagues have incorporated the unwritten code of behavior developed by players into the formal rules regarding fighting, and severely penalize players who interfere in a fight between two other combatants. Rule 46 in the NHL rulebook outlines the conditions to be granted to players by the officials on the ice to engage in a fight, as well as the penalties that can be imposed for “unsportsmanlike” fighting (kicking, pulling off an opponent’s equipment and so on). This tolerance for fighting can be traced back to the early days of ice hockey in Canada before the inception of the National Hockey League (NHL) in 1917. Beginning in 1893, amateur teams from any part of the country could challenge to win the Stanley Cup in an annual tournament. Players were often unskilled and made up for this by playing a rough game. The winner of the cup kept its possession as long as any “challengers” did not take it away. Up to

⁴ See S. Whyno, [NHL players bristle at fighting debate despite fan support for a ban](http://sports.nationalpost.com/2013/11/07/nhl-players-bristle-at-fighting-debate-despite-fan-support-for-ban/), National Post, November 7, 2013. [http:// sports.nationalpost.com/2013/11/07/nhl-players-bristle-at-fighting-debate-despite-fan-support-for-ban/](http://sports.nationalpost.com/2013/11/07/nhl-players-bristle-at-fighting-debate-despite-fan-support-for-ban/)

1904, players were not penalized for violating the rules of play, instead a guilty player was given two warnings for the same offense before being ejected from the game. The professional National Hockey Association took sole possession of the Stanley Cup in 1910, awarding it to its annual champion. Rules at the time did not significantly punish fighting and players were often injured as a result of fights. It was in this early period in hockey history that fighting became ingrained in the sport. The NHL adopted its formal rules regarding fighting in 1922, but fights were still frequent and often bloody.

The American Hockey League

The American Hockey League (AHL) came into formal existence in 1939 with the merging of the International Hockey League and the Canadian-American Hockey League. The AHL has always been considered the top-tier minor hockey league since it supplies a large number of players to the NHL. Other minor hockey leagues in North America include the Canadian Hockey League (CHL) and the East Coast Hockey League (ECHL).⁵ The NHL lies at the top of the hockey pyramid in North America, followed below by the AHL in the second tier and the CHL and ECHL in the bottom tier. The number of teams in the AHL fell to a low of only six in the 1976 season, largely due to rapid expansion in the NHL in response to the rival World Hockey Association (WHA) that existed from 1972-79. Currently the AHL boasts 30 teams, 27 in the United States and 3 in Canada. The league underwent a major expansion for the 2001-02 season when it absorbed six teams from the International Hockey League that failed due to financial

⁵ The CHL is the umbrella organization for three minor hockey leagues in Canada: the Western Hockey League, the Ontario Hockey League and the Quebec Major Junior Hockey League.

losses. Each AHL team plays 76 regular season games from October through April. A total of 16 teams qualify for the Calder Cup playoffs that crown a league champion in June. As such, the AHL schedule closely rivals the NHL for the number of games played (82 in the NHL) and number of months to complete a season with playoffs. Most AHL clubs are located near the eastern seaboard of the United States. Only a few clubs have existed west of Chicago and in Canada, probably due to the higher costs of travel.

The largest recorded attendance for an AHL game was 45,653 for an outdoor game played at Citizens Bank Park in Philadelphia in 2012, however attendances for indoor games average between 2,000 and 5,000 with most clubs in the 2,000-3,000 range. Arenas are much smaller than NHL arenas and attendance is typically less than 50% of capacity. Ticket prices are also much lower than the NHL, ranging from an average of \$16.40 for the lowest priced ticket to \$35.20 for the highest price ticket in the 2011-12 season.⁶ Assuming an equal number of low and high priced tickets gives a simple average ticket price of \$25.80, but this is probably an overestimate. The average ticket price for an NHL game in the same season was \$57.49.⁷

Every AHL team is affiliated with a parent NHL club. This agreement allows the NHL club to place its younger players that need further development with the AHL team. These players typically sign two-way contracts that pay the player a higher salary if he moves to the NHL parent club. Salaries in the AHL are capped at \$70,000 with a minimum salary of \$40,500

⁶ See AHL Average Ticket prices, <http://www.coppernblue.com/2011/11/1/2518919/2011-12-ahl-ticket-prices> sourced on September 3, 2014.

⁷ Taken from Rod Fort's Sports Business Data website on September 3, 2014.

(\$42,000 for Canadian clubs). Some older players have two-way contracts that exceed the maximum AHL salary if they have several seasons of NHL service⁸, however most young players in the AHL earn between \$55,000 and \$65,000. Players signed to one-way contracts by their NHL club receive the same salary whether playing in the AHL or the NHL. To put AHL salaries in perspective, the average NHL salary was \$1.3 million for the 2013-14 season.⁹

Fighting Rules and Penalties in the AHL

Rule 46 of the AHL Rulebook outlines the definitions and penalties for incidences of fighting.¹⁰ Referees are allowed a great degree of latitude in determining penalties in order to take into consideration the degrees of responsibility in starting a fight and persisting in continuing the fight. Each combatant is assessed a major penalty, typically five minutes in the penalty box, however each team may still play with the full five skaters. An *instigator* is defined as the player that initializes the fight by striking or verbally challenging another player who is otherwise unwilling to fight at that moment. The instigator is penalized with an additional two minute minor penalty and a major penalty (ten minutes).¹¹ His team must play one player short for the two minute minor penalty. It has become practice for players to avoid the instigator penalty by mutually agreeing to fight, then simultaneously dropping their gloves and engaging in combat. This has proven to be an effective strategy as instigator penalties are very rarely called.

⁸ For instance, Chris Butler (NHL St. Louis Blues) earned \$400,000 playing in the AHL in the 2013-14 season.

⁹ Players in the CHL are not paid salaries, but do receive monthly living stipends and are eligible for generous university scholarships. The ECHL has a minimum salary of \$415 per week and \$460 per week for returning players.

¹⁰ The AHL Rulebook can be found at http://cdn.rapidmanager.com/ahl/files/13_14_AHLRuleBook.pdf

¹¹ This rule was established in 1992.

An *aggressor* is defined as a player that continues to throw punches when his opponent is in a defenseless position or is unwilling to continue fighting. The penalties for an aggressor are severe: a major penalty (ten minutes) and ejection from the game. The unwritten code of conduct among hockey players does not tolerate aggressors. The offense is usually punishable by retaliation in a future match, therefore penalties for being an aggressor are very rare. In most incidences of fighting, each player is assessed a five minute major penalty with no further punishment. Each of the teams is allowed to play with the full five skaters.

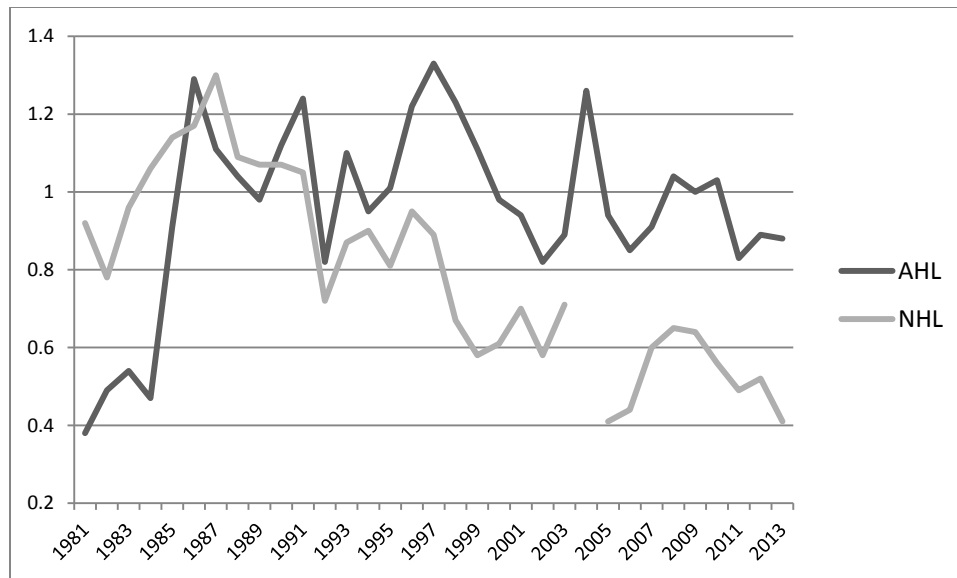
While being deemed an instigator does not expel a player from the game, being deemed an instigator three times in a game does in Rule 46. This rule was changed prior to the 2014-15 AHL season so that being deemed an instigator just two times in a game results in expulsion from the game. Rule 46 also specifies that players must cease fighting when they have been separated and are ordered to stop by an official. Failure to do so results in a major penalty (ten minutes) or expulsion from the game at the discretion of the official. Other penalties can be assessed for removing a helmet before fighting, fighting off the ice surface, being the third player into a fight¹², fighting before play is started and wearing inappropriate equipment during a fight. Suspensions and fines can be levied to a player who is penalized as an instigator or an aggressor in three or more games during a season, although the fines are modest (\$250).

¹² Established in 1977.

The AHL Rule 46 is identical to the NHL Rule 46 in regards to fighting with the exception that fines for repeated offenses are much higher in the NHL (\$25,000). When taken as a share of the average player salary, the fines are slightly higher in the NHL at 1.5% of salary, versus 0.5% in the AHL. Figure 1 plots the number of fights per game from the 1981-82 season through the 2013-14 season for each league. Despite the same rules regarding fighting, the AHL has boasted a much higher number of fights per game (averaging 1.016) than the NHL (averaging 0.688) since the 1990-91 season.¹³ The 1981-85 period saw fighting more prevalent in the NHL than the AHL, probably due to the large number of players absorbed into the NHL from the WHA with the 1979 merger of the two leagues. In addition, the correlation coefficient between fights per game in the AHL and NHL since the 1990-91 season is 0.641, suggesting a moderately strong association. Both leagues have experienced a downward trend in fights per game since the 1990-91 season, but more so in the NHL with a 61.7% reduction compared to a 21.4% reduction for the AHL. With much higher salaries, there is less room on NHL rosters for players who specialize in fighting at the expense of more important offensive and defensive skills.

Figure 1. Fights per game, AHL and NHL.

¹³ The 2004-05 NHL season was not played due to a player lockout.



Source: <http://www.dropyourgloves.com>

Fighting as a Profit-maximizing Strategy for the AHL

Since the 1990-91 season, 55 teams have either expanded into the AHL and continue to exist today (but may have relocated to another city) or have failed. The NHL parents of AHL clubs are not particularly loyal to any city, hence relocations are frequent and swift if the club does not perform well at the box office. Table 1 provides a summary of the wandering path some AHL clubs have taken to where they are today. These relocations have taken place as a result of a private owner or the NHL parent owner club moving or selling the club. In some cases, clubs are suspended by their owner for a season or more, then re-enter the AHL by agreement with the league. Nineteen of the current thirty clubs in the AHL have been relocated from another city, usually after a sale of the club. By way of contrast, only seven NHL teams have been relocated

since 1970¹⁴ and only one has relocated twice.¹⁵ Most of the other AHL clubs are new expansion teams that have begun operations within the last ten years. An exception is the Hershey Bears club that has been operating since the inception of the AHL in 1939. The club was originally established by the Hershey chocolate company as a clever marketing tool (the original name was the Hershey Bars, changed to the Bears after a few seasons). The Bears have never relocated and are still owned by a division of the Hershey company.

Table 1. Franchise relocations of current teams in the AHL.

<u>AHL Team</u>	<u>Location</u>	<u>NHL Parent Team</u>	<u>Previous Teams</u>
Adirondack Flames (2014)	Glenn Falls, NY	Calgary Flames	Abbotsford Heat (2009-13) Quad City Flames (2007-08) Omaha Ak-Sar-Ben Knights (2005-06) St. John Flames (1993-2003)
Albany Devils (2010)	Albany, NY	New Jersey Devils	Lowell Devils (2006-09) Lowell Lock Monsters (1998-2005)
Binghamton Senators (1992)	Binghamton, NY	Ottawa Senators	
Bridgeport Sound Tigers (2001)	Bridgeport, CT	New York Islanders	
Charlotte Checkers (2011)	Charlotte, NC	Carolina Hurricanes	Albany River Rats (1994-2010) Capital District Islanders (1990-93)
Chicago Wolves (2001)	Chicago, IL	St. Louis Blues	
Grand Rapids Griffins (2001)	Grand Rapids, MI	Detroit Red Wings Montreal	
Hamilton Bulldogs (1996)	Hamilton, ON	Canadiens	Cape Breton Oilers (1988-95)
Hartford Wolf Pack (1997)	Hartford, CT	New York Rangers	Providence Reds (1926-76) Binghamton Dusters (1977-96)

¹⁴ These include the Atlanta Thrashers, Colorado Rockies, Kansas City Scouts, Minnesota North Stars, Oakland Seals, Quebec Nordiques and Winnipeg Jets.

¹⁵ The Oakland Seals relocated to become the Cleveland Barons in 1976, then merged with the Minnesota North Stars in 1978. The North Stars moved to Dallas in 1993 to become the Dallas Stars.

Hershey Bears (1938)	Hershey, PA	Washington Capitals	
Iowa Wild (2013)	Des Moines, IA	Minnesota Wild	Houston Aeros (2001-12)
Lake Erie Monsters (2006)	Cleveland, OH	Colorado Avalanche	
Lehigh Valley Phantoms (2014)	Allentown, PA	Philadelphia Flyers	Adirondack Phantoms (2009-13) Philadelphia Phantoms (1996-2008)
Manchester Monarchs (2001)	Manchester, NH	Los Angeles Kings	
Milwaukee Admirals (2001)	Milwaukee, WI	Nashville Predators	
Norfolk Admirals (2000)	Norfolk, VA	Anaheim Ducks	
Oklahoma City Barons (2010)	Oklahoma City, OK	Edmonton Oilers	Edmonton Road Runners (2005-06) Toronto Road Runners (2003-04) Hamilton Bulldogs (1996-2002) Cape Breton Oilers (1989-95) Nova Scotia Oilers (1984-88)
Portland Pirates (1993)	Portland, ME	Arizona Coyotes	Baltimore Skipjacks (1983-92)
Providence Bruins (1993)	Providence, RI	Boston Bruins	Maine Mariners (1987-92)
Rochester Americans (1956)	Rochester, NY	Buffalo Sabres	
Rockford IceHogs (2007)	Rockford, IL	Chicago Blackhawks	Cincinnati Mighty Ducks (1998-2005) Baltimore Bandits (1995-97)
San Antonio Rampage (2006)	San Antonio, TX	Florida Panthers	
Springfield Falcons (1995)	Springfield, MA	Columbus Blue Jackets	
St. John's IceCaps (2012)	St. John's, NL	Winnipeg Jets	Manitoba Moose (1996-2011) Minnesota Moose (1994-96)
Syracuse Crunch (1995)	Syracuse, NY	Tampa Bay Lightning	Hamilton Canucks (1992-94)
Texas Stars (2009)	Cedar Park, TX	Dallas Stars	Iowa Chops (2008-09) Iowa Stars (2005-08)
Toronto Marlies (2005)	Toronto, ON	Toronto Maple Leafs	St. John's Maple Leafs (1992-2004) Newmarket Saints (1987-91) St. Catharines Saints (1982-86) New Brunswick Hawks (1978-81)
Utica Comets (2013)	Utica, NY	Vancouver Canucks	Peoria Rivermen (2005-12) Worcester Ice Cats (1994-2004) Springfield Kings (1967-75) Syracuse Warriors (1951-54) Springfield Indians (1936-46)
Wilkes-Barre/Scranton Penguins (1997)	Wilkes-Barre, PA	Pittsburgh Penguins	Cornwall Aces (1993-96)
Worcester Sharks (2007)	Worcester, MA	San Jose Sharks	Cleveland Barons (2001-06) Kentucky Thoroughblades (1996-2001)

On the other end of the spectrum lie the Adirondack Flames who have relocated four times since 2005 with the same parent NHL club as owner (Calgary Flames). The team's last move in 2014

from Abbotsford (British Columbia) was prompted by \$12 million in losses since 2010 due to low attendance.¹⁶ Taxpayers agreed to subsidize annual losses up to \$5.7 million for ten years under the deal to move the team from Quad Cities to Abbotsford. The City of Abbotsford agreed to pay the parent NHL Calgary Flames \$12 million to be released from the contract and evict the team.

The bottom line is that franchise sales and relocations are far more frequent in the AHL than the NHL and the looming specter of job uncertainty might force management, coaches and players to try the Slap Shot strategy of using fighting and rough play on the ice to maintain the box office. This strategy can have two contrasting effects on the income statement. Fighting and rough play might attract more fans to games who might not otherwise be interested in hockey. Stewart et al (1992) referred to this rather dramatically as the "blood-lust" effect. Unfortunately the Slap Shot strategy usually results in more time in the penalty box, forcing the team to play short-handed and potentially lose more games. Fans that value a winning team and do not buy tickets to watch fights will lose interest in the team.

The motivations for a player to fight can be varied. Goldschmied and Espindola (2013) used data from the 2010-11 NHL season to examine whether fighting is just an impulsive action by players due to the physical contact of the game, or if fighting is a calculated action to gain an intimidating advantage over the opponent. Fights were found to be more likely to occur early in regular season games when the apparent costs are lower. Fighting was more frequent in pre-

¹⁶ <http://www.cbc.ca/news/canada/british-columbia/abbotsford-heat-leave-city-with-12m-in-losses-1.2610985>. Referenced on September 10, 2014.

season games when the cost was nil, but almost non-existent in playoff games when the cost could be very large. The authors concluded this was evidence that players consider the benefits and costs of their actions when choosing to fight. They further suggest that raising the costs of fighting by increasing penalty time, fines and suspensions could be an effective deterrent to fighting.

Major penalties, such as fighting, spearing and so on, might respond differently to increase enforcement of the rules than minor penalties, such as interference and tripping. The NHL added an additional on-ice official for the 1998-99 season which should have increased the likelihood of detection of either type of penalty, thus increasing the probability of incurring the cost of a penalty (but not increasing the cost having committed a penalty and being caught). Allen (2002) found that occurrences of minor penalties decreased with the extra referee, but the occurrences of major penalties *increased* and appeared to be more random. The author attributes this to an *apprehension* effect where the presence of extra policing results in greater frustration for players whose job on the ice is to intimidate the opposition by aggressive play and fighting (so-called “goons”) as their offenses are detected more frequently.

Heckelman and Yates (2003) revisited the penalty data for the 1999-2000 NHL season to determine if the addition of a third referee on the ice reduced major penalties, such as fighting. Two effects can result from adding more referees: the *deterrent* effect and the *monitoring* effect. The deterrent effect is observing a reduction in attempts by players to commit major penalties due to the greater likelihood of being caught. The monitoring effect arises from a greater ability

by officials to detect penalties resulting in more penalties called, without any increase in attempts to commit penalties. The authors found evidence that the monitoring effect was significant but that there was no deterrent effect. Hence the results suggest again that increasing the costs of committing major penalties could be an effective deterrent.

It could be that the variations in the frequency of fights in the AHL versus the NHL in Figure 1 are influenced by the talent pool that is available to both leagues. It has already been noted that in the mid-1970's, the NHL competed with the rival World Hockey Association (WHA) for players, resulting in an increase in salaries and the number of player positions to be filled. In the meantime, the AHL experienced a reduction in the number of clubs to just six in 1976. With the NHL-WHA merger in 1978, the large demand and small supply of talented players resulted in many marginal players being employed in the now larger NHL. Some of these players were known to be more prone to fighting, the so-called "goon" players, whose role on the team was to protect the more talented players from physical intimidation. Fighting in the NHL peaked in the late 1980's and has fallen since, while, with far more teams in the AHL today than in 1976, fighting in the AHL is a more common occurrence. With the average salary in the NHL at \$2.4 million in 2012, there is no room for "goon" players who are not also talented skaters, shooters and defenders.¹⁷ This sort of specialization has disappeared in the modern NHL, but might remain as a profitable strategy in the AHL.

¹⁷ See <http://www.forbes.com/sites/monteburke/2012/12/07/average-player-salaries-in-the-four-major-american-sports-leagues/> accessed on September 24, 2014.

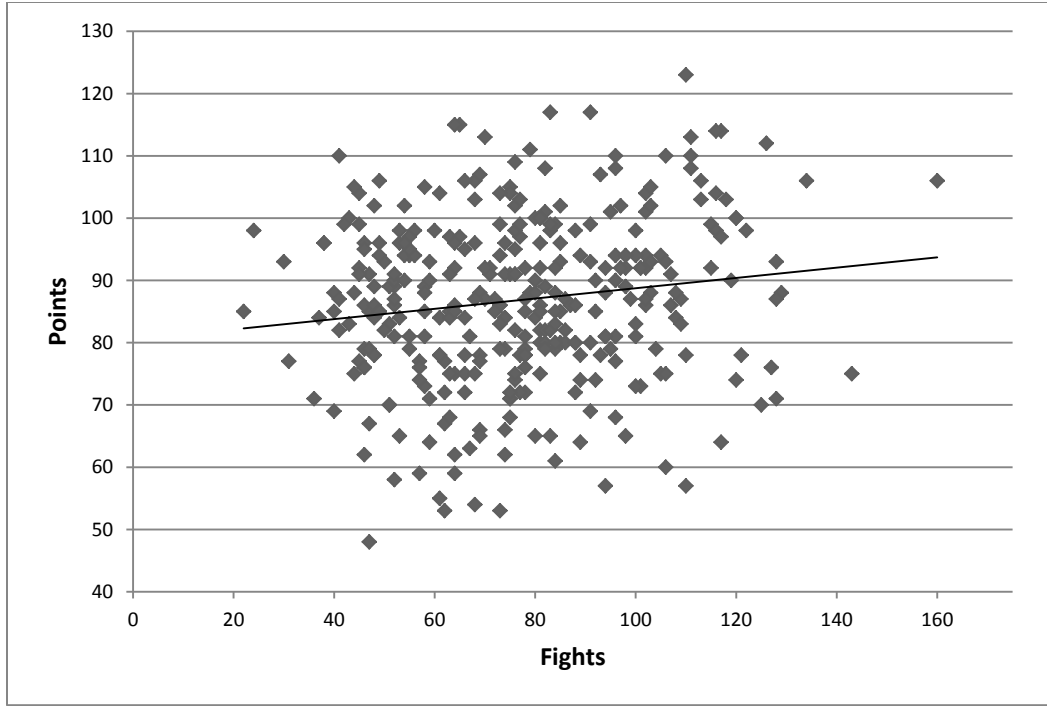
Owners might encourage fighting as a way to improve their bottom lines. Evidence of the effects of fighting and rough play on attendance is mixed. Jones (1984) estimated a model of NHL attendance that included coefficients for the independent variables that measured violent behavior. The regression model was estimated using individual game data for the 1977-78 season and used an indicator variable to denote whether the opponent was a fighting team or a skating team. The results suggested that a fighting team could increase ticket demand regardless of type of opponent. Some of the methodological problems in Jones (1984) were addressed in Stewart et al (1992) where the analysis was refocused to consider the effects of violence on ticket demand more closely than other factors. The paper constructs a model of a profit-maximizing club owner who considers violence to be an important input into the production of wins on the ice. The authors argue convincingly that violence shifts ticket demand through greater on-ice success and through the “blood lust” of the fans. This is an important paper since it builds a model of how hockey violence affects attendance through these two channels.

Jones et al (1993) tested for any difference in fan preferences towards violence between Canadian and American clubs with the argument being that American clubs that operate in weaker markets might promote violence to a greater extent as a way to maintain revenues. American fans were found to respond positively to violence (about 1,500 more fans per misconduct penalty) but Canadian fans responded negatively (about 680 fewer fans per misconduct penalty) using data from the 1983-84 NHL season. Jones et al (1996) repeated the estimation using a single attendance equation and data from the 1989-90 NHL season and found qualitatively identical results: American fans prefer violence and Canadian fans do not.

Paul (2003) replicated the method of Jones et al (1996) using the number of fights per game for each club from the 1999-2000 NHL season, instead of major and minor penalty minutes. The study found that both American and Canadian fans preferred fighting with American fans somewhat more responsive (about 4,700 more fans per game compared to 3,100 fans per game for Canadian fans for fighting teams). Rockerbie (2012) extended the work of Jones et al (1993) to include a much longer sample period (1997-2009) and to use fights per game as the measure of violence. Doubling the number of fights per season (a historically large increase) decreased attendance by about 1.63%, so fans in the United States or Canada were not particularly responsive to fighting.

The question of whether fighting is a profit-maximizing strategy in the AHL has not been previously examined. Figure 2 plots a scatter diagram of the number of fights in a season versus the number of points accumulated in the final regular season standings (out of a maximum possible number of 160 points) for all AHL teams that operated in the 2001-02 through 2013-14 seasons, including those that relocated or failed. The scatter diagram offers no clear association between fighting and team performance. The correlation coefficient is small at 0.146, but is statistically significant at 95% confidence ($t = 2.719$). Of course, no other variables that might affect team performance are being held constant so little can be offered in the way of definite conclusions.

Figure 2. Number of fights versus total points in the AHL



Source: <http://www.dropyourgloves.com> and <http://www.ahl.com>

The Model

The model of team behavior used here is simpler than the model specified by Stewart et al (1992) and used in Rockerbie (2012). As will be explained, the simpler model is largely due to data limitations for the AHL. The league is assumed to be composed of N clubs each facing an attendance inverse demand function of the form

$$p_{it} = \delta + \beta v_{it} + bw_{it} + cy_{it} - dA_{it} \quad (1)$$

Season attendance for club i in year t is given by A_{it} . The variable v_{it} is a measure of violence over an entire season that affects attendance independently of its potential effects on the club's winning percentage. Club success on the ice is measured by w_{it} which is the total points earned during a season divided the maximum number of points that can be attained (152 in the AHL). Wins are the direct output of each club that results in greater attendance. The term \mathbf{y}_{it} is a vector of independent variables that capture the demographic and economic characteristics of the team location. Finally, p_{it} is the average ticket price for each club.

Increased violence might increase attendance directly through the spectacle of watching two combatants square off on the ice as a form of entertainment, similar to boxing or mixed martial arts fighting. In those sports, greater violence by one opponent often results in a greater chance of victory, however the connection between violence and club success is not so clear in hockey. Violence in hockey often results in one or both participants being penalized, putting their club at a numerical disadvantage on the ice. Frequent violence can result in fewer wins and a lower winning percentage, resulting in lower attendance in (1), ignoring the blood-lust effect. The question of paramount interest here is which effect dominates attendance and to determine that, we need to specify a contest-success function. Many exist in the theoretical sports economics literature with the logistic form being the most desirable in the case of a two-team league. Unfortunately with more than two teams in the league, well-defined functions do not exist, so we specify a linear form. Any probability model that is not a logistic form can suffer from the weakness that the predicted values fall outside the $(0, 1)$ range, however the winning percentages for the AHL clubs in the sample are clustered rather narrowly around 0.5 so a linear form might be a good approximation. Linear contest-success functions have been estimated in the sports economics

literature with some examples being Scully (1974) and Krautmann (1999). Generally logistic functions are avoided in empirical work due to inherent instability of the results.¹⁸ In our case, a non-linear functional form will not allow for identification of the model parameters.

$$w_{it} = \gamma - ev_{it} + \mathbf{g}x_{it} \quad (2)$$

The term x_{it} is a vector of team-specific performance measures that are thought to contribute towards winning percentage. The last term allows for an interaction between team violence and team measures of performance based on the simple idea that if a team spends a lot of time in the penalty box, the marginal effect of the performance measures could be lower.

We assume that each club maximizes profit and we impose this on the empirical model by deriving a restriction. The assumption is that all costs are fixed costs, that is, costs are independent of the number of fans who attend games when each club has a fixed playing schedule. Maximizing team revenue with respect to A_{it} gives a simple first-order condition which is substituted into (1) to arrive at the optimal attendance level.¹⁹

$$A_{it}^* = \frac{1}{2d} (\delta + \beta v_{it} + bw_{it} + \mathbf{c}y_{it}) \quad (3)$$

¹⁸ See Peeters (2011) for examples.

¹⁹ We maximize with respect to A_{it} rather than p_{it} due to the lack of availability of a time-series of AHL ticket prices.

Maximizing revenue with respect to team violence (v_{it}) results in a simple first-order condition that imposes the restriction that $\beta = be$. Estimating the model is straight-forward. The contest-success function (2) can be estimated using least squares to obtain estimates of e and g . Imposing the restriction in the attendance function (3) results in

$$A_{it}^* = \frac{1}{2d} (\delta + b(ev_{it} + w_{it}) + cy_{it}) \quad (4)$$

The restricted attendance function (4) can be estimated using least squares and the estimate of e . This places a cross-equation restriction on the estimate of β . Since a time-series of ticket price data for the AHL is not available, (4) will have to be estimated using a grid search method by assuming different values for the inverse price elasticity d . The net effect of increased violence on attendance is $\hat{\beta} = \hat{b} \cdot \hat{e}$.

Data

The sample periods covers the 2002-03 through 2013-14 AHL seasons. Not all clubs played in every season in the sample period, in fact, a few played only a single season before moving on to another city. The net sample size was composed of 341 observations for each variable. Three

internet sources were used to obtain the necessary data to estimate the contest success function in (2).

Table 2. Variable definitions and data sources for Eq.(2)

Points (2 points for win, 0 points for loss, 1 point for overtime loss, maximum 152 for regular season)	w_{it}	www.hockeyDB.com
Fights (total per regular season)	v_{it}	www.dropyourgloves.com
Goals allowed (total per regular season)	GA_{it}	www.hockeyDB.com
Power-play percentage (regular season number of power-plays in which goal scored as a percentage of total number of power-plays)	PP_{it}	cdn.rapidmanager.com/ahl/files/AHL2002-03.pdf, various issues
Penalty-kill percentage (regular season number of penalties in which goal not allowed as a percentage of total number of penalties against)	PK_{it}	cdn.rapidmanager.com/ahl/files/AHL2002-03.pdf, various issues
Number of 20-goal scorers in regular season	TG_{it}	www.hockeyDB.com

The hockeyDB web site contains a variety of time series data for most of the North American hockey leagues that have ever existed, as well as some European leagues. More detailed player statistics for each season was found from the AHL produced annual statistical reports available as PDF files from the source in Table 2. Readers can probably think of other variables that could be included in Table 2 to explain the team winning percentages, however it is important not to include variables that merely provide an accounting summary of each team's performance, such as goals scored, lest the specification of (2) become too much like a definition and lose its behavioral qualities.

The specification for the attendance function in (3) included the variables listed in Table 3 below. Arena capacity was included as a scaling variable and to account for the potential of any capacity constraints. This was probably not an issue for the estimation of (3) since the capacity utilization rate (attendance/capacity) did not exceed 85% for any of the clubs over the sample period, and most clubs fell at 50% or less. Population estimates can only be obtained for the county in which each AHL team is located since the U.S. Census Bureau uses the county delineation to define a metropolitan boundary. The FRED2 database maintained by the Federal Reserve Bank of St. Louis was used to download the population figures from Census Bureau files. In most cases, the county boundary enclosed the AHL club's capture area reasonably well, but in a few cases, the county boundary contained an overly large area.²⁰ Population estimates for Canadian cities were obtained from the Statistics Canada E-Stat website.²¹ Real income per capita was obtained also at the county level in 2009 dollars from the U.S. Bureau of Economic Analysis website and E-Stat websites. The county-level unemployment rate was obtained from the U.S. Bureau of Labor Statistics and E-Stat. Finally a zero-one variable was created to estimate any shift in attendance for AHL clubs located in Canada.

Table 3. Variable definitions and data sources for Eq.(3)

Attendance (per game in regular season)	ATT_{it}	www.hockeyDB.com
Fights (total per regular season)	v_{it}	www.dropyourgloves.com
Points (2 points for win, 0 points for loss, 1 point for	w_{it}	www.hockeyDB.com

²⁰ Lowell, Massachusetts lies in Middlesex County that contains an area of 2,196 km² and a population of 1.5 million. The city of Lowell had a population of just 108,861 in 2013 (U.S. Census Bureau). For Lowell and two other cases, the county population was ratio-scaled with the 2013 city population and the county population growth rate was then applied to estimate city populations.

²¹ Unfortunately for economists interested in economic data for Canada, Statistics Canada has discontinued the E-Stat web portal, although the main STATSCAN web portal is still active and much harder to use.

overtime loss, maximum 152 for regular season)		
Arena capacity	CAP_{it}	www.hockeyDB.com
Population (annual estimate for county)	POP_{it}	research.stlouisfed.org/fred2/, www.statcan.gc.ca/estat
Real income per capita (annual estimate for county, 2009 dollars)	INC_{it}	www.bea.gov, www.statcan.gc.ca/estat
Unemployment rate (annual estimate by county)	$UNEMP_{it}$	data.bls.org, www.statcan.gc.ca/estat
Zero-one variable for Canadian clubs	CAN_{it}	

Empirical Results

The attendance function in (4) incorporates the restriction that $\beta = be$ that comes as a result of the assumption of profit-maximization. To test this restriction, (4) was first estimated in unrestricted form as a part of a two-equation system with the contest success function in (2). A weighted least squares procedure was used to correct the coefficient standard errors for heteroskedasticity. Due to the presence of the arena capacity variable, cross-section fixed effects could not be used without incurring perfect multicollinearity, so fixed effects were not included in estimating the restricted or unrestricted forms of (4).²² The restriction $\beta = be$ was tested with a Wald test that is distributed as a chi-squared with a critical rejection value of $\chi^2_{0.05,1} = 3.8415$. The restriction could not be rejected with a Wald test value of 0.1175. It is well known that the Wald test can provide differing results if the non-linear restriction is expressed in a different way, such as $e = b/\beta$ or $b = e/\beta$. Fortunately the non-linear restriction could not be rejected in any of the three forms. Having failed to reject the restriction, the two-equation system could be estimated in restricted form and the estimated coefficients for b and e be recovered to compute

²² Dropping the capacity variable and including fixed effects resulted in many of the statistically significant slope coefficients moving to statistical insignificance.

an estimate for β , the so-called “blood-lust” effect on attendance. These regression results are given in Table 4 taken from the EViews econometrics program.

Table 4. Estimation results of equations (2) and (4)

System: VIOLENCE

Estimation Method: Weighted Least Squares

Date: 10/10/14 Time: 12:20

Sample: 2002 2013

Included observations: 341

Total system (unbalanced) observations 672

Iterate coefficients after one-step weighting matrix

Convergence achieved after: 1 weight matrix, 5 total coef iterations

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	68.46703	7.280195	9.404560	0.0000
C(2)	0.018897	0.011645	1.622786	0.1051
C(3)	0.843547	0.114454	7.370205	0.0000
C(4)	0.119061	0.067312	1.768805	0.0774
C(5)	-0.189335	0.010987	-17.23228	0.0000
C(6)	2.068602	0.187177	11.05160	0.0000
C(7)	1756.895	657.5742	2.671783	0.0077
C(8)	0.000197	7.98E-05	2.463858	0.0140
C(9)	-0.018652	0.006258	-2.980411	0.0030
C(10)	11.99900	33.68128	0.356251	0.7218
C(11)	0.117097	0.024401	4.798873	0.0000
C(12)	54.66719	8.914404	6.132456	0.0000
C(14)	-280.4866	237.2970	-1.182006	0.2376

Determinant residual covariance	49072864
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Equation (2): $w_{it}=C(1)+C(2)*v_{it}+C(3)*PP_{it}+C(4)*PK_{it}+C(5)*GA_{it}+C(6)*TG_{it}$

Observations: 336

R-squared	0.679492	Mean dependent var	57.21139
Adjusted R-squared	0.674636	S.D. dependent var	8.753421
S.E. of regression	4.993011	Sum squared resid	8226.951

Equation (4): $ATT_{it}=C(7)+C(8)*POP_{it}+C(9)*INC_{it}+C(10)*UNEMP_{it}+C(11)*CAP_{it}+C(12)*w_{it}+(C(12)*C(2))*v_{it}+C(14)*CAN_{it}$

Observations: 336

R-squared	0.242390	Mean dependent var	5509.704
Adjusted R-squared	0.226222	S.D. dependent var	1635.199
S.E. of regression	1438.397	Sum squared resid	6.79E+08

The contest success function in (2) fits reasonably well with an adjusted R^2 of 0.674. A one point increase in the team power-play percentage (say from 18% to 19%) increases the team winning percentage by 0.843 points (say from 50.0% to 50.843%) and is statistically significant at 95% confidence. Since most penalties are “killed off” in the AHL (average penalty kill percentage over the sample is 82.93%), a one point increase has a much lower effect on the winning percentage than does a one point increase in the power-play percentage (average power-play percentage is just 16.93%) at an increase of just 0.119 points. Reducing the number of goals given up over the season by one goal will increase the club winning percentage by a statistically significant average of 0.189 points. The largest effect on the club winning percentage is the addition of an additional 20 goal scorer at 2.068 percentage points. Twenty goal scorers are surprisingly uncommon in the AHL. Teams averaged less than three in the sample period (2.744) and in only 41 out of a total of 341 club seasons did a team possess more than four. Most clubs experienced far more players moving in and out of the roster in a season than is typical for an NHL club, so scoring is very spread out among players.

The attendance demand function fit only modestly well with an adjusted R^2 of 0.226. Fighting had a positive, albeit small, effect on the club winning percentage, contrary to the negative effect found by Rockerbie (2012) for NHL clubs. Recording one more fight in a season increased the team winning percentage by just 0.019 points and was statistically significant at only the 89.25% confidence level. It is probably safe to say that fighting neither improves nor worsens team performance in the AHL.

County population and per capita income are statistically significant factors in average game attendance, however the negative coefficient for per capita income suggests that AHL hockey is an inferior good for consumers. This could be due to the close proximity of NHL teams and other professional sports teams to AHL cities. Higher per capita incomes tend to be observed in the larger urban centers in the sample, where substitute forms of entertainment to AHL hockey are readily available. It is also worth noting that AHL teams tend to be located in areas with lower per capita incomes than NHL cities. Perhaps this is a marketing strategy for the owners of the AHL clubs, principally NHL clubs. The unemployment rate is not statistically significant suggesting that AHL hockey attendance is acyclical. An increase in arena capacity has a small statistically significant effect on attendance (0.117 seats), however its inclusion was principally to hold capacity constant when considering the effects of the other demand variables. A one point increase in the team winning percentage increase per game attendance by an average of 54.667 seats and was highly statistically significant. Yet the overall modest fit of the attendance demand function suggests that there are many factors other than winning that influence attendance. Having a team located in Canada had no statistically significant effect on attendance, *ceteris paribus*.

The “blood-lust” effect of fighting on attendance is given by the estimate of $\beta = be$ (C(2)*C(12) in Table 4). Calculating the product gives a value of just 1.033, suggesting that an additional fight during the season increases per game attendance by only one seat. The standard error of the product $\beta = be$ was computed using the delta method (Greene (1997), p. 124) to be 1.678, resulting in a statistically insignificant result. Removing the statistically insignificant county unemployment rate and zero-one indicator for a Canadian team resulted in a new system estimate

for $\beta = be$ of 1.028, providing some evidence that the result is robust. As a further check, the attendance demand function was estimated without the restriction $\beta = be$ using weighted least squares. The “blood-lust” coefficient was estimated to be 3.3644 and was not statistically significant. Although three times larger than the coefficient from the restricted system estimation, it is only just over three seats per game – not qualitatively different from the restricted estimate.

Conclusions

It has been documented in this paper that fighting has been far more prevalent in the AHL than the NHL since 1990, although movements in both are strongly correlated. The econometric results in this paper suggest that it is not the case that profit-maximizing owners are encouraging greater fighting in the AHL as a means to earn more revenue. Unlike previous results for the NHL (Rockerbie (2012)), fighting does not adversely affect a team’s winning percentage, but it also does not encourage more attendance. With these results in hand, the greater prevalence of fighting in the AHL cannot be explained by either an intimidation effect on the opponent team or bringing in fans to watch the fights. The recidivism argument for fighting requires that the punishments for fighting in the AHL are not as severe as in the NHL, but that is simply not the case. In fact, the AHL rules regarding fighting are identical to the NHL rules, however the financial penalties in the AHL are smaller than the NHL when taken as a percentage of the average player salary. However fines for fighting are rarely given in either league.

An alternative argument is that the AHL is a sort of purgatory for semi-professional hockey players. Highly skilled younger players will have a good chance of ascending to the NHL after having been judged by their on-ice statistics. Lesser skilled players might quickly fall out of the AHL after being judged as unworthy of the NHL. But for some players, the judgment takes longer and the AHL can provide a decent living combined with some other off-season employment. A few recent examples of AHL season fight leaders who have had lengthy AHL careers are Zack Stortini (9 seasons), Bobby Robins (9 seasons) and Kyle Hagel (7 seasons). Many more examples exist. There still exists a role for the player who is a known fighter in the AHL that has not existed in the NHL since the rapid increase in NHL salaries in the 1980's. If every other AHL team has one, then your team better have one (or more). There is no strategic advantage to having a player whose main skill is fighting on your team, but if you do not have one, your team could be at a significant disadvantage. Reaching a league-wide agreement to not keep "fighters" on the roster must be difficult in the AHL – for the NHL, no agreement is necessary as high salaries are just as effective.

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