Player Movement and Post-Season Success in the NHL: A Regression Analysis

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ABSTRACT

In professional team sport, there are always clubs that are believed to have a better chance of winning a championship than others. These teams can help their chances during the season by acquiring players from clubs that are out of contention. But does this strategy actually work in practice? Evidence from a regression analysis of playoff teams in hockey demonstrates that the impact of acquired players on playoff success is not significant. Other patterns that emerge is that factors that are believed to be inherent in successful teams, such as nationality of players and regular season performance, are negligible in the later rounds of the post-season.

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"Any mathematician will tell you that we're all crazy... We're all nuts because there are 30 teams and 1 parade. After the first round, you get 22 teams on the sidelines. The math is horrible."

Brian Burke, General Manager,
Toronto Maple Leafs Hockey Club

I - Introduction

"Winning isn't everything, it's the only thing" is a common refrain in professional team sports, but should teams stop at nothing for a chance at a championship? Every National Hockey League (NHL) team invests in numerous scouts, who are paid to examine every relevant junior hockey league in the world in order to increase a team's stock of talent for future years. But teams will throw this research out the window if they feel they have a chance at winning a championship today. That is, they will mortgage the future by trading away these assets to acquire players for the final month of the NHL season and the playoffs; in the hope that these additional players will take the team to a championship today. The question is: Does trading away young prospects for additional players late in the season actually lead to playoff success for NHL teams? This paper addresses this question by using regression analysis to analyze player movement and playoff success in the NHL (1993-94 to 2003-04 seasons). While previous research has looked at the effects of player acquisition on a teams' revenue stream, this paper fills a niche by taking the perspective of the average fan: Do these trades actually help my team perform better in the playoffs? This paper aims to be the first to analyze the effect of player acquisition on playoff success in this way.

Within the literature, only one paper has undertaken research similar to this work. Krautmann and Ciecka (2009) explored how much an acquired star player was worth to a baseball team, given that the player has the unique ability to propel the team to post-season success. The authors labeled this ability the "Over-The-Top" effect and used regression analysis to test the worth of the star player to a baseball team. The authors found a 40% premium on the salaries of a star player, relative to other players. While

financial variables are of importance in professional sport, this work takes a different angle, ignoring any pecuniary variables and focusing solely on an acquired player's impact on the probability of success in an NHL post-season.

Moreover, this research employs an ordered logit regression to test whether NHL players acquired midway through the season have a significant impact on a team's playoff success. The regression uses team-level data from the 1993-94 to 2003-04 NHL regular seasons. The results show that acquired players do not have a significant impact on a team's playoff success. Moreover, the estimated marginal effects show that the impact is only evident in the first round; in further rounds, the quantity of acquired players has a negligible impact on playoff success.

This paper is organized as follows. The next section describes the structure of the regular season and playoffs in the NHL, along with a discussion on the NHL Trade Deadline. Section III provides a review of the literature on the Economics of Player Movement and Competition. Section IV discusses the data sources and presents summary statistics. Section V presents the model itself with the underlying model assumptions, and Section VI presents the regression results. Sections VII and VIII summarize and conclude the paper. All tables and figures can be found in the appendix.

II - Fundamentals of the National Hockey League

It may be useful for the reader to discuss the basics of a season in the NHL. The NHL regular season consists of 82 games and lasts from the beginning of October to the beginning of April in the following year. Teams play 41 games in their home arena and

41 games on the road in the regular season. There are 30 NHL teams, which are divided equally into two conferences, the East and the West.[1] Within each conference, teams are then divided into 3 divisions (5 teams in each division), based on geographical location. Since 2005-06, teams earn 2 points for a win, 1 point for a loss in overtime/shootout, and 0 points for a loss.[2] Teams play 24 games within their own division (6 against each divisional opponent) and 40 games outside of their own division, but within their conference (4 games each). The remaining 18 games are played against teams outside the conference.

Teams are ranked within the standings based on the cumulative number of points they have achieved. It follows that teams seek to earn as many points as possible in order to achieve a higher rank within the standings, since a certain rank is necessary to qualify for the playoffs. In the NHL, the top 8 teams in each 15-team conference earn a berth in the leagues' post-season (16 post-season spots in total). The ordering of teams for the post-season is similar to the system currently in place in the National Basketball Association. The top three teams in each conference consist of the three division leaders, which are ranked in terms of points. The remaining five spots in each conference are filled by the next 5 non-division leaders with the most points. At the end of the regular season, the playoff ranks are determined, and the NHL's post-season begins.

The Stanley Cup playoffs are an elimination tournament where pairs of teams go head-to-head in a best-of-seven series, with the winner of each series moving on to the next round. In the first round, the matchups are determined as follows: the first seed plays

the eighth seed; the second seed plays the seventh seed, and so on. It follows, then, that in each conference there are 4 playoff series' being played in the first round. In each subsequent round, the match-ups are determined as follows: the highest ranked team remaining plays the lowest ranked team remaining in its own conference. In each round, the team with the higher rank in the season is given home-ice advantage. The importance of home-ice advantage is that it ensures that the majority of the games in a seven-game series are played in the arena of the higher-ranked team. Thus, in a typical playoff series teams play 2 games at the home rink of the higher-ranked team, followed by 2 games at the opponent's home rink, before alternating each game until the series has determined a winner. The teams that reach the Stanley Cup final are the respective playoff winners of each conference.

Indeed, there are many financial incentives for NHL clubs to play as often as possible in their home rink during the post-season. In addition, each club understands the emotional importance of championships to maintain fan interest. They will therefore seek to make mid-season adjustments to their rosters in order to give themselves the best chance of success in the playoffs. This, of course, is done through player transactions amongst the 30 NHL teams. Most major transactions begin to occur slightly before and/or after the NHL's All-Star weekend, which also serves as the half-way point.[3] At this point in the season, teams at the bottom of the conference standings have usually formed rational expectations that their chances are poor of qualifying for the post-season. These teams are typically looking to rebuild their team for the next season and will be looking to trade away players in order to stockpile young assets for future seasons. Usually the

players coming from teams at the bottom of the standings are commonly known as "rental players". A rental player is someone whose NHL contract expires at the end of the season and is able to become a free agent at season's end. Since the struggling team has done poorly, it is unlikely that a player (with an expiring contract) from these teams will re-sign in the off-season and so these teams will look to trade these players away in order to get at least something in return. Thus, these teams are commonly known as "sellers" late in the season.

Similarly, teams at the top of standings will look to add the final piece of the puzzle for a run at a championship. These teams are usually willing to risk trading away their stock of young prospects for a rental player. The thinking is that the rental player can be the catalyst to push the contending team to the next level. Thus, teams at the top of the standings acquiring rental players are typically called "buyers" at the trade deadline. Lastly, there are those teams fighting for the final playoff berths who likely believe that they have a chance of qualification. These teams may be buyers, in that they want that extra piece of the puzzle in order to become a contender, or they may be sellers since they may be looking to be a stronger team in future seasons.

Teams can make as many trades as they wish in a given season, but they have only until the NHL imposed trade deadline to do so. Prior to the current CBA (2005), the trade deadline was on the 26th day before the end of the regular season. Currently, it is set for the 40th day before the deadline. In both cases, the deadline has typically been set for

three-o-clock in the afternoon on the day itself, Eastern Standard Time (National Hockey League, Collective Bargaining Agreement).

Due to its nature, the NHL trade deadline generates large spikes of publicity among hockey fans and the media; with much of discussion revolving around the persistent rumours of the marquee players and their potential suitors in the NHL. Recently in Canada, the day has received so much attention that the major sports television stations, along with offering online and mobile phone updates, devote their entire daytime schedule to deadline day coverage. For the 2010 NHL trade deadline, The Sports Network (TSN) saw 184,000 average viewers over the ten-hour period (along with 12.8 million webpage visits), while Rogers Sportsnet had 85,000 average viewers (1.7 million webpage visits) (Zelkovich).[4] The coverage is similar to that of a major news network on national Election Day. The networks analyse trades that have happened earlier in the week, and during the day. Other time is spent reporting any rumoured transactions that may or may not happen any longer. In all, each channel is in stiff competition with the other to be the first to report any news.

The intrigue lies in the fact that the general manager (the one who makes the trades) typically "makes more mistakes on this day than the rest of the year combined" (Farber). There are plenty of examples within our sample of teams that effectively mortgaged the stock of their prospects for a run at a championship; only to lose in the first round. The irony is that, in hindsight, these teams could have achieved these levels of success without trading away young prospects for a star player. For instance, in 2004, the

Ottawa Senators (5th seed) acquired Peter Bondra from the Washington Capitals (472 career goals at the time of the trade; Hockey Databank) for a second-round draft choice in 2005 and a young prospect drafted in the sixth round of 2001 draft, Brooks Laich. The Senators lost in the first round that year, to their bitter rival Toronto Maple Leafs. Peter Bondra left the Senators that following summer to join the Atlanta Thrashers. In contrast, today Laich has developed into one of the league's top defensive forwards with the Capitals, while contributing at least 20 goals in each of his past three seasons (NHL Official Guide and Record Book 2009). Another example is the 2003 acquisition of Adam Oates (over 1,000 career assist; Hockey Databank) by the Philadelphia Flyers (4th seed) from the Capitals for goaltending prospect Maxime Ouellet, and the 1st, 2nd, and 3rd round picks of the Flyers. The Flyers would go on to lose in the first round, in five games, to the Ottawa Senators (NHL Official Guide and Record Book 2003). Similar to Bondra, Oates would go on to join the Anaheim Ducks in the following off-season. These two examples go to show that some teams will certainly be willing to mortgage their future assets if they believe that, before the trade, their team has one of the best chances to win the Stanley Cup.

III - Evidence on the Economics of Player Movement and Competition in Sport

Early economic research in competition in professional sport leagues sought to link basic managerial principles in sport (usually baseball) with the foundations of Industrial Organization. In what is generally regarded as the first paper on competition, Rottenberg (1956) employed industrial organization to discuss the structure of professional baseball leagues and the incentives of individual clubs within the league.

Among these, Rottenberg proposed that teams in relatively large markets (i.e., a larger revenue base) would not necessarily hoard all of the league's marquee players; for fear that competition (which drives fan interest, and team revenue) would disappear. In other words, should the competition weaken, fans would be driven away by the near certainty of the contests. The observation was in contrast to the traditional perfectly competitive market: Here a firm only stands to gain if it can cause its competitors to suffer losses and become the market's sole supplier (monopoly). But in league sport, a team can only be successful if its competitors also survive; hence differences in team ability and quality of play among teams can never be too vast. Consequently, Rottenberg developed an optimum level of winning where the (declining) marginal revenue was equal to the marginal cost in adding more talent.

For example, suppose a high-talent team in baseball employs three hitters with over 40 Home Runs. Rottenberg argued that it would not be in this team's best interest to acquire another player with 40 Home Runs: the team would find that by adding more star players, total output (i.e., admission receipts) would likely rise at a decreasing rate, and then fall absolutely. Thus, for a certain level of talent, a star player would be worth more to a small-market team than to a team in a large market. In all, this ensured that playing talent would be more or less distributed equally among the teams in the league. A corollary to this argument was that each player was distributed to a specific team to ensure that they were put to their most productive use. Thus, it was argued that each player ultimately played for the team that was able to get the highest return from his services. In sum, for Rottenberg, the rich teams may still have had the greater financial

incentive to win than small market teams, but it was this financial interest which would prevent them from becoming too dominant (Rottenberg 1956, Eckard 2001).

In the following years, research in Sports Economics sought to develop this paradigm of competition in professional sport leagues. Neale (1964) proposed similar arguments to Rottenberg's competition model, by applying the idea to other sports. Boxing became the pure example: if the general public is certain that the star boxer will win each of his matches, fan interest will dissipate and the boxer would not receive any publicity for his matches. In this, Neale took Rottenberg's idea further by considering the role of external factors in a team's effort to generate excitement about its product; that being, the media. The author argued that the media provide the most current updates of the league standings, based on the previous nights' set of matches. It stands to reason that the closer the teams are in the standings, and the more frequently that the relative rankings of each team are set to change within each set of matches, the larger the fan interest will be and subsequently the larger will be the gate receipts. As Neale states, this externality is favourable to each team (and the leagues as a whole) as it acts as a form of free advertising for all teams involved.

Thus, for Neale, the total product produced by professional sport teams was not simply the individual matches and the pursuit of championships but rather a combination of (1) the match, and (2) the interest in the team/league generated by the media and its secondary word-of-mouth effect amongst the general public. It was further argued that altogether, the team cannot produce any of these factors by itself. It requires the

cooperation of many teams to create a professional league, with matches, as well as the cooperation of many independent media firms associated with generating fan interest. Ultimately, "the conclusion, then, is that ... the Yankees are not the firm as understood in economic theory. Rather the firm is the league... Once this point is realized, the theoretical conclusion is clear: each professional sport is a natural monopoly" (Neale p. 4). With that, Neale defines professional sport teams as complex entities made of the joint products of many firms, with each firm (team) needing to make some sort of positive contribution for the league to survive.

It was not until 1988 that research began to apply the ideas of sport competition to team performance both in the regular season and the playoffs. Whitney (1988) employed an empirical analysis to gauge the level of fan interest in baseball (i.e. ticket demand) with respect to the structure of the league. Based on the earlier work of Rottenberg and Neale, the author took as given that the prospect of a certain team winning has a positive effect on fan interest. But what was implied by "winning"? Did this simply involve winning the most matches in a regular season? Or could fan interest rise even further if a team's winning percentage is greater in the post-season? In terms of the former, the fan would be viewing each match in isolation from the context of the season: the goal is to win the game, on any given day. Therefore, winning percentages would be an accurate proxy of fan interest. In terms of the latter, if fans measured team performance in terms of whether or not a championship was won, one would need to study the probability of winning championships, rather than winning percentages.

With this in mind, Whitney ran two separate logit regressions for the years 1970-1984: one where winning percentage in the regular season was the dependent variable and another where a championship dummy variable was the dependent variable (=1 if team won championship). The results showed that, all else equal, a divisional championship in the previous season was associated with an attendance increase of around 13 to 16 percent in the following season. The value was given in a range to account for the fact that some teams may face stiffer competition from other teams in the same market, which may depress attendance somewhat (Chicago White Sox vs. Chicago Cubs for example). For Whitney, the results suggested that "championships are the icing, not the cake, but they matter nonetheless" (Whitney, p.724)

In the research that followed, sports economists placed greater emphasis on what were the main enablers and inhibiters of competitiveness in sports leagues. Research varied from the impact of salary caps on league competitiveness (Fort and Quirk, 1995; Kesenne 2000; Vrooman 1995), to the importance of the socio-economic background of league players (Kahn 2000). One area that began to receive more attention at the start of the last decade was the increase in the movement of players from team to team, and its impact on league competitiveness (Scully 1989, Fort and Quirk 1995, Vrooman 1995, Horowitz 1997), and finally league success (i.e., championships, Eckard 2001, Haugen 2006, Krautmann & Ciecka 2009, Vrooman 2009). For the purposes of this paper, the rest of this literature review will focus on the highlights of this latter section of sports economics research.

Eckard (2001) was part of the first research to empirically investigate the impact of player movement on championship contention. The paper was, in effect, an update to the work initiated by Rottenberg (1956). The author maintained Rottenberg's initial hypothesis regarding the diminishing marginal returns that teams face when adding marquee players to already star-studded line-ups and picked up where Rottenberg left off by empirically testing the assumption. Eckard employed various measures of competitive balance and compared these measures before and after the allowance of free agency in baseball to determine whether increased player movement in baseball influenced the league's parity. Since 1976 was the first year of free agency in baseball, the author used two separate periods: 1961-1975 (pre-free agency) and 1976-1992 (post-free agency). When comparing the variance within each team's winning percentage, Eckard found that there was an increase in competitive balance; implying that relatively weaker teams now had a greater chance to win a championship, while the already strong teams saw their chances somewhat diminish. When comparing the concentration of previous champions, the author again found that league competitiveness improved with the increase in player movement. Thus, Eckard was able to support with empirics the initial hypothesis made by Rottenberg some 45 years earlier.

As noted by Vrooman (2009), the economics of playoffs and/or player movement in professional sports leagues is highly underdeveloped by sports economists. Given the emotional importance of playoff success to fans, and the financial incentives that exist for teams, it is surprising that more research has not been undertaken in the area. Only in the

past 2 years has research begun to investigate both the movement of players from team-to-team and its impact on team success (to varying degrees) in the post-season.

Perhaps the one paper most applicable to this research was undertaken by Krautmann and Ciecka (2009). Here the authors focused on estimating how much a star player was worth to a baseball team, when that star player has the ability to propel a team to post-season success. Were these players worth their Marginal Revenue Product (MRP)? Or could this value exceed their MRP? The authors focused on the very question of a contending team acquiring a star player at the start of the season in hopes of improving their chances of winning a championship. The research was centered on pecuniary variables; the authors included attendance figures, team salary, and the revenues generated from additional home games in the playoffs in their work. While this research differs somewhat in that regard, the principles behind the authors' work have implications for what will follow in the coming sections.

For instance, Krautmann and Ciecka call the star players' unique ability the "Over-the-Top" (OT) effect. Furthermore, star players have the special, and more importantly, scarce talent to help a team reach an extra level of post-season success, which is that which makes them so attractive to contending teams during the regular season. As the authors point out, the lure of acquiring that extra star player is large: in Major League Baseball, a team beginning the playoffs with home field advantage throughout could play up to 11 additional home games by the time the championship has been decided; which roughly translates to $33 million in extra revenue.[5] To test the OT

effect, the authors included in their sample only those players who excelled at their position; since it is these players who would be expected to have the greatest positive impact on a new team's performance. Thus, star players considered in the sample were only those who were in the top 20% in terms of productivity (pitchers were excluded for statistical purposes). Contending teams were only those who had finished within 10 games of making the post-season in the previous year. In their regression model, the authors found that a 40% premium on salaries is associated to star players from contending teams.

As the authors note, the result is intriguing given the hypotheses of Rottenberg (1956), Neale (1964) and findings of Eckard (2001), that of diminishing returns: a team at or near the top of standings must already have many outstanding players on its roster. Thus the marginal impact of the acquired player should diminish. However, the authors are quick point out that most managerial decisions are based on *perceived* marginal benefit, and that the actual marginal benefit may be difficult to measure. Indeed, as the architect of the 2007 Stanley Cup champion Anaheim Ducks, General Manager Brian Burke has noted:

> "The notion that you're going to add to your team and hope you win a round, the math defies that. But the human element is, first off, there's an optimism we all share, that belief we're missing that one piece. Second, your team expects it. Your players are looking to you to add weapons for this last part of the race. So we all get sucked in." (Farber)

Therefore, even though a team may recognize that the long-run costs of acquiring a player with "over-the-top" abilities outweighs the benefits, it may still complete the trade in order to show that it seeks to make a serious run at a championship.

While the work of Krautmann and Ciecka (2008) is similar in certain aspects, this research fills a niche in many ways. For one, all of the research described above is focused around estimating the pecuniary gains of acquiring a star player and/or winning a championship. Of course, the bottom line for owners is the return on their investment; however this paper concerns itself more with whether or not a team improves its chances of winning a championship by acquiring players. Another difference with the work of the authors' is that this work considers only players acquired halfway through the season (from January 1st of calendar year, until the trade deadline). On the other hand, the research above considered only trades/signings made in the previous off-season. In short, to this author's knowledge, this research is unique in that no other study seems to have investigated the impact of acquired players in mid-season on the probability of championship success in any sport, let alone hockey.

IV - Data Sources and Summary Statistics

In this section we describe the availability and quality of data necessary for this research, as well as present some general summary statistics. For our purposes, the data gathering process involved various sources. Acquiring the data from a unique source was not possible, given the complex nature of the regression.

The initial goal of this research was to model playoff success based on a team's trade activity late in the season, for the 1979-80 to 2003-04 seasons. However, this proved to be more difficult than what was initially thought. A starting point was the 1979-80 season since this was the first season where the NHL instituted a trade deadline. Upon further review, it was clear that the NHL went through various structural changes throughout the 25 year period. For one, the NHL altered its format for seeding playoff teams in the regular season twice during the period. In 1979-80, the league accepted the top 16 teams in the league, regardless of the conference. Starting in the 1981-82 season, the league altered this system by accepting the top 4 teams in each division (there were two divisions per conference at the time). This system was kept in place until the 1993-94 season, when the NHL instituted its current structure described earlier. In an effort to obtain robust results, it was decided to allow the study's time period to begin at the 1993-94 season.

Another issue was the league's efforts to expand membership. Beginning in 1979-80, the league accepted four teams from the then-defunct World Hockey Association, which gave the league a total of 21 teams. This total remained constant until the next wave of expansion before the 1991-92 season when the San Jose Sharks joined, followed by the Ottawa Senators and Tampa Bay Lightning in 1992-93, and finally the Florida Panthers and Anaheim Mighty Ducks in 1993-94, bringing the total to 26 teams. Since 1993-94 was the end of that expansion cycle, it was another reason for setting the initial time period then. The league did go through another wave of expansion from 1998-2000, adding four more teams. However, the cost of continuously avoiding league expansion in

the sample was a decreased sample size, and so it was decided that this recent expansion would be included in the sample.

A decision was made to limit the sample to the end of the 2003-04 season, which coincided with end of the previous Collective Bargaining Agreement between the NHL and National Hockey League Players' Association. The 2004-05 season was cancelled due to a labour dispute between the league and its players.[6] The league resumed play in 2005-06 with drastic rule changes, involving increased penalties for physical infractions of nearly any sort and the inclusion of shootouts to decide games (tie games no longer were possible). The post-lockout NHL, known around the media as the "new NHL", had undergone a unique makeover. In order to not corrupt the data, it was decided to limit the sample from the 1993-94 season to the 2003-04 season. Finally, we should note that the NHL altered the number of games played in a season for the 1996-97 season, moving from 84 games to 82 games. This value stayed constant until the end of the period.

Data on NHL standings of each season from 1993-94 to 2003-04 were available for download from the website, "Hockey-Reference.com". Hockey-Reference provides team and individual level data for each NHL season (since 1917-18). Team-level data includes the standard wins, losses, ties, and points. From these statistics, one can derive the winning percentage of each team for each season (percent of games won out total games played), and the points percentage. The point percentage is of some importance as out of all of the major North American team sports (Baseball, Basketball, Football, and Hockey), hockey is the only sport to reward points for a loss (in overtime only) and, prior

to 2005-06, reward points for a tie as well. It stands to reason that teams may accumulate more points than the number of wins may suggest. Thus for hockey, we believe that point percentage may be a better proxy of a team's regular season success than winning percentage.

Also retrieved from Hockey-Reference was individual player statistics for each playoff team in each year. While it is an excellent source of historical hockey statistics, the Hockey-Reference does not contain any socio-economic information, such as country of birth, age, and/or years of NHL experience. This information comes from another database, known as the Hockey Databank. The Hockey Databank is collective database consisting of academics and historians interested in research involving hockey statistics. An entire set of data, consisting of individual player statistics and various socio-economic variables going back to 1917-18, was retrieved from the Hockey Databank. The data was then parsed through to include only information on players from the reference period 1993-94 to 2003-04. With this information, one could then calculate team averages for various socio-economic variables, including age, years of NHL experience, and country of birth.

The final variable to account for was the number of transactions made by each team. While some websites keep a database of these transactions, it was deemed that the best source would be the National Hockey League's Official Guide and Record Book. After each season, the NHL produces this publication as a historical guide. It involves any updates to league rules and official records, while also providing a summary of the past

season. A full list of transactions from the past season can be found in each edition, and so a database was created based on this information; including the teams making the transactions and the players involved. It was determined that only those trades made on or after January 1st in a given season (until the trade deadline) would be included in the model.

In order to put the regression results in the pages that follow into context, we now use the collected data to present summary statistics. Table 1 presents the means and standard deviations of variables we believe to be important factors for playoff success in the NHL, for the entire sample period. Of course, for some of these variables, the values are somewhat redundant. For instance, the means and standard deviations of playoff success and conference rank are constant each year. That is, for each year, there are always two teams (since there are two conferences) for each ranking, one through eight. Similarly, since there are always sixteen teams in each playoff season, there are always eight who do not win the first round, four who lose out in the second round, etc.

The playoff teams in our sample had an average point percentage of 0.5360, suggesting that teams in the sample, more often than not, earned at least a point in each regular season game. The standard deviation is quite low, which tells us that most teams fall either slightly above or below this mean. Teams in our sample went into the playoffs with an average of almost seven years of NHL experience per team. Thus, playoff teams in our sample, on average, consisted of teams that were not stocked with rookies, or veterans, but rather players in the "prime years" of their careers. Still, a standard deviation

of almost 1.5 tells us that there were some teams that chose to fill their teams with either rookies or veterans in our sample. The average standard deviation of Canadian players per team is slightly less than zero, telling us that the average playoff team in the sample had less Canadians than the league average. Lastly, teams on average acquired 2.5 players in our sample for the playoff season.

We can investigate these variables further from season-to-season. Figure 1 in the appendix tracks the average playoff success of teams in the Eastern Conference by rank. More often than not, the teams that were ranked first, third, or fourth won, on average, the most rounds in a given playoff season. In fact, in the sample, no team in a position worse than fourth place won the Stanley Cup. The closest team was the 1998-99 Buffalo Sabres, who were ranked seventh and lost in the Stanley Cup final to the Dallas Stars. In addition, the eighth ranked team won its first round matchup three times in the sample, but never progressed past the 2nd round. Finally, within the conference, the first placed team had the highest frequency of winning the Stanley Cup (twice). In all, a team from the Eastern Conference won the Stanley Cup four times in the sample.

Conversely, the Western Conference had six Stanley Cup winners in the sample. Figure 2 (see appendix) tracks the average playoff success of teams in the Western Conference. Of the Cup winners from the West, the worst ranked team finished in 3rd place. This suggests that it would be difficult for a given team from the West to win a Championship if it is not among the three division winners. Incredibly, only twice did a team that finished in 5th or 6th place in the conference go on to win in the first round. As

well, in two season's a seventh placed team made it to the Stanley Cup finals, only to lose the championship final (Vancouver 1994, Anaheim 2003).

Turning our attention to years of NHL experience, the oldest team to win the Stanley Cup was the 2002 Detroit Red Wings, with an average of ten years of experience per player, and an average age of 31 years. From Table 2 of the appendix, this team ranks among the top ten oldest teams in the sample and is the only one in that group to win a championship; the other teams lost in either the first or second round. Of the 10 youngest teams (see table 3 of appendix), 6 failed to advance past the first round. For the record, the youngest team to win the Stanley Cup were the 1996 Colorado Avalanche (6 years of experience, average age of 26 years). Thus both teams stocked with veterans and teams stocked with young players have struggled to advance in the post-season in our sample.

Figure 3 (appendix) presents the distribution of players in our sample by nationality. Canadian players make up 53% of the total sample period. This average ranges from 66% in 1996 to 53% in 2004. Players born in territories of the former Soviet Union make up 19% of the sample, while Americans and the other parts of Europe make up 15% and 13% respectively. Thus, while the majority of players in our sample are Canadian, it appears to be losing its grip in later years as the league's experience an influx of players from other countries.

Table 4 presents the trade activity of the ten Stanley Cup winners in the sample. It is interesting to note that no team completed more than 4 trades (1994 NY Rangers, 1999 Dallas Stars). Moreover, for each team, none of the acquired players would be confused s

as being a goal-scorer. Table 5 of the appendix presents the season statistics of each acquired player for each Stanley Cup winner in the sample. For instance, the NY Rangers acquired Brian Noonan, Stephane Matteau, Glenn Anderson, and Craig MacTavish. While Glenn Anderson had been a known goal-scorer throughout his career, 1994 turned out to be his 3rd-last season in the NHL and was only able to contribute 3 goals in 23 playoff games (Hockey Databank). To the passionate hockey fan, it is clear from this list of names that then-Rangers General Manager Neil Smith chose to add experience to his roster at the trade deadline, rather than talent. A similar story can be told for the 1999 Dallas Stars. Of the four players acquired (Benoit Hogue, Blake Sloan, Derek Plante, and Doug Lidster), only one player managed to score a goal in Dallas' Stanley Cup run (Plante). Like the 1994 Rangers, none of these players would be confused with an elite goal-scorer and it is clear again that the Stars had chosen to add experience to their line-up in 1999.

In fact, within the entire sample, one could subjectively say that only two teams acquired a star player and went on to win the Stanley Cup. The 2001 champion New Jersey Devils acquired forward Alexander Mogilny from the Vancouver Canucks. While Mogilny was known as a pure goal-scorer throughout his career, he would contribute only four goals and 3 assists for 7 points in 23 games during the Devils' cup run (11^{th} in team scoring). These are hardly impressive numbers for a player who finished his career with over 473 goals and 1,032 points in his career (Hockey Databank). The other team, the 2001 champion Colorado Avalanche, acquired three players (Rob Blake, Steve Reinprecht, and Bryan Muir). While the latter two names are not generally known as

strong offensive players, Rob Blake was a perennial all-star throughout his career. During Colorado's cup run, he would contribute 6 goals and 13 assists for 19 points to finish fourth in team points, leading all defensemen on the team (Hockey Databank). One could say that the 2001 Avalanche are the one Stanley Cup winner in the sample who acquired a star player at the trade deadline and ultimately won the cup, with the player making a strong contribution to success.

V - Model Strategy

Following in the footsteps of Whitney (1988), Liu and Zhang (2008), and Krautmann and Ciecka (2009), we employ a probit/logit estimation to model the probability of playoff success in the NHL. While ordered probit and logit models are equally useful when employing a probability model, we use an ordered logit since, as well be seen in the following section, the standard errors from the initial OLS regression are not normal. In what follows here, a brief description of the intuition and rationale behind the choice of model is provided below.

Since our dependent variable can only take on a discontinuous set of values (0, 1, 2, 3, or 4), we cannot use a standard OLS (Ordinary Least Squares) regression. That is, the OLS regression will not produce results that are BLUE (Best Linear Unbiased Estimator). Thus, if we were to put our model in an OLS regression, there would be no way to ensure that the probabilities of our estimated coefficients are between zero and one.

For our research, since our dependent variable takes on a discontinuous, ordered set of values, we use an application of the logit model, the ordered logit model. Ordered logit models are useful whenever there are two or more values for the dependent variable and the values represent some meaningful, sequential order. (i.e., our model assumes that winning the second round is better than winning just the first round). As well, this type of regression inherently accounts for the fact that four is better than three, which is better than two, etc. For the coefficients to have any meaning, we must calculate the marginal effects of each independent variable from the estimates generated from the ordered logit regression. The marginal effect of an independent variable is the derivative (i.e. slope) of the prediction function, which is the probability of success from our ordered logit model.[7] Therefore, since it is a probability distribution model, the values from the ordered logit regression must be between 0 and 1. On the other hand, the values generated from the marginal effects can be greater than 1 (absolute value). This is because the marginal effects represent the slope of the prediction function in the ordered logit regression. (Greene 2007). By design, the marginal effects will be generated for each step. Thus, the model will generate one set of estimates for the probability of not winning a round in the Stanley Cup playoffs, another set for the probability of winning 1 round, and so on.

In terms of our dependent variable, unlike most research, here we do not define playoff success in terms of additional revenue earned by playing more playoff games. The point of view taken here, rather, is purely based on a fan's perspective: How far can my team get in the playoffs? Furthermore, do any mid-season changes that my team makes have any impact on team success?[8] With this in mind, each team was given a value

ranging from zero to four to quantify playoff success. Formally, this is defined as follows: a value 0 was given if the team qualified for the playoffs, yet did not win their first round series; 1 if the team won its first playoff series, but lost in the 2nd round; 2 if the team won its first two playoff series, but lost in the 3rd round; 3 if the team won its first three playoff series, but lost in the fourth round; and 4 if the team won each of its four playoff series (i.e. won the Stanley Cup). In this context, the regression equation can be stated as:

$$Prob(Y_{i,t} = j) = \frac{e^{\beta_j' x_{i,t}}}{\sum_{k=1}^{6} e^{\beta_k' x_{i,t}}}, \quad j = 0, 1, \ldots, 4$$

where;

Y = Probability of playoff success, taking any value *j* from 0 to 4

X = Our individual regressors; to be discussed below

i = Identifier for a each given playoff team

t = Identifier for a given season (can be any season from 1993-94 to 2003-04)

k = Represents the number of regressors; in our case 6 (no constant)

This is the standard form of an ordered logit regression with six regressors and where the dependent variable can take on any of five values (Greene 2007). An advantage of research in sport economics is that the data is relatively easy to retrieve. While this gives the added bonus of having many possible proxies for a given variable in a regression model, it also becomes somewhat of a burden to have so much choice. In the end, it was determined that the model would include the following variables for each playoff team:

a) Conference Rank

As stated at the outset of the paper, the NHL ranks' its playoff teams in order of the points acquired throughout the season, with the top ranked teams in each conference playing the lowest ranked teams in the same conference. It therefore stands to reason that the first seed has the greatest advantage: not only does it secure home-ice advantage in each round until at least the Stanley Cup final, but, should it win each round, it guarantees itself of playing the lowest ranked team remaining from its conference in each round. On the other hand, the 8th seeded team always faces the toughest path: in each round, it never has home-ice advantage and must always play the best remaining team in the conference, should it advance past each round.

Since the NHL rewards teams that succeed in the regular season with a relatively easier road to the Stanley Cup, and based on the summary statistics, we would therefore expect a positive correlation between the level of playoff success and the rank of teams within their conference prior to the beginning of the playoffs.

b) Points Percentage

Since the NHL allocated points for tie and/or losses in overtime during this study's time period, winning percentage is not the best proxy of team success; unlike similar research in baseball for instance. Instead, percentage of points (from the total amount of possible points) was calculated. Teams are ranked by the number of points which they accumulate throughout the season. It follows that the more points a team collects against the other teams, the better their rank will be. One slight anomaly is that

since the first three seeds in a conference are the three division leaders by default, it is possible that the 4th placed team could have more points (and perhaps be a stronger team) than the 2nd and/or 3rd placed teams. Of course, since teams play the games to gain points in order to achieve a higher ranking, it seems reasonable to include this variable in study of playoff success. Just like the conference rank variable, one would expect that point percentage in the regular season has a positive effect on playoff success.

c) Average Years of NHL experience

In most team sports, older players are typically asked to contribute to team success through experience and leadership, rather than through goal-scoring. With respect to the post-seasons of the other major North American sport leagues, the NHL's playoff season is typically regarded as physically and mentally draining; making the Stanley Cup arguably the most rewarding of the championships in the other major team sports. Players will frequently play through injuries in order to contribute to team success[9]. Usually, these players are those who have either won a championship before, or have been in the league long enough to develop a win-at-all-costs mentality. For this reason, it may never be a bad option for teams to have players with plenty of NHL experience on their roster.

It is, however, somewhat of a tricky science to determine the magic number of veterans for post-season success. A general manager (who wants to win this year) would not want to stock his team full of younger players, since these players may not have the experience necessary to mentally cope with the gruelling post-season. Similarly, a team stocked with only veteran players may have the desire to win, but not the physical health

necessary to compete consistently in each round. The summary statistics stated earlier seem to confirm this hypothesis since both the oldest and youngest teams in the sample have not "*experienced*" much playoff success. It would therefore appear that it is most likely that years of NHL experience follows an inverted U-shaped curve, with respect to playoff success: at low levels, experience has a positive impact on playoff success, but at the very high levels of experience, this impact begins to decrease. In this light, two variables were included in the model to capture experience: one, to measure the Years of NHL experience on average per team, and the square of this variable.

d) Standard Deviation of Canadian Players

Hockey pundits have long argued that playoff hockey is where Canadian players excel. While the game continues to require skill, the physical play and mental endurance needed to continue in the Stanley Cup playoffs is stereotypically thought to exist particularly in Canadian (and also American) players. To be sure, until 2002, the Conn Smythe Trophy, annually awarded to the player judged to have been most valuable to his team in the Stanley Cup Playoffs, had been awarded to a Canadian with one exception: American Brian Leetch in 1994 (Conn Smythe Trophy).[10] Indeed, Neale (1964) may have been the first to formally observe that location of birth may be good proxy for the talent level of athletes in various sports:

> "How else can we explain the disproportionate number of first class tennis players and cricket batsmen from Australia... or of passing quarterbacks from Texas, other than by reference to the public attention and private concentration put into the development of these particular

> skills? And this input into the inputs is a result of the enthusiasm for the sport in the area, which in turn is both a consequence and a cause of the scale of operations of the sport in the area." (Neale, p. 8)

Since the majority of hockey players in the sample are Canadian, we seek to measure the standard deviation of the total number of Canadian players per team, for each season. Hence, when analyzing this variable, the question is: If a given team (for a given season) has one more Canadian player than the league average, what is the marginal effect? We expect that having more Canadian players than the league has a positive effect on a team's playoff success. Thus, given Neale's argument, it would seem reasonable to expect that the standard deviation of Canadian players per team has a positive impact on the playoff success.

e) Number of Acquired Players

This is the key interaction variable for our research. The question is: How best to capture the trades made by teams during the season, with respect to playoff success? In our view, there were basically two ways of capturing trades in off-season. One method was to focus on quality. It certainly is one thing to acquire players, but another question is whether the players that a given team acquires are talented enough to make an impact. One idea to capture this effect was to calculate the percentage of goals in the playoffs that an acquired player was involved in, out of the total amount of goals that a team scored in a playoff season. The difficulty in this is that, as was discussed earlier, not all players are acquired for their goal scoring prowess. Some players are acquired for veteran leadership; others are defensive forwards, while still others may be defensemen, of varying degrees

(offensive, defensive, shot-blocking, etc.). In addition, one would need to create dummy variables to include any goalies that were acquired in mid-season (or omit goalies altogether). In the research by Krautmann & Ciecka, this was resolved by removing pitchers from the sample. The advantage with analyzing baseball statistics, however, is that apart from the pitchers, all other players can be measured by similar statistics. On the other hand, in hockey, there are a wide range of players being moved in and around deadline day which makes it difficult to capture empirically.

In this light, it was decided in order to simplify the research; the trade variable would be captured simply by the number of players a team decided to acquire from January 1st of a given season, until the trade deadline. While this measure is certain to have its imperfections, its advantage is that it simplifies the research. For other sports like football, which consists of many players playing different positions at one time, this method of capturing trades may also be appropriate. For sports like baseball, perhaps the method by Krautmann and Ciecka is more applicable.

VI - Regression Results

We can now turn our attention to the results of the regression. First, in order to determine whether an ordered logit or ordered probit model is more appropriate, we must test the error terms from an OLS regression for normality. Should we have normally distributed errors, we can run an ordered probit model; otherwise we must run an ordered logit model. We employ a Skewness/Kurtosis test to determine normality. As Table 6 in the appendix demonstrates, we reject the null hypothesis that the errors are normally

distributed. Therefore, we employ an ordered logit model to further the analysis. Of course, for the estimated ordered logit model to be of any meaning, we must calculate the marginal effects from that regression. Thus the complete results of the ordered logit regression are presented in Table 7. Most importantly, Table 8 presents the marginal effects from the ordered logit regressions.

Table 8 is the crux of our work, as it allows to us to ultimately draw conclusions from the discussion thus far. The only variables that are significant are those accounting for point percentage and the number of Canadians on each team. The other variables for conference rank, years of NHL experience, and the number of acquired players are consistently not significant for each level of playoff success. It is interesting to note that while the conference rank estimates are always not significant, the opposite is true for the point percentage. This may reflect the fact that teams can artificially have a high rank (because the division leaders are automatically seeded 1, 2, and 3) and thus a better measure of a team's strength may lie in the percentage of points they have accumulated. Towards the end of the paper, we examine this issue by looking at the significance of conference rank, by omitting point percentage in the regression.

Second, the only time our significant variables are less than zero is for the outcome where the team has failed to proceed past the first round. In this case, a negative sign is to be expected because for this outcome we are essentially estimating the probability of not having any success; i.e., the probability of not winning a round. Since these estimates are less than zero, we would expect that for points percentage, ceteris

paribus, as it increases, in the first round, the probability of not having success decreases. Thus the higher the point percentage was for a given team, the better chance it had of making it past the first round (or on the contrary, the worse chance it had of not making it past the first round). And similarly for the number of Canadians per team: as the number of Canadians (greater than the league average) per team increases, the better chance a team had of advancing past the first round.

The ordered logit model produces intriguing and intuitive marginal effects, yet one must be cautious when interpreting. For example, the point percentage variable exhibits a marginal effect of -2.328. All else constant, it does not make sense to interpret point percentage as a 0 to 1 increase; that is, it is virtually impossible for a team to experience an increase in points from 0 (lose all games in a season) to 164 (win all games in a season). Thus, we should interpret point percentage for a more realistic change of, say 10%, rather than 100%. Thus, if point percentage increases by 10%, the probability of not advancing past the first round decreases by 23.3%. Similarly, if point percentage increases by 10%, the probability of advancing past the first round increases by 7.6%. This is followed by a 7.9% increase in second round, a 4.4% increase in third round, and finally a 3.4% increase in probability to win the Stanley Cup.

The Canadian players variable behaves in a similar way: a 100% increase (going from 0 Canadian players on a given team to having a team completely made up of Canadian players) decreases the chances of not getting past the first round by only 4.9%. In subsequent rounds, a similar situation leads to a (in general) improvement of only 1%

in the probability of success. Note how the marginal effects decrease as the teams get further into the Stanley Cup playoffs, which is a common thread in this discussion.

The behaviour of the Conference Rank is also interesting. The important feature to remember with this variable is that the lower the value, the greater the rank (i.e. a rank of 1 implies the team finished first in the conference, while a rank of 8 implies that the team finished last). From Table 8, the marginal effects show that, ceteris paribus, a fall in rank of 1 place increases the probability of not advancing past the first round by 2.9%. But in subsequent rounds, if conference rank decreases by 1, the probability of advancing past, say, the second round, decreases by -0.1%; these values are similar for subsequent rounds. This leads us to suggest that conference rank, while not a significant variable, also does not play a deciding role in the probability of success in the NHL post-season as teams advance further.

Turning our focus to our key variable, the number of acquired players, we see a similar story being played out. The marginal effect is largest (positive or negative) when the team does not advance past the round; the impact is muted in subsequent rounds. For example, ceteris paribus, the probability of not advancing past the first round decreases by 3.5% as the number of acquired players increases by 1. But in the final round, as the number of acquired players' increases by 1, the probability of winning the fourth round (the Stanley Cup) is 0.5%, which is negligible.

Thus, for the most part, the marginal effects for the variables (whether significant or not) decrease as teams advance past each round of the playoffs. This is economically

important as it suggests that those variables (such as the number of Canadians, the points percentage, the Conference rank etc.) that we believe to be deciding factors in the make-up of a model Stanley Cup team are not pertinent as a team moves further in the Stanley Cup playoffs. It suggests that as teams continue in the Stanley Cup playoffs there may be other, unobservable factors at play. Indeed, by the time the finalists for the Stanley Cup finals have been determined, the two remaining teams may have already proven their mettle from already winning three rounds that with the championship in sight, the intrinsic randomness of competition takes over.

One interesting aspect of ordered logit models is that we can calculate the predicted probabilities (for each level of playoff success) of the acquired players' variable when the other independent variables are set to their mean values. This is beneficial as it allows us to look at the behaviour of the acquired players' variable for each outcome of playoff success; and this will give further evidence to help to determine whether trades have an impact on playoff success.

Table 9 of the appendix presents the predicted probabilities for each number of players acquired, for each level of playoff success. For the outcome where the team does not win a playoff series (i.e. no success), the impact that each acquired player makes is decreasing as the number of acquired players increase. In fact, the gap is nearly 30 percent between the probability of no success and not acquiring any players (57 percent) and acquiring nine players (28 percent). This is the only outcome to behave in this way. Of course this result may be trivial: it is essentially saying that the probability of not

having success (i.e. not win a round in the Stanley Cup playoffs) is lower when that team made many trades, than when that team made few trades. Otherwise, this observed relationship is reversed for each level of playoff success. In fact, the predicted probabilities decrease for each outcome in the dependent variable. Thus, if a team won the Stanley Cup, the probability that it did not acquire any single player is only 3 percent, as opposed to only 10 percent for nine players acquired. Therefore, if a team wants to win the Stanley Cup, it may be best to acquire some players rather than no players, but in the end, the overall impact is negligible. This conclusion was also seen previously in the marginal effects.

Finally, as a simple robustness check, it is of interest to verify the interaction of the conference rank and point percentage variables by removing point percentage. Of interest is whether conference rank suddenly becomes significant. The reason being is that since both variables contain primarily the same information, perhaps the point percentage variable dominates the conference rank variable; forcing it to become obsolete in our regression. Table 10 presents the results of the OLS regression.

The table confirms our reservations of the point percentage variable. With this variable omitted from the regression, the conference rank variable becomes highly significant at the 1% level. The other variables maintain the same behaviour as in the previous regression, suggesting that either model essentially gives the research robust results. The result further suggests that either strategy can be employed to generate the same outcome.

VII - Conclusion & Recommendations for Future Research

Can we therefore conclude that adding players in mid-season to an NHL team does not have a direct influence on post-season success? While our model has admittedly omitted some key factors for the sake of simplicity (talent level of players, position of players, etc.), our results suggest that adding many players to a team has no impact on success achieved by teams in the playoffs. Furthermore, from the summary statistics provided earlier, it appears that the players' acquired by the eventual cup winners were not the most talented, but rather had the most leadership and experience.[11]

Perhaps the most intriguing result is that for each of the variables, significant or not, their marginal effects shrunk as a playoff team in our sample continued further in the post-season. As stated earlier, this may imply that as teams advance in the playoffs, other unobservable factors may at play, such as increased desire or motivation to win. In fact, the round which the variables had the biggest impact was for getting out of the first round. Thus, this research shows that acquiring players may not be pertinent for winning the Stanley Cup, but rather they can be a piece of the puzzle for teams to get past the first round matchup. Any success afterword appears to increasingly involve other unobservable factors.

There is something to be said of whether there is an ideal type of player to acquire at the deadline. One could argue that this research shows that any trades made at mid-season should instead be made in an effort to improve the intangibles of a hockey team; i.e. leadership, experience, etc.). Indeed, star players usually face increased pressure from

fans and the media to produce immediately when joining a new team late in the season; which could certainly have a negative impact on personal and team success. Furthermore, because the tasks for the star player (generate goals scored) require such a high amount of skill, it may take time for the player to form chemistry with his new teammates; and perhaps 40 days left in the regular season is not sufficient. On the other hand, those players acquired for leadership and experience do not necessarily need to carry weight of fan and team expectations; while trying to get used to the new surroundings. Indeed, the pressure to form on-ice chemistry with teammates is not comparable, and these players can instead rely on their innate leadership abilities and past experience to make a positive contribution to team success. This study would therefore show that trades do not have an impact on playoff success in the NHL.

With regards to future research, a more extensive study would be to account for the quality of the players involved in trades. From the results, we cannot say for certain that it is leadership and experience that should be the order of the day at the Trade Deadline, rather than star players; however the results in this work surely point to that conclusion. As GM Brian Burke concedes, there may not be a science to acquiring players at the trade deadline: as the architect of the 2007 Stanley Cup champion Anaheim Ducks, Burke acquired one player at the deadline, enforcer Brad May. Given this fact, perhaps the majority of the General Manager's work should lie in the off-season, in order to build a solid team for the start of the season, rather than for the start of the playoffs. A similar study could also be undertaken to account for the positions of the players acquired. One could ignore the goaltender position (only a handful have switched teams late in the year),

and create categories for offensive and defensive players, etc. Some interesting research could lie in the success of those teams that sacrifice so much future talent for a run at a Stanley Cup. Do these teams struggle to compete in future years? Conversely, do those struggling teams become contenders in future years because of their high stock of young talent? Still, another option is to this apply the methodology from this paper to the other major North American sports. It would certainly translate well to football, where it is also difficult to account for player quality given the number of positions needed to run a play.

VIII - Summary

This paper has taken a series of random events, that is, four rounds of playoff hockey, and attempted to make conclusions with regards to the impact of certain variables on the success of teams in the playoffs; based on the regular season. The main conclusion has been that the trades teams make have no impact on the level of playoff success. For the nearly 300,000 viewers (nearly 15 million web users) on Trade Deadline day, this work may serve as a deterrent to succumbing to the hype generated by the league and the sports media. Or, 300,000 viewers may be just the beginning, as for each coming year, NHL teams will seem to forget rationale and reason, and focus on hockey's Holy Grail, that is the Stanley Cup. Indeed, as Whitney notes, "Economists must be ever humble, for a stack of econometric results can carry less weight than the opinion of a single well-informed insider" (Whitney 1988, p. 719). Of course, with 40 days left in an NHL regular season, there may be twenty well-informed insiders; but come June, we usually only find there was really only one.

Endnotes

[1] For the reference period in this paper (1993-94 to 2003-04), the number of teams in the league changed in four separate years: The 1993-94 season had 26 teams, while the 1998-99 and 1999-00 seasons each added a team for a total of 28 teams. The 2000-01 saw two more teams added for a total of 30 teams. As well, the number of games in season was also changed. In 1993-94, there were 84 total games played. In 1995-96, there were 82 games played, which has remained constant to the present day

[2]Prior to 2005-06, the league allowed for the possibility of a tie-game (1 point for each team). Prior to 1999-2000, the league did not award points for a loss in overtime.

[3] Author's calculations.

[4] While 2010 is outside of the reference period for this study, it is assumed that these values have not changed drastically over time.

[5] The 2008 Pittsburgh Penguins made a serious push for a Stanley Cup by acquiring Marian Hossa at the trade deadline, arguably one of the best players available at the deadline for quite some time. As Farber notes, although the 2008 Pittsburgh Penguins lost the Stanley Cup final in 7 games to the Detroit Red Wings, the additional revenue generated by the number of home games most likely made up for the loss for the owners.

[6] The 1994-95 season was also affected by a labour dispute, which was resolved to allow for a shortened 48-game regular season. For statistical consistency purposes, this season was omitted in the sample.

[7] To run an ordered logit, we must run an OLS regression, followed by the logit regression, followed by the ordered logit regression (i.e. marginal effects)

[8] We've held constant any coaching and/or managerial changes that can occur in mid-season, focusing only on player transfers.

[9] In the third round of the 2001 NHL playoffs, Pittsburgh Penguins defenseman Darius Kasparitis blocked a shot by New Jersey Devils forward Petr Sykora in the first period. The blocked shot caused a broken bone in two places in Kasparitis' foot; however he never missed a shift and played the remainder of the series (Devils won the series 4-1).

[10] In all, only 3 Europeans have won the Conn Smythe Trophy, and only 1 within our sample: Nicklas Lidstrom (2002), Henrik Zetterberg (2008), Evgeni Malkin (2009).

[11]The highest scoring player is a defenseman, Rob Blake. As well, most of the players are at or above the age of 30.

Appendix – Tables and Figures

Table 1 – Means and Standard Deviations of Key Variables

Variable	Mean	Standard Deviation
Playoff Success	0.8125	1.1876
Conference Rank	4.5000	2.3094
Points Percentage	0.5360	0.0614
Years of Experience	6.8362	1.4938
Years of Experience^2	48.9507	21.4869
Canadian	-0.1000	2.6850
Number of Acquired Players	2.4813	1.6971

Table 2 –Ten Oldest Playoff Teams from 1993-94 to 2003-04

Season	Conference	Team	Average Age	Average Years in NHL	No. Playoff Rounds Won
2002-03	Western	Detroit Red Wings	32.2	10.8	0
2003-04	Western	Detroit Red Wings	31.5	10.8	1
2001-02	Western	Detroit Red Wings	31.2	9.9	4
2002-03	Eastern	Toronto Maple Leafs	31.0	10.7	0
2003-04	Western	Dallas Stars	30.8	10.1	0
2003-04	Eastern	Toronto Maple Leafs	30.7	10.7	1
1999-00	Western	Detroit Red Wings	30.6	9.8	1
2000-01	Western	Detroit Red Wings	30.6	10.1	0
1995-96	Western	St. Louis Blues	30.3	9.1	1
2002-03	Western	Dallas Stars	30.0	9.8	1

Table 3 – Ten Youngest Playoff Teams from 1993-94 to 2003-04

Season	Conference	Team	Average Age	Average Years in NHL	No. of Playoff Rounds Won
1995-96	Eastern	Montreal Canadiens	24.6	3.9	0
2000-01	Western	Vancouver Canucks	25.2	4.3	0
1996-97	Western	Edmonton Oilers	25.2	4.3	1
1997-98	Eastern	Buffalo Sabres	25.3	4.7	2
1996-97	Eastern	Buffalo Sabres	25.3	4.3	1
1996-97	Eastern	Montreal Canadiens	25.5	5.1	0
1993-94	Eastern	Montreal Canadiens	25.5	5.1	0
2000-01	Western	Edmonton Oilers	25.5	4.4	0
1998-99	Western	Edmonton Oilers	25.5	4.8	0
1993-94	Western	San Jose Sharks	25.7	3.8	1

Table 4 – Number of Trades Completed by each Stanley Cup Winning Team, 1993-94 to 2003-04

Team	Conference	No. of Acquired Players
New York Rangers	Eastern	4
Colorado Avalanche	Western	1
Detroit Red Wings	Western	2
Detroit Red Wings	Western	2
Dallas Stars	Western	4
New Jersey Devils	Eastern	2
Colorado Avalanche	Western	3
Detroit Red Wings	Western	1
New Jersey Devils	Eastern	3
Tampa Bay Lightning	Eastern	2

Table 5 – Season Statistics of those Players Acquired by the Eventual Stanley Cup Winner, 1993-94 to 2003-04

Team	Player	GP	G	A	PTS	Age	Country of Birth	No. of Stanley Cups
1994 NY Rangers	Brian Noonan	76	18	23	41	28	United States	0
	Stephane Matteau	77	19	19	38	24	Canada	0
	Glenn Anderson	85	21	20	41	33	Canada	5
	Craig MacTavish	78	20	12	32	35	Canada	3
1996 Colorado Avalanche	Dave Hannan	61	7	10	17	34	Canada	1
1997 Detroit Red Wings	Larry Murphy	79	9	36	47	36	Canada	2
	Tomas Sandstrom	74	18	24	42	32	Sweden	0
1998 Detroit Red Wings	Jamie Macoun	74	0	7	7	36	Canada	1
	Dmitri Mironov	77	8	35	43	32	Russia	0
1999 Dallas Stars	Benoit Hogue	74	12	17	29	32	Canada	0
	Blake Sloan	14	0	0	0	23	United States	0
	Derek Plante	51	6	14	20	28	United States	0
	Doug Lidster	17	0	0	0	38	Canada	1
2000 New Jersey Devils	Alex. Mogilny	59	24	20	44	31	Russia	0
	Vlad. Malakhov	24	1	4	5	32	Russia	0
2001 Colorado Avalanche	Rob Blake	67	19	40	59	31	Canada	0
	Steve Reinprecht	80	15	21	36	24	Canada	0
	Bryan Muir	18	0	3	3	27	Canada	0
2002 Detroit Red Wings	Jiri Slegr	46	3	6	9	30	Czech Republic	0
2003 New Jersey Devils	Grant Marshall	76	9	23	32	29	Canada	0
	Pascal Rheaume	77	8	10	18	29	Canada	0
	Richard Smehlik	55	2	11	13	33	Czech Republic	1
2004 Tampa Bay Lightning	Darryl Sydor	80	3	19	22	31	Canada	0
	Stan Neckar	-	-	-	-	28	Czech Republic	0

Notes: No. of Stanley Cups refers to the number of championships won by the acquired player at the time of the trade.

Table 6 – Testing the Normality of the Error Term of the OLS Regression

Variable	No. Observations	Pr(Skewness)	Pr(Kurtosis)	adj chi2(2)	Pr>chi2
Residual	160	0.446	0.419	1.25	0.5351

Table 7 – Results of the Ordered Logistic Regression

Variable	Coefficient
Conference Rank	-0.1166
	(0.1051)
Points Percentage	-9.3153***
	(3.8666)
Years of Experience	1.0252
	(0.0945)
Years of Experience^2	-0.0815
	(0.0555)
Canadian	0.1946***
	(0.6163)
Number of Acquired Players	0.1398
	(0.0945)

Notes: *** Indicates significance at the 1% level; **Indicates significance at the 5% level; *Indicates significance at the 10%, No stars indicates no level of significance; Number of Observations: 160

Table 8 – Marginal Effects of the Ordered Logistic Regression

Variable	Did not win First Round	Win in First Round	Win in Second Round	Win in Third Round	Win in Fourth Round
	Marginal Effects				
Conference Rank	0.0291	-0.0096	-0.0099	-0.0055	-0.0043
Points Percentage	-2.328***	0.7632**	0.7886**	0.4354**	0.3407**
Years of Experience	-0.2562	0.0839	0.0868	0.0479	0.0375
Years of Experience^2	0.0204	-0.0067	-0.0069	-0.0038	-0.0029
Canadian	-0.0486***	0.0159**	0.0165***	0.0091***	0.0071**
Number of Acquired Players	-0.0349	0.0114	0.118	0.0065	0.0051

Notes: *** Indicates significance at the 1% level; **Indicates significance at the 5% level; *Indicates significance at the 10%, No stars indicates no level of significance; Number of Observations: 160

Table 9 – Predicted Probabilities for each Outcome of Playoff Success, for the Number of Acquired Players

Outcome	Number of Acquired Players	Predicted Prob.
Do not win First Round	0	0.5743
	1	0.5406
	2	0.5065
	3	0.4724
	4	0.4385
	5	0.4051
	6	0.3727
	7	0.3413
	9	0.2897
Won First Round	0	0.2633
	1	0.2776
	2	0.2905
	3	0.3016
	4	0.3107
	5	0.3174
	6	0.3217
	7	0.3233
	9	0.3185

Notes: Number of Observations – 160;

Table is continued on the following page

Table 9 (continued)

Outcome	Number of Acquired Players	Predicted Prob.
Won Second Round	0	0.0950
	1	0.1053
	2	0.1163
	3	0.1279
	4	0.1399
	5	0.1523
	6	0.1647
	7	0.1771
	9	0.2006
Won Third Round	0	0.0366
	1	0.0413
	2	0.0466
	3	0.0525
	4	0.0589
	5	0.0660
	6	0.0736
	7	0.0819
	9	0.1002
Won Fourth Round	0	0.0308
	1	0.0351
	2	0.0401
	3	0.0457
	4	0.0520
	5	0.0592
	6	0.0673
	7	0.0764
	9	0.0980

Notes: Number of Observations - 160

Table 10 – Robustness Check: Removing Point Percentage (OLS Regression)

Variable	With PTS PCT	Without PTS PCT
	Coefficient	**Coefficient**
Constant	-3.8604	-0.2556
	(-2.0680)	*(1.5566)*
Conference Rank	-0.7363	-0.1791***
	(0.0567)	*(0.0401)*
Points Percentage	-5.3278***	-
	(2.0589)	-
Years of Experience	0.6899*	0.6329
	(0.4249)	*(0.4321)*
Years of Experience^2	-0.0530*	-0.04970*
	(0.0291)	*(0.0296)*
Canadian	0.0917***	0.0912***
	(0.3240)	*(0.0329)*
Number of Acquired Players	0.0609	0.0422
	(0.0533)	*(0.0537)*

Notes: *** Indicates significance at the 1% level; **Indicates significance at the 5% level; *Indicates significance at the 10%, No stars indicates no level of significance; Number of Observations: 160

Figure 1 – Average Playoff Success in the Eastern Conference, by Conference Rank, 1993-94 to 2003-04

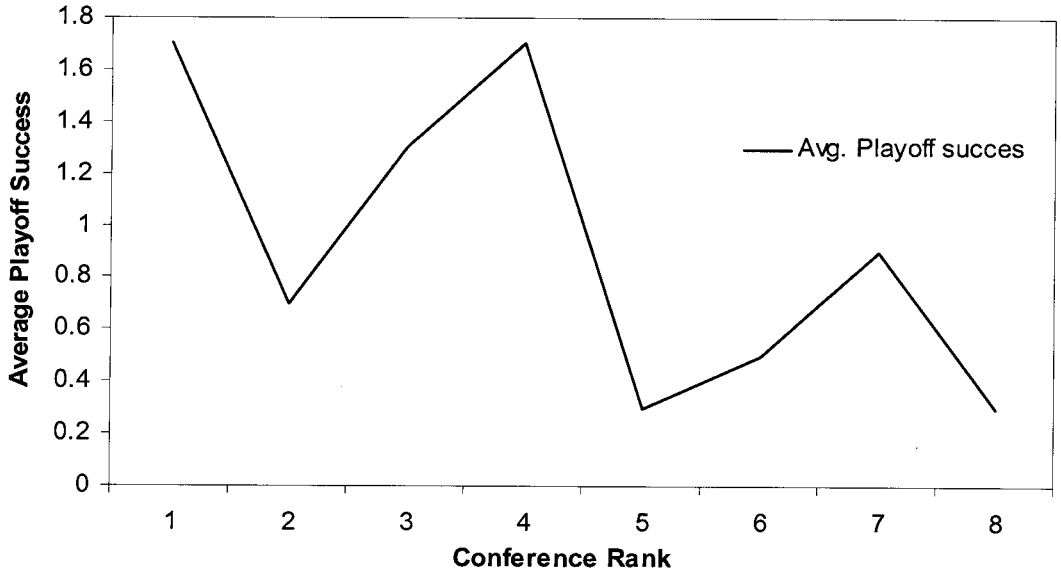


Figure 2 – Average Playoff Success in the Western Conference by Conference Rank, 1993-94 to 2003-04

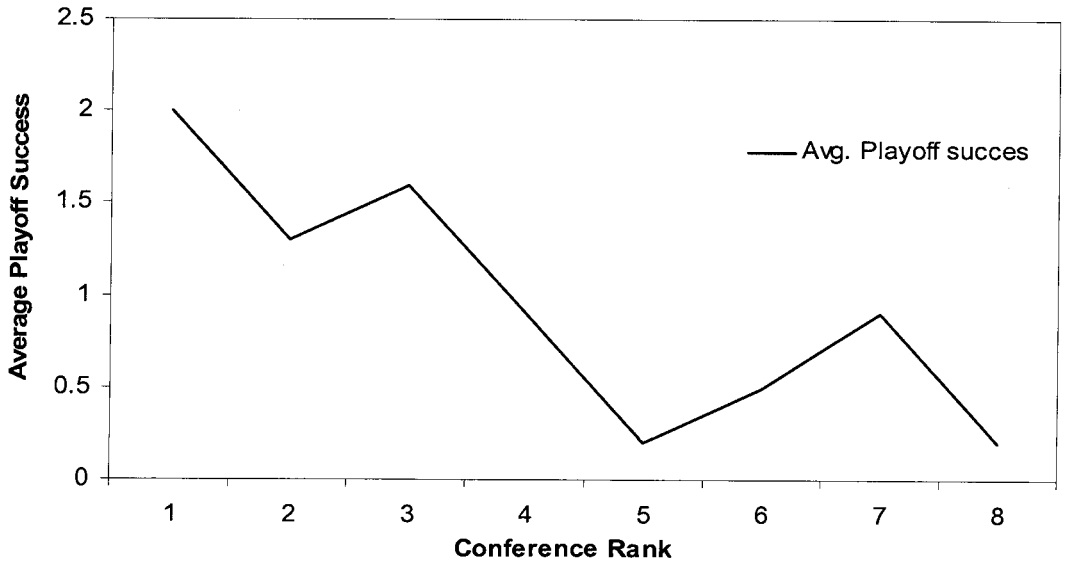
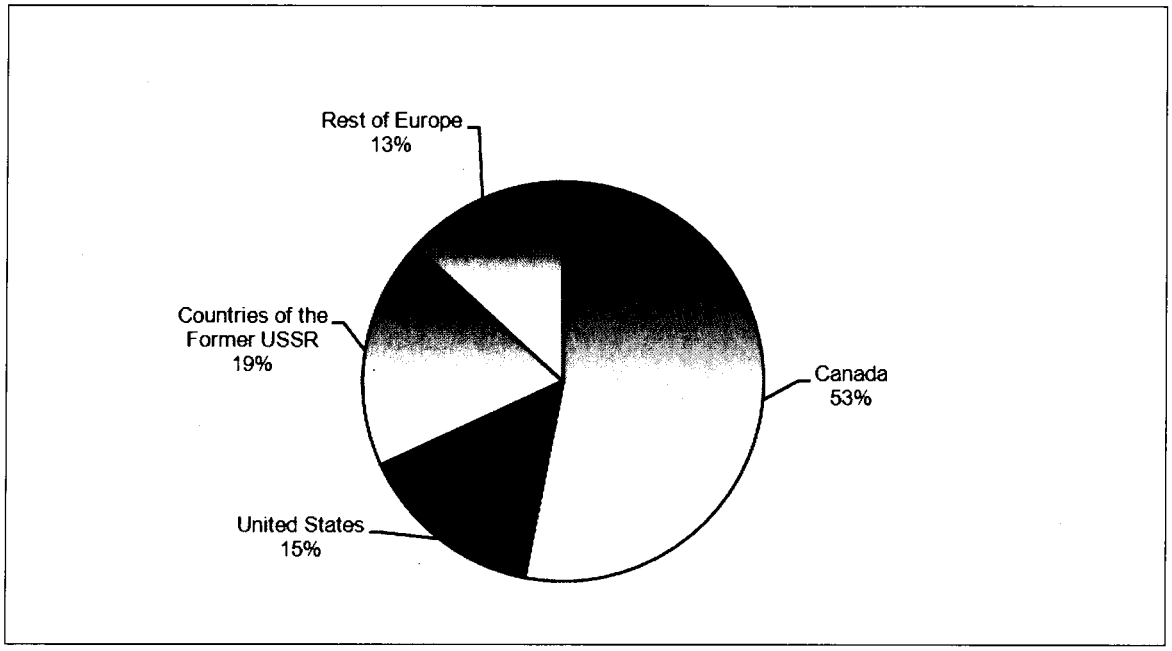


Figure 3 – Distribution of Player Nationality, 1993-94 to 2003-04



Works Cited

Eckard, E.W. (2001) Free Agency, Competitive Balance, and Diminishing Returns to Pennant Contention. *Economic Inquiry* 39(3), 430-442

Farber, M. March 5, 2009. The Irrational Exuberance of NHL Trade Deadline Day. *Sports Illustrated, SI.com* Available: <http://sportsillustrated.cnn.com/2009/writers/michael_farber/03/03/trade.deadline.haste/index.html>

Fort, R. and Quirk, J. (1995) Cross-Subsidization, Incentives, and Outcomes in Professional Team Sports Leagues. *Journal of Economic Literature,* Vol. 33 September 1995, 265-1299

Greene, W. (2007) *Econometric Analysis* (6th ed.) Upper Saddle River, NJ: Prentice Hall

Haugen, K. (2006) An Economic Model of Player Trade in Professional Sports: A Game Theoretic Approach. *Journal of Sports Economics*, 7(3) 309-318

Hockey-Reference. <Available: http://www.hockey-reference.com/>, Accessed: May 2010

Hockey Databank. <Available: http://sports.dir.groups.yahoo.com/group/hockey-databank/?v=1&t=directory&ch=web&pub=groups&sec=dir&slk=9> Accessed: May 2010

Horowitz, I. (1997) The Increasing Competitive Balance in Major League Baseball. *Review of Industrial Organization, 12,* 373-387

Kahn, L.M. (2000) The Sports Business as a Labor Market Laboratory *Journal of Economic Perspectives*. 14(3), 75-94

Késenne, S. (2000) The Impact of Salary Caps in Professional Team Sports. *Scottish Journal of Political Economy*, 47(4), 422-429

Krautmann, A. and Ciecka, J. (2009) The Post-Season Value of an Elite Player to a Contending Team. *Journal of Sports Economics*, 10(2), 168-179

Liu, F. and Zhang, Z. (2008) Predicting Soccer League Games using Multinomial Logistic Models. Unpublished. Purdue University
Available: http://mashmario.com/research/pub/soccer.pdf

Neale, W.C. (1964) The Peculiar Economics of Professional Sports. *The Quarterly Journal of Economics*, Feb. 1964 No.1, 1-14

National Hockey League. *Collective Bargaining Agreement between the National Hockey League and National Hockey League Players' Association.* July 22, 2005. Available: < http://www.nhl.com/cba/2005-CBA.pdf>

National Hockey League "Conn Smythe Trophy". 2008 <Available: http://www.nhl.com/trophies/smythe.html>

National Hockey League. *NHL Official Guide and Record Book (1994-95)* Chicago Triumph Books: Chicago 1994

National Hockey League. *NHL Official Guide and Record Book (1996-97)* Chicago Triumph Books: Chicago 1996

National Hockey League. *NHL Official Guide and Record Book (1997-98)* Chicago Triumph Books: Chicago 1997

National Hockey League. *NHL Official Guide and Record Book (1998-99)* Chicago Triumph Books: Chicago 1998

National Hockey League. *NHL Official Guide and Record Book (1999-00)* Chicago Triumph Books: Chicago 1999

National Hockey League. *NHL Official Guide and Record Book (2000-01)* Chicago Triumph Books: Chicago 2000

National Hockey League. *NHL Official Guide and Record Book (2001-02)* Chicago Triumph Books: Chicago 2001

National Hockey League. *NHL Official Guide and Record Book (2002-03)* Chicago Triumph Books: Chicago 2002

National Hockey League. *NHL Official Guide and Record Book (2003-04)* Chicago Triumph Books: Chicago 2003

National Hockey League. *NHL Official Guide and Record Book (2004-05)* Chicago Triumph Books: Chicago 2004

Rottenberg, S. (1956) The Baseball Players' Labor Market *The Journal of Political Economy, 64(3), 242-258*

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

Vrooman, J. (1995) A General Theory of Professional Sports Leagues. *Southern Economic Journal*, Vol. 61, 971-990

Vrooman, J. (2009) Theory of the Big Dance: The Playoff Payoff in Pro Sports Leagues, The Oxford Handbook of Sports Economics, Vol.1: The Economics of Sports, Leo H. Kahane and Stephen Shmanske, eds, Oxford University Press, forthcoming 2010. Available: < http://www.vanderbilt.edu/Econ/faculty/Vrooman/vrooman-big-dance3.pdf>

Whitney, J.D. (1988) Winning Games Versus Winning Championships: The Economics of Fan Interest and Team Performance. *Economic Inquiry* 26 (4), 703-724

Zelkovich, C. March 4, 2010 "TSN holds on to (yawn) Trade Deadline Title", *Sports Media Watch, (Blog), The Toronto Star.* Available: < http://thestar.blogs.com/sportsmedia/2010/03/rogers-channel-boy-that-didnt-take-long-when-tsn2-launched-19-months-agoit-was-basically-a-rerun-channel-which-isnt-e.html>