Labor Economics: A Replication of Ethnicity, productivity, and salary: player compensation and discrimination in the National Hockey League[1]

Paul Curtis Foster

Graduate Student, Department of Economics

Gordon Ford College of Business 433
Western Kentucky University
Bowling Green, KY 42101-1056

Email: paul.foster574@topper.wku.edu

Phone: 270-943-0939

December 14, 2012

Abstract

Discriminatory practices are studied to great lengths within the world of labor economics. They are a sociological aspect that is easily understood, and generally easy to quantify within most markets. The National Hockey League, and its corresponding Players Association, offers a widely recognizable example of such a market. Despite this fact, the NHL provides a relatively untapped source of sports statistics to explore. This paper aims to reexamine the work of J. Colin H. Jones, Serge Nadeau, and William D. Walsh, whom have pioneers the subject with relation to hockey.

Keywords: Discrimination, hockey, NHL, NHLPA, Labor Economics, Sports Economics, Canada, United States

[1] This thesis is to be presented on Friday December 14, 2012. I would like to give my special thanks to my thesis chair, Dr. Dennis Wilson; department chair, Dr. Brian Goff; SAS consort, Dr. Alex Lebedinsky; first economics professor, Dr. Bruce K. Johnson; and the Western Kentucky University Economics Department, who have all too patiently fostered my study of economics over many years. This paper is dedicated to them.

Introduction:

Professional sports are not immune to labor discrimination. Indeed, many economist and statisticians are intrigued by this occurrence. Szymanski (2000) studied such practices against black player in English soccer during 1970s and 1980; Leonard, Pine, and Rice (1988), Leonard (1988), Lavoie and Leonard (1990) against Hispanics in Major League Baseball; and Marple (1973) against blacks in professional basketball. Much of the focus has been racially charged. In terms of hockey however, many of the authorities that are well versed in the factors at play focus on ethnic and/or language differences as a source of discrimination. More specifically, I have concerned myself with testing the notion that francophone players (French speaking players) are discriminated against with respect to compensation.

There are many different approaches other economists have adopted to try to establish the presence of discrimination. For example, Lavoie (2003) uses previous year's statistics as a function of entry draft position to determine whether or not each player was being over or undervalued. Longley (1995), used players' salaries dependent upon previous year's statistics in the development of his model. Lavoie [2000]; Jones, Nadeau, and Walsh [1999] also used salary as a function of performance in the development of their given models, but not surprisingly, their modifications produced different results. Generally speaking, most of these models show little to the overall effect of any ethnic group being undervalued. The nature of the league however, has changed greatly within the last few seasons, opening the door for potential shifts toward discriminatory practices. With the use of a large sample of current data (accordingly a more current understanding of factors that might be at play), and the foundation modular design of Jones, Nadeau, and Walsh [1999], I aim to retest for the presence of discrimination. The thesis of this paper therefore stands as follows: Pay discrimination against Francophones and foreign players exists to an observable extent in English speaking Canada. Furthermore, inspection of the discriminatory teams' market structures allows me to speculate as to source of that discrimination. This paper will proceed by describing the model, presenting the results, and concluding with implications of what the results mean, with reference to the work of Jones, Nadeau, and Walsh [1999] throughout.

Background Information and Nature of Model:

The model for this paper consists of the dependent variable as a function of four independent variable subgroups: time period and position, performance/productivity, market structure, and ethnic/team affiliations as found, sorted by color, below. Please look to Appendix Equation 1 for the unabbreviated SAS version of the equation.

$$\text{lnSalary} = \alpha + \sum_{i=1}^{6}(\beta_i Y_{2004+i}) + \beta_7 \text{Position} + \beta_8 \text{TotalGoalsPG} + \beta_9 \text{TotalAssistsPG} + \beta_{10} \text{TotalGamesPlayed} + \beta_{11} \text{TotalGamesPlayed}^2 + \beta_{12} \text{TotalPenaltyMinutesPG} + \beta_{13} \text{Goon} + (\beta_{14} \text{Goon*TotalPenaltyMinutesPG}) + \beta_{15} \text{Height} + \beta_{16} \text{Height}^2 + (\beta_{17} \text{Height*BodyWeight}) +$$

β_{18}BodyWeight + β_{19}WeightSquared + β_{20}Awards + β_{21}Draft$_1$ + (β_{22}Draft$_1$* DraftNumber) + β_{23}Draft$_3$ + β_{24}Draft$_4$ + $\sum_{i=1}^{3}$(β_{24+i}Draft$_i$ *YearsSinceDraft) + (β_{28}Draft$_1$*DraftNumber*YearsSinceDraft) + β_{29}Population2011 + β_{30}IncomePerCapita1999USD + β_{31}ArenaSize + β_{32}SportCompetition+β_{33}TeamPoints09_10 + β_{34}TeamPoints10_11 + $\sum_{i=1}^{3}$ $\sum_{j=1}^{2}$($\gamma_{i,j}$ + $\delta_{i,j}$Vet)*Ethnic$_i$*TeamLoc$_j$ + ε

These variables are titled accurately, but for more thorough definition of each, look to the Appendix Table 1. Please note that due to limitations in the number of goalies; only "skaters" (forwards and defensemen) will be included in the analysis.

Player Salary

The NHLPA releases compensation data each year, as it becomes available. July 1st, of each year marks the start of that season's free agency period, with the trade deadline on the following February 27th. Within the model itself I used that natural logarithm of each player's salary as the dependent variable.

Performance/Productivity

The NHL releases quite a bit of information concerning performance statistics as they occur. Unfortunately for my purposes, most of these statistics are offensive in nature. They consist of the clearly important variables on experience (games played), stardom (trophies awarded) and skill (goals, assists, etc.), but lack in-depth evaluations of more defensive/physical play (showing only penalty minutes), and the biased (therefore not included) plus-minus score[2]. I, much like the work of Jones, Nadeau, and Walsh [1999], use a second-order Taylor expansion of height and weight as a proxy to account for physical play. In an effort to gauge the uncertainty teams have of players' productivity potential, given imperfect information; I used a dummy variable for veteran versus non-veteran players. This, of course, follows the assumption that teams are risk-averse when choosing a player, and results in some of that risk being transferred to potential salaries[3]. I also include the entry draft variable as a source of salary dictation, in a further effort to gauge non-veteran abilities/potential. Draft round dummy variables, as well as draft number, were shown by Jones, Nadeau, and Walsh [1999] to be important when determining how much a player will be paid. Finally, I also included a goon

[2] The plus-minus score consists of a point given to every player on the ice during a even-strength or shorthanded (opposing team has more men on the ice due to penalty) goal, and a point is taken from every player on the ice when the team allows a goal. This, of course, excludes penalty shots. As you might imagine, this score generally favors forwards, who are less likely to be on the ice during times that more physical play is required (opposing power plays for instance), and more likely when on the attack (power plays).

[3] As considered by Aigner and Cane in 1977.

dummy variable[4] in the same manner as Jones, Nadeau, and Walsh [1999]. For those that are unfamiliar with the game, there are specific players who's sole (or near sole) job is to pick fights with the opposing team in order to disrupt their concentration or pay them back for equally rough play. Please look to Appendix Table 1 to see how each variable was assessed in greater detail.

Market Structure

It is important to understand the changes that have occurred recently within the NHL in order to gain a clear view of the current market structure for players, as opposed to market structure during the Jones, Nadeau, and Walsh [1999] study. The National Hockey League, mimicking the fast paced sport of which it governs, has in recent history shown the ability to expand and contract more so than its counterparts in other professional sports (MLB, NBA, NFL, MLS, etc.). From 1992 to the present, the league has expanded from 22 teams to 30 (adding the: Tampa Bay Lightning, Ottawa Senators [1992]; Mighty Ducks of Anaheim, Florida Panthers [1993]; the Nashville Predators [1998]; Atlanta Thrashers [1999]; Minnesota Wild, Columbus Blue Jackets [2000])[5]. The league has also seen many teams change locations (Minnesota North Stars to the Dallas North Stars [1993], Quebec Nordiques to the Colorado Avalanche [1995], Winnipeg Jets to the Phoenix [1996], Hartford Whalers to the Carolina Hurricanes [1997], Atlanta Thrashers to the Winnipeg Jets [2011]). This is important for two major reasons. First, the number of observations (or players) has increased greatly. And second, the number of French-speaking and English-speaking Canadian teams has decreased (with the Nordiques moving to Colorado). In addition, labor disputes interrupted play in 1992, the 1994-1995 season, and resulted in the 2004-2005 season to be cancelled completely. These brakes are most important for my analysis through the changes made to the collective bargaining agreement between the league and the Player's Association[6], as well as the rule changes concerning regular season overtime[7]. Understanding the easy, or lack thereof, at which players can be traded gives us insight into the structure of the market for players. With the Entry Draft

---

[4] Goon will equal one if the player's career penalty minutes per game are 1.25 times the standard deviation above the mean AND career points per game are 1.25 times the standard deviation below the mean.

[5] This information can be found directly from the League (NHL.com), as well as a variety of new/information sites <http://sports.yahoo.com/nhl/news?slug=ac-6959634>, <http://en.wikipedia.org/wiki/History_of_the_National_Hockey_League>.

[6] A copy of the agreement up to the 2012-2013 season can be found through the National Hockey League Players Association's website <http://nhlpa.com/docs/about-us/nhl_nhlpa_2005_cba.pdf>.

[7] Up until the 2004-2005 lockout, if the teams were tied at the end the first overtime during a regular season game, the game officially ended in a tie. From that point onward, the NHL empliments a points system, awarding 2 points for any win, 1 point for a overtime lose, and 0 points for a lose in regulation. This will be important when speaking of regular season point totals. Rutledge-Taylor, Matthew. May 18, 2010. <http://bleacherreport.com/articles/393599-the-nhl-points-system-time-to-rethink-points-for-losing>

regulating most of the amateur free agents, and NHL by-laws making it difficult to trade, I expect to see the teams showing varying signs of monopolistic revenue potential and monopsony power in contract negotiations (as shown earlier by Jones, Nadeau, and Walsh [1999]). So in other words, if monopolistic revenue potential is dominate, I would expect players' salaries to be higher in locations with larger markets (e.g. larger population, bigger arena, higher per capita income, fewer competing sports teams, etc.). If team's monopsony power is dominate, I would expect the bargaining power gained from "off-ice" income potential to be greater and salaries lower, in larger markets (for the same reasons). Finally, part of the makeup of each teams market is team success, accounted for here by regular season point totals. This is a slight departure from that of Jones, Nadeau, and Walsh, who used final season rank because the point system had not been implemented yet. In this case, point totals simply gives rank a sense of scale. Unfortunately for this analysis, teams are deemed most successful from playoff wins (resulting in a Stanley Cup victory) rather than, the here accounted for, regular season wins (resulting in a President's Cup victory). Playoff hockey, while interesting, produces too few observations to be considered at all. Please refer to Appendix Table 1 for further information on how these variables were assessed.

Ethnic Factors

In an effort to avoid one of the pitfalls Longley (1995) discovered in the works of Lavioe and Grenier (1992) and Jones and Walsh (1988) , I will not simply be looking at the aggregate discrimination across the entire league, but rather the discrimination within the three separate ethnic groups alluded to above (French-speaking Canada, English-speaking Canada, and the United States). It is also important to note that the Ottawa Senators, while located in a province of Canada that is officially classified as bilingual[8], will be included in the analysis as a French-speaking team. The nature of this young organization and its proximity to Quebec is such that much of their fan base are francophones. For these reasons, it is unlikely it would fall victim to the same prejudices (or presumed prejudices) held by its English speaking counterparts. Although, with the reach of the press being league wide, I cannot assume it is immune completely. Please note, that the structure of this section of the model allows the variables to be considered interactively, with separate interaction based on whether or not the player is a veteran. Please look to Table 1 for more in-depth information on the variables.

To this point, I have only considered the presence of wage discrimination, and not the source. Indeed, outright prejudice could exist between francophones playing for an Anglophone establishment. The source could also simply be the cost of bilingualism, as was considered by Jones, Nadeau, and Walsh [1999]. Because coaches' and other players' limited communication abilities reduce team performance, pay is reduced. Veteran players, however would be immune

[8] Ontario Bar Association < http://www.oba.org/En/about/GovernanceDocuments/official-lang-policy.aspx>

to this pay reduction because, for all intends and purposes, they are bilingual. However, if I notice the depression of francophones' salaries among both veteran and non-veteran players, it is more likely outright prejudice is the source. It is also important to consider that a source of income prejudice comes from the consumer, rather than NHL coaches, players and officials. Often fans support players that are ethnically equal to themselves. This puts pressure on the teams to pay them more, which is fuelled by the higher revenues generated from having that player. I would consider this relationship weak if fans value matching non-veteran ethnicity, and non-matching veteran ethnicity; or strong if fans value matching ethnicities for both veteran and non-veteran players. Please look to Table 1 for further identification of the variables used.

Empirical Analysis

The data set employed in this analysis uses a total of 2763 observations (1793 forwards and 970 defensemen). Each player must have been active during the 2011-2012 season, as well as played at least one previous year in order to gather performance information. Additional observations were also included for these players spanning back as far as the2005-2006 season, as long as the previous year requirement was met[9]. This is resultantly a much larger sample size than was used by Jones, Nadeau, and Walsh [1999] (388 total observations). The model is tested under Ordinary Least Squares conditions; a Wald test rejects the hypothesis that coefficients between positions are jointly equal (p-value <0.001), hence providing reason to regress them separately as first demonstrated by Jones, Nadeau, and Walsh [1999]. The respective adjusted R^2s (0.7718 for defensemen, 0.7633 for forwards) indicate the equation provides a relatively accurate representation of salary determination. Descriptive statistics appended in Table 2.

Performance/Productivity

The premonition that salary differentials are subject to a player's performance carries weight within my model for both positions when considering the variables : TotalGoalsPG, TotalAssistsPG, TotalGamesPlayed, TotalGamesPlayed2, TotalPenaltyMinutesPG, Awards, and the Taylor Expansion for player size.[10]

Across positions I find the gooning variable produces similar results. Forwards' salaries seem to be unaffected by that style of aggressive play (p-value=0.4613), alone with those of defensemen (p-value=0.3306). This is a departure from other results, suggesting a shift towards

[9] There are clear negative implications set by using a data of this nature, however sample size necessitated expansion past the base year 2011-2012.

[10] A Wald test confirms the hypothesis that the function for player's size has little effect on salary of forwards (p-value=0.7206), but does effect the salaries of defensemen (p-value=0.0528). This follows the logic that other variables are better at evaluating skill/performance, but size does explain salary effects for the players expected to be more physical.

skill rather than outright physical play[11]. The stardom factor, based on the entry draft, does have an effect on both forwards and defensemens' salaries[12]. This result supports the notion that players from both positions are more highly evaluated before they are drafted than what was indicated by past analyses, and therefore receive higher compensations instantaneously upon entering the league.

Finally, the experience variables, designed to gauge the ambiguity about a players potential productivity, shows that highly experienced players in both positions earn significantly more than their less experienced counterparts[13]. This suggests that these organizations are at least somewhat successful in transferring the costs of uncertainty to players that have played fewer games.

Market Structure

Free agency, observed through the dummy variable $Draft_4$, is shown to be insignificant for forwards (p-value=0.1781), and for defensemen (p-value=0.8712). This suggests that most (if not all) quality players are subject to the entry draft, thereby making initial free agency inconsequential in determining salary[14].

In terms of the differing characteristics of each organization in determining salary, I find that I must reject the null hypotheses that salaries in both positions are unaffected by these factors (forward p-value=0.0327, defensemen p-value=0.0440). This is in accord with the results found by Jones, Nadeau, and Walsh when using the 1989-1990 data, suggesting franchise characteristics continue to matter in determining salary, even with expansion of the league and widening market gap.

Finally, I find that team success (represented by points earned for two separate seasons) has little to no effect on defensemen salaries (p-value=0.4364), but does have an effect on the salaries of forwards (p-value=0.0736). I suspect these results are due to the high profile nature of forwards when a team is successful. These results also coincide with Jones, Nadeau, and Walsh [1999] (p-value=0.866 and p-value<0.001 respectively).

Ethnicity

---

[11] Jones, Nadeau, and Walsh [1999] rejected the null hypothesis that forwards salaries are unaffected by the goon variable (p-value=0.004).

[12] The joint hypothesis that the draft has no effect on players salaries is rejected for both positions (p-value<0.0001 for forwards, p-value<0.0001 for defensemen). This too is at odds with the results of Jones, Nadeau, and Walsh [1999], who found the entry draft to be "of limited relevance" for defenders (p-value=0.135).

[13] The joint hypothesis that gamesplayed and gamesplayedsquared has no effect on determining salary is rejected for both positions (p-values<0.001). This is consistent with the results of Jones, Nadeau, and Walsh [1999] (p-values =0.007 and 0.060 respectively).

[14] Coincides with Jones, Nadeau, and Walsh [1999].

Salary Determination for Francophones

If I assume that under player/official prejudices, Francophone players' salaries will be adversely affected, regardless of their veteran/non-veteran status, I discover the absence of conclusive evidence of such bias, as did Jones, Nadeau, and Walsh [1999]. First, it is necessary to test the hypotheses that veteran and non-veteran Franophones are paid the same as other players with the same experience level. As I see from Table 4, I must reject this initial null hypothesis for non-veteran players. This alone would suggest the presence of discrimination; however, it is necessary to evaluate each component more closely to gain a truer understand of what is happening.

Upon this introspection I find results I might not have expected if there truly was evidence of prejudice, specifically, in terms of Anglophone defensemen playing for French speaking teams. Logically I would expect these players to be paid the same or less than their Francophone teammates, however, I find that both veteran and non-veteran Anglophone defensemen in fact earn significantly more. Since it is least likely that Francophones are suffering from prejudice while playing for a French speaking team, I must exclude veteran and non-veteran Anglophone defensemen from my original 'no discrimination' hypothesis. After doing so, I find that I can accept the null hypothesis that both veteran (p-value=0.257) and non-veteran (p-value=0.186) Francophones are paid the same salary as other players[15]. It is also important to note the degree of change between these values. Unfortunately, this is one of the drawbacks associated with my larger sample size. Because I used the roaster from 2011-2012 as a base for the observations taken from other time periods, there are far more veteran than non-veteran players in my data set. Granted, this also makes each observation less relevant than in the Jones, Nadeau, and Walsh study, but it is important to note.

Fan Preferences and Players Salaries

If hockey consumers show preferential treatment based upon a player's ethnicity, it stands to reason that hockey organizations will collect higher revenues and resultantly offer salary differentials based upon those preferences. To test to what extent these preferences exist, I again use the leagues pay structure. Looking at the league as a whole, I find I must accept the null hypothesis that salary is unaffected by fan preference for like ethnicity (test 5.1 and 5.2), but in order to gain a clearer picture, I evaluate based by region and position. Within the National Hockey League, this breaks down fairly simply: Francophones in French speaking Canada (test 5.3 and 5.4), Anglophones in English speaking Canada (test 5.5 and 5.6), and American in the United States (test 5.7 and 5.8). Over all, I find little support to suggest the

[15] Much the same as was found by Jones, Nadeau, and Walsh.

presence of ethnically based consumer preference in Francophone Canada, Anglophone Canada, or the United States. However, when comparing the p-values between the two positions, it seems fans value like ethnicities in forwards more so than in defensemen, even with the overall effect of no preference. When compared to other studies, the decline of the already 'weak ethnic preferences'[16] makes logical sense. The ease at which relevant information reaches fans about players has caused ethnic origin is becoming increasingly irrelevant.

Conclusion:

My analysis of NHL salaries has provided us with some pertinent results, not all of which are in accord with those of Jones, Nadeau, and Walsh, but can still be logically explained. First, in line with what I assume, but is nonetheless relevantly proven, a professional hockey player's salaries is determined primarily by that given player's productivity on the ice, experience, and franchise characteristics. My proxies of height and weight, which were irrelevant in determining salary when evaluated by Jones, Nadeau, and Walsh, are relevant for defensemen in my own analysis. While it is hard to say what really caused this change, it is possible Jones, Nadeau, and Walsh's sample size was too small to gauge the importance of the variable as a proxy. Additionally, the gooning variable that Jones, Nadeau, and Walsh found relevant for salary dictation was found irrelevant in my own analysis. Again, this could be due to sample size, but could also indicate a push league wide away from such practices. Stardom, which was significant for only forwards in Jones, Nadeau, and Walsh's tests, leaked over into defensemen as well in my own. A possible explanation of this is a new appreciation and better evaluation of the work of good defensemen, which wasn't intact in the late nineties. Interestingly, team success matter only for forwards in both studies, showing best how both positions are not treated the same. Fan ethnicity preference proved to be even less of a factor in my model than in that of Jones, Nadeau, and Walsh. This could be because ethnicity is actually becoming more irrelevant, or because Jones, Nadeau, and Walsh were unable to value it as accurately with a small sample size. All that said, the ultimate goal was to give validity to the presence or absence of discrimination. As did Jones, Nadeau, and Walsh, I didn't find conclusive evidence of teams or fans being biased against francophones. It is intriguing that French speaking teams seem to consistently value Anglophone Canada defensemen more highly than others. I feel that this phenomenon occurred because both studies used height and weight as a proxy for performance rather than direct statistics. Say for example, the NHL started taking records of the different types of checks executed by defensemen; we might discover the source of this occurrence. I think it probably speaks more to the style of play rather than to the productivity in

[16] Mentioned by Jones, Nadeau, and Walsh.

general. Nevertheless, the debates on the presence of ethnic discrimination will continue, but I, as did those before me, found little evidence of any such bias on the part of the teams themselves or the fans that support them.

Appendix

Equation 1-Raw Equation:

lnSalary = a + d1 * y2005 + d2 * y2006 + d3 * y2007 + d4 * y2008 + d5 * y2009 + d6 * y2010 + b0 * position + b2 * TotalGoalsPG + b3 * TotalAssistsPG + b4 * TotalGamesPlayed + b5 * TotalGamesPlayed2 + b6 * TotalPenaltyMinutesPG + b7 * goon + b8 * goon * TotalPenaltyMinutesPG + b9 * Height + b10 * Height2 + b11 * Height * BodyWeight + b12 * BodyWeight + b13 * Weight2 + b14 * Awards + b15 * DraftOne + b16 * DraftOne * DraftNumber + b17 * DraftThree + b18 * DraftFour + ((b19 * DraftOne * YearsSinceDraft) + (b20 * DraftTwo * YearsSinceDraft) + (b21 * DraftThree * YearsSinceDraft))+ b22 * DraftOne * DraftNumber * YearsSinceDraft + b23 * Population2011 + b24 * IncomePerCapita1999USD + b25 * ArenaSize + b26 * SportCompetition + b27 * TeamPoints09_10 + b28 * TeamPoints10_11 + ((c1 * Anglo) + (c2 * franco) + (c3 * other) + (c4 * teamlocque) + (c5 * teamlocroc) + (c6 * vet) + (c7 * anglo * teamlocque) + (c8 * anglo * teamlocroc) + (c9 * anglo * vet) + (c10 * franco * teamlocque)+ (c11 * franco * teamlocroc) + (c12 * franco * vet) + (c13 * other * teamlocque) + (c14 * other * teamlocroc)+ (c15 * other * vet) + (c16 * teamlocque * vet) + (c17 * teamlocroc * vet) + (c18 * anglo * teamlocque * vet)+ (c19 * anglo * teamlocroc * vet) + (c20 * franco * teamlocque * vet) + (c21 * franco * teamlocroc * vet)
+ (c22 * other * teamlocque * vet) + (c23 * other * teamlocroc * vet))+ ε

Table 1-Variable Definitions:

lnSalary	The natural log of each player's salary for the observed season as release by the National Hockey League's Players Association.
Y2005	Dummy variable that is equal to 1 if the observation occurred during the 2005-2006 regular season. Else, equals 0.
Y2006	Dummy variable that is equal to 1 if the observation occurred during the 2006-2007 regular season. Else, equals 0.
Y2007	Dummy variable that is equal to 1 if the observation occurred during the 2007-2008 regular season. Else, equals 0.
Y2008	Dummy variable that is equal to 1 if the observation occurred during the 2008-2009 regular season. Else, equals 0.
Y2009	Dummy variable that is equal to 1 if the observation occurred during the 2009-2010 regular season. Else, equals 0.
Y2010	Dummy variable that is equal to 1 if the observation occurred during the 2010-2011 regular season. Else, equals 0.
Y2011	Dummy variable that is equal to 1 if the observation occurred during the 2011-2012 regular season. Else, equals 0.

Position	Dummy variable that is equal to 1 if the given players position is primarily that of a defenseman, and 0 if primarily a forward.[17]
TotalGoalsPG	The total number of career goals divided by total number of career games played during the regular season.
TotalAssistsPG	The total number of career assists divided by total number of career games played during the regular season.
TotalPointsPG	The total number of career goals and assists divided by total number of career games played during the regular season.
TotalGamesPlayed	The total number of career games played during the regular season.
TotalGamesPlayed2	The total number of career games played during the regular season SQUARED.
Total PenaltyMinutesPG	The total number of career penalty minutes served divided by total number of games played during the regular season.
Goon	Dummy variable that is equal to 1 if TotalPenaltyMinutesPG is greater than or equal to 1.25 times the standard deviation of the mean, AND TotalPointsPG is less than or equal to 1.25 times the standard deviation of the mean. Else, is equal to 0.
Height	The player's height in inches.
Height2	The square of height.
BodyWeight	The player's weight in pounds.
Weight2	The square of BodyWeight
Awards	The total number of career personal trophies awarded, plus the number of All-Star Team appearances.
$Draft_1$	Dummy variable that is equal to 1 if the player was selected in the first round of their given National Hockey League Entry Draft. Else, equal to 0.
$Draft_2$	Dummy variable that is equal to 1 if the player was selected in the second or third round of their given National Hockey League Entry Draft. Else, equal to 0.
$Draft_3$	Dummy variable that is equal to 1 if the player was selected in the fourth round or later of their given National Hockey League Entry Draft. Else, equal to 0.
$Draft_4$	Dummy variable that is equal to 1 if the player was not selected in their given National Hockey League Entry Draft. Else (those who's first contract was as a free agent). Else, equal to 0.
DraftNumber	The number the player was selected in the National Hockey League Entry Draft. If free agent it equals 0.
YearsSinceDraft	The number of years since the player was drafted.
Population2011	The 2011 population statistics (for Canada) and the estimated 2011

[17] Very rarely players have played different positions on the ice during different periods of their career (e.g. offensive defensemen switching to the forward position).

	population statistics (for the United States as adjusted from the 2010 Census) of the metropolitan areas in which a given team resides. Released by the U.S. Census Bureau and Statistics Canada respectively.
IncomePerCapita1999USD	The income per capita in 1999 USD for the given state or providence in which the team resides adjusted for purchasing power as considered by Basher and Lagerlöf (2008).
TeamPoints09_10	The number of playoff points at the end of the 2009/2010 regular season (3 points for each win [regulation or overtime], 1 point for an overtime lose, 0 points for a lose in regulation).
TeamPoints10_11	The number of playoff points at the end of the 2010/2011 regular season (3 points for each win [regulation or overtime], 1 point for an overtime lose, 0 points for a lose in regulation).
Franco	Dummy variable that is equal to 1 if the player is from French speaking Canada. Else, is equal to 0.
Anglo	Dummy variable that is equal to 1 if the player is from English speaking Canada. Else, is equal to 0.
(USA)[18]	Dummy variable that is equal to 1 if the player is from the United States. Else, is equal to 0.
Other	Dummy variable that is equal to 1 if the player is from somewhere other than the United States or Canada (e.g. Europe, Asia, etc.). Else, is equal to 0.
TeamLocQue	Dummy variable that is equal to 1 if the team is located in French Speaking Canada. Else, equal to 0.
TeamLocRoc	Dummy variable that is equal to 1 if the team is located in English Speaking Canada. Else, equal to 0.
(TeamLocUS)[19]	Dummy variable that is equal to 1 if the team is located in the United States. Else, equal to 0.
Vet	Dummy variable that is equal to 1 if the given player has played at least one game for three or more seasons at the time of the observation. Else, equal to 0.

Table 2-Descriptive Statistics

	Defensemen	***Defensemen***	***Forwards***	***Forwards***
Variable	***Mean***	***Standard Dev***	***Mean***	***Standard Dev***
observe	5730.03	3413.35	5537.31	3354.26
Height	73.787619	2.1822665	72.9260958	1.942609
BodyWeight	211.2961905	15.6070333	202.8960245	14.8685347
totalgamesplayed	328.3447619	263.6260625	330.3797146	267.113093

[18] This dummy variable is omitted as a part of the base group within the ethnic evaluation summation.
[19] This dummy variable is omitted as a part of the base group within the ethnic evaluation summation.

y2005	0.0838095	0.277234	0.0779817	0.2682111
y2006	0.1152381	0.3194612	0.108053	0.3105265
y2007	0.1285714	0.3348845	0.1258919	0.3318121
y2008	0.1428571	0.3500939	0.1457696	0.3529651
y2009	0.1619048	0.368539	0.1630989	0.3695501
y2010	0.1590476	0.3658948	0.1636086	0.3700143
y2011	0.2085714	0.4064809	0.2155963	0.4113402
Population2011	4623812.52	4497877.54	4453905.74	4208189.23
IncomePerCapita1999USD	34204.09	4512	34203.47	4376.92
TeamPoints09_10	93.2556701	12.6938465	92.945343	13.0255725
TeamPoints10_11	92.9670103	12.9926924	92.6625767	13.144986
DraftNumber	74.8247619	77.6897582	61.0948012	72.2772665
Awards	0.3390476	1.886508	0.4699286	1.7896418
lnSalary	14.2688267	0.8188577	14.1954746	0.8680346
Vet	0.707619	0.4550731	0.6921509	0.4617215
TotalGoalsPG	0.0702844	0.0499342	0.2086644	0.114748
TotalPointsPG	0.3039802	0.1593496	0.4920955	0.2635819
TotalAssistsPG	0.2336958	0.1179031	0.2834311	0.1643611
TotalPenaltyMinutesPG	0.7953782	0.4566661	0.7629445	0.6266735
goon	0.007619	0.0869954	0.0310907	0.1736072
Height2	5449.37	323.237435	5321.99	282.948278
Weight2	44889.43	6740.85	41387.76	6099.13
Franco	0.2352381	0.4243497	0.3175331	0.4656354
Anglo	0.2628571	0.4403953	0.2410805	0.4278481
USA	0.2247619	0.4176243	0.1972477	0.3980224
Other	0.2771429	0.4478009	0.2405708	0.4275391
TeamLocQue	0.1333333	0.3400966	0.1269113	0.3329585
TeamLocROC	0.1361905	0.3431542	0.1355759	0.342425
TeamLocUS	0.7304762	0.4439239	0.7375127	0.4400982
DraftOne	0.3028571	0.4597129	0.4138634	0.4926502
DraftTwo	0.2228571	0.4163615	0.2186544	0.413439
DraftThree	0.3447619	0.4755171	0.2589195	0.438153
DraftFour	0.1295238	0.3359388	0.1085627	0.3111691
YearsSinceDraft	10.2447619	4.0360738	9.843527	4.1270592
TotalGamesPlayed2	177242.79	280887.58	180463.79	269448.72

Table 3-Parameter Estimates:

Linked Variable	***Defencemen Parm Est***	***Defencemen Std Errors***	***Forward Parm Est***	***Forward Std Errors***
-	-12.2418	13.4617	29.19204	12.5406

TotalGoalsPG	0.78463	0.4356	2.114776	0.1542
TotalAssistsPG	1.635522	0.2054	1.406763	0.1115
TotalGamesPlayed	0.004596	0.00025	0.003421	0.000201
TotalGamesPlayed2	-3.27E-06	2.09E-07	-2.28E-06	1.68E-07
TotalPenaltyMinutesPG	-0.00109	0.0391	0.009976	0.0214
Goon	-0.48862	0.5547	-0.14051	0.2536
Goon*TotalPenaltyMinutesPG	0.251308	0.2036	0.086526	0.1019
Height	0.72964	0.4732	-0.66913	0.441
Height2	-0.00549	0.00453	0.00615	0.00405
Height*BodyWeight	0.000386	0.00117	-0.00111	0.000943
BodyWeight	-0.02713	0.0594	0.071335	0.049
Weight2	3.96E-06	8.4E-05	0.000024	0.00007
Awards	0.067617	0.0115	-0.00949	0.00699
Draft1	-0.09249	0.1441	-0.37201	0.0928
Draft1*DraftNumber*	0.003886	0.0078	0.016672	0.0051
Draft3	0.12822	0.1186	0.054938	0.0835
Draft4	0.017929	0.1106	-0.10219	0.0759
Draft1*YearsSinceDraft	0.045978	0.012	0.03923	0.00937
Draft2*YearsSinceDraft	0.018978	0.0104	-0.00787	0.00667
Draft3*YearsSinceDraft	0.000311	0.00859	-0.01863	0.00686
Draft1*DraftNumber*YearsSinceDraft	-0.00087	0.00078	-0.00197	0.00052
Population2011	-3.19E-09	5.25E-09	1.47E-09	4.10E-09
IncomePerCapita1999USD	4.31E-07	4.16E-06	6.67E-06	3.15E-06
ArenaSize	0.00003	1.7E-05	0.000038	0.000013
SportsCompetition	0.023645	0.0156	-0.00909	0.0118
TeamPoints09_10	0.003031	0.0015	-0.00246	0.00116
TeamPoints10_11	-0.00201	0.00158	0.000684	0.00119

anglo	-0.0538	0.0737	-0.08285	0.0612
franco	-0.12714	0.0732	-0.13777	0.0569
other	0.114822	0.0762	-0.10454	0.0635
teamlocque	0.430792	0.2456	-0.15028	0.1756
teamlocroc	0.313633	0.2165	0.163359	0.1454
vet	0.041013	0.0714	-0.02348	0.0603
anglo*teamlocque	-0.42515	0.3832	0.516007	0.2339
anglo*teamlocroc	-0.499	0.2578	-0.17841	0.1753
anglo*vet	-0.01963	0.0907	0.057314	0.0746
franco*teamlocque	-0.69159	0.3228	0.122039	0.209
franco*teamlocroc	-0.02866	0.2478	0.06308	0.1716
franco*vet	-0.01144	0.0914	0.153408	0.0692
other*teamlocque	-0.61545	0.2834	-0.00417	0.2215
other*teamlocroc	-0.37357	0.268	-0.02112	0.1834
other*vet	-0.1244	0.0936	0.184968	0.0757
teamlocque*vet	-0.44493	0.2793	0.082346	0.2114
teamlocque*vet	-0.05314	0.2363	-0.14976	0.1683
anglo*teamlocque*vet	0.246616	0.4262	-0.16391	0.3299
anglo*teamlocroc*vet	0.526122	0.2879	0.351428	0.2057
franco*teamlocque*vet	0.24817	0.4248	-0.0819	0.2551
franco*teamlocroc*vet	0.122841	0.283	-0.2382	0.203
other*teamlocque*vet	0.647585	0.3281	0.170371	0.267
other*teamlocroc*vet	0.160309	0.297	-0.0149	0.2155
y2005	-0.47449	0.0676	-0.42944	0.0536
y2006	-0.27632	0.0592	-0.26798	0.0461
y2007	-0.26951	0.0525	-0.20194	0.0413
y2008	-0.06218	0.0483	-0.1355	0.0372
y2009	-0.05812	0.0444	-0.09529	0.0347
y2010	-0.03625	0.0441	-0.05209	0.0336

Table 4- Wald Test for Francophone Salary Determination

	Combined Position p-values	Defensemen p-values	Forward p-values
[4.1] H_0: Non-veteran Francophone players are paid the same as all other player ethnicities at all locations.	0.0137	0.0429	0.0092
[4.2] H_0: Veteran Francophone players are paid the same as all other player ethnicities at all locations.	0.3869	0.0004	0.0101
[4.3] H_0: Cost of bilingualism	0.0284	0.0003	0.0020

Table 5-Wald Test for Consumer Preferences

	Combined Position p-values	Defensemen p-values	Forward p-values
[5.1] H_0:Non-veteran salary effects based on consumer ethnicity comparison, total sample.	0.1537	0.0987	0.0407
[5.2] H_0: Veteran salary effects based on consumer ethnicity comparison, total sample.	0.2747	0.0789	0.1334
[5.3] H_0: Non-veteran salary effects based on consumer ethnicity comparison, Quebec.	0.1142	0.3482	0.0207

[5.4] H_0: Veteran salary effects based on consumer ethnicity comparison, Quebec.	0.1119	0.3421	0.0201
[5.5] H_0: Non-veteran salary effects based on consumer ethnicity comparison, English speaking Canada.	0.1132	0.3538	0.0204
[5.6] H_0: Veteran salary effects based on consumer ethnicity comparison, English speaking Canada.	0.1056	0.3735	0.0194
[5.7] H_0: Non-veteran salary effects based on consumer ethnicity comparison, USA.	0.1107	0.3632	0.0199
[5.8] H_0: Veteran salary effects based on consumer ethnicity comparison, USA.	0.1097	0.3648	0.0200

Works Cited

Basher, Syed A., and Nils-Petter Lagerlof. "Per-capita Income Gaps across US States and Canadian Provinces." *Journal of Macroeconomics* 30 (2008): 1173-187. Print.

Grenier, Gilles, and Marc Lavoie. "Discrimination and Salary Determination in the National Hockey League:1977 and 1988 Compared." *Advances in the Economics of Sport* 1 (1992): 151-75. Print.

Johnson, Norris R., and David P. Marple. "Racial Discrimination in Professional Basketball: An Empirical Test." *Sociological Focus* 6.4 (1973): 6-18. Print.

Jones, Colin H., Serge Nadeau, and William D. Walsh. "Ethnicity, Productivity and Salary: Player Compensation and Discrimination in the National Hockey League." *Ethnicity, Productivity and Salary: Player Compensation and Discrimination in the National Hockey League* 31 (1999): 593-608. Print.

Jones, J.C.H., and William D. Walsh. "Salary Determination in the National Hockey League: The Effects of Skills, Franchise Characteristics, and Discrimination." *Industrial and Labor Relations Review* 41.4 (1988): 592-604. Print.

Lavoie, Marc. "The Entry Draft in the National Hockey League: Discrimination, Style of Play, and Team Location." *American Journal of Economics and Sociology* 62.2 (2003): 383-405. Print.

Lavoie, Marc. "The Location of Pay Discrimination in the National Hockey League." *Journal of Sports Economics* 1 (2000): 401-11. Print.

Leonard, Wilbert, Jon Pine, and Connie Rice. "Performance Characteristics of White, Black, and Hispanic Major League Baseball Players: 1955-1984." *Journal of Sport and Social Issues* 12.1 (1988): 31-43. Print.

Leonard, Wilbert M., and Marc Lavoie. "Salaries, Race/ethnicity, and Pitchers in Major League Baseball: A Correction and Comment." *Sociology of Sport Journal* 7.4 (1990): 394-98. Print.

Leonard, Wilbert M. ""Salaries and Race in Professional Baseball: The Hispanic Component"" *Sociology of Sport Journal* 5 (1988): 278-84. Print.

Longley, Neil. "Salary Discrimination in the National Hockey League: The Effects of Team Location." *Canadian Public Policy* 21.4 (1995): 413-22. Print.

Szymanski, Stefan. "A Market Test for Discrimination in the English Professional Soccer Leagues." *The Journal of Political Economy* 108.3 (2000): 590-603. Print.

White, Halbert. "A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity." *Econometrica* 48.4 (1980): 817-38. Print.