Wage Discrimination in the National Hockey League

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Table of Contents

List of Figures

Chapter 3

List of Tables

Chapter 4:

Abstract

This study examines wage determination and discrimination in the National Hockey League (NHL) during the 2002-2003 and 2003-2004 seasons. The existence of discrimination in the NHL is based on a bilateral monopoly framework with differences in bargaining power between North American and European players.

Using ordinary least squares regressions, player skill data and nationality are used to explain salary levels. The initial results were designed to determine if wage differentials exist between Canadian, American and European players regardless of their playing location.

Additional player attributes and playing location variables were added to further investigate possible wage discrimination. After correcting for differences in skill sets, it was found that European forwards are paid more on average than Canadian forwards. When adding United States versus Canadian franchise location variables, the analysis indicated that European forwards playing in Canada or the United States earn more than Canadian forwards playing in Canada. It was also found that European defensemen playing in the United States earn more than Canadian defensemen playing in Canada. This study detected no wage differential between European and Canadian defensemen playing in Canada.

Chapter 1: Introduction

The National Hockey League (NHL) was founded in 1917, at a time when NHL franchises were struggling financially, as evidenced by the fact that during the NHL's second season only three teams operated (National Hockey League 2006). As the league matured, it began to emerge as the premier North American hockey league as its ability to pay high wages to players was unmatched by rival leagues. After World War II, the original six NHL teams emerged and competed solely against each other until 1967 when expansion began. Between 1967 and 1970, eight NHL franchises were awarded to various cities. In the late 1970's, the only significant competition the NHL ever faced, the World Hockey Association (WHA), folded and six WHA teams merged to form four addition NHL franchises. Expansion cooled during the 1980's, but the 1990's saw massive growth of NHL franchises. Three more teams were added by 1992 and when Gary Bettman became NHL Commissioner in 1993, five more teams were added. Expansion in the 1990's was significant also because southern US cities, such as San Jose and Tampa Bay, were being awarded franchises.

The country composition of NHL player origin has significantly evolved over time. Initially, Canadian players dominated the league. The first European player placed on an NHL franchise's reserve list was Jaroslav Drobny in 1947, but he never played an NHL game (World Cup of Hockey 2004). The first European to play an NHL game was not until 1965 when Sweden's Ulf Sterner competed for the New York Rangers (World Cup of Hockey 2004). Today, the player composition of the NHL is very diverse as evidenced by the fact that during the 2005-2006 season: (1) 53.1% of NHL players were

Canadian, (2) 18.3% of NHL players were American, and (3) 21.1% of NHL players were European (National Hockey League 2006).

Discrimination has existed in society for centuries and manifests itself through such forms as racial, gender, and nationalistic, among others. Sports facilitate a unique context for examining discrimination as the general public perception is that sport provides a plethora of equal economic opportunity for all individuals (Eitzen and Sage 1978). This perception stems from the fact that in sport, winning is the ultimate goal and thus to achieve this, merit is given to skill factors as opposed to discriminatory ones. Said differently, it is assumed that winning is the objective and thus athletes will be evaluated on their contribution to winning regardless of their non-skill attributes. This statement is reinforced through the fact that minorities are more highly represented in major team sports than that of the overall labour force (Kahn 1991).

Wage discrimination is generally described as the inequitable treatment of equally productive labour (Becker 1971). Previous studies have examined discrimination in the NHL using regression attributes to isolate discriminatory variables. These studies have mainly focused on discrimination against French-Canadian hockey players. Thus, when considering the increasingly diverse pool of NHL players, coupled with the significant expansion of NHL teams, discrimination in the NHL has had the potential to evolve over previous periods.

This study examines discrimination in the NHL during the seasons of 2002-2003 and 2003-2004. The research questions addressed in this study are: (1) what are the significant skill factors involved in determining a player's NHL salary? And (2) if

present, how does discrimination manifest itself in the NHL during the 2002-2003 and 2003-2004 seasons?

Using ordinary least squares (OLS) regression, a wage determination model is formulated for NHL players. Player salary is used as the dependant variable and a set of skill variables, such as goals per game, are used as independent variables to explain the variation in NHL player salaries. Dummy variables representing Canadian, American and European nationalities along with Canada and the United States (US) playing locations were included. This is done to examine discrimination related to player nationality and playing location.

Chapter 2, discuses literature related to economic discrimination and wage discrimination applied to professional sports is reviewed. In Chapter 3, a theoretical basis for wage discrimination and its existence in the NHL is presented. In Chapter 4, data from two NHL seasons is analyzed and interpreted. Finally, in Chapter 5 a concluding summary is presented with future research possibilities discussed.

Chapter 2: Review of the Literature

Wage discrimination in professional sports was brought to the forefront with the work of Scully (1974). The interest in examining discrimination in professional sports relates to the distinct characteristics that professional sports offer over most other labour market scenarios. "There is no research setting other than sports where we know the name, face and life history of every production worker and supervisor in the industry" (Kahn 2000, 75). The availability of work performance and compensation data in professional sports, allows for productivity measures to be observed much more easily than in other industries.

The idea of the economic effects and causes of wage discrimination in the labour market are rooted in the work of Becker (1957). Becker developed a model where he treated African Americans and Caucasians as two distinct countries in an international trade model. Becker developed the model to where the Caucasian country owns a higher ratio of capital to labour than does the African American country. Accordingly, Becker states that if discrimination was non-existent, the Caucasian country would export capital and import labour to the point where the marginal product of capital, and labour, are equal between both countries. He stipulates a "taste for discrimination" (Kahn 2000, 75) among the Caucasians country, where Caucasian capitalists require a premium, to induce them to work with the African American factors of production. The result is that incomes among the two countries are greatly affected by discrimination.

The work of Scully (1974) was innovative as it allowed for the examination of monopsony power of Major League Baseball (MLB) owners over MLB players. Scully

determined that a team's performance, and thus attendance and revenues, are a function of its players' abilities indicated by its hitters' slugging percentage and its pitchers' strikeout to walk ratio. From this, Scully calculated the marginal revenue product (MRP) of players categorized into three groups according to their skill level. After determining MRP, Scully then compared a player's MRP to the player's salary and was able to determine the degree of monopsonistic exploitation. A player, whose marginal revenue product, net of development costs, was greater than that of their salary, is said to be monopsonistically exploited. The research found that average and star players were exploited by the team, whereas mediocre players exploited the team by yielding a net marginal revenue product less than their salary.

The monopsonistic exploitation of players, as explained by Scully, resulted from the Reserve Clause, where barring a trade, a player was unable to move among teams. In a later study completed by Sommers and Quinton (1982), when the Reserve Clause was weakened and the MLB player market became much more competitive, the degree of monopsonistic exploitation decreased as players were being paid closer to their net marginal revenue product.

One of the earliest studies of wage discrimination in NHL hockey was put forth by Gilles Grenier and Marc Lavoie (1988). Regression analysis was used to determine an equation with scoring points as the dependant variable and explanatory skill set variables such as draft round and playing position. Variables such as whether or not the player is Francophone were included. From this Grenier and Lavoie concluded: (1) forwards have an insignificant positive coefficient for French-Canadian, (2) French-Canadian defensemen have a significant negative coefficient and (3) goalies have an insignificant

negative coefficient for French-Canadians. This follows the theory of Lavoie, Grenier, and Coulombe (1987) that hiring discrimination in the NHL is most prevalent under the circumstance of a high degree of uncertainty as it applies to predicting future performance at each player position. This theory states that, *ceteris paribus,* "the greater the difficulty in assessing the expected contribution of a player to the performance of the team, the higher the degree of discrimination" (Lavoie, Grenier, and Coulombe 1987). Defensive skill is more difficult to access than that of forward or goalie where statistics provide an accurate measure of performance. Accordingly, it was found that Francophones were underrepresented at defense, but not forward or goalie.

The study of salary discrimination in the NHL was further advanced by Jones and Walsh (1988). Using a monopsony hypothesis, Jones and Walsh (1988) explain that each franchise embodies unique characteristics which differentiate player ability to earn off-ice income through appearances and sponsorships. Jones and Walsh (1988) theorize that an increased ability to earn off-ice income for a player results in increased monopsony power of owners in such high off-ice income potential locations. Thus it is expected that a negotiated salary between an owner and player would result in a lower wage on average for a player where potential for off-ice income was high, assuming all other relevant factors held equal. Variables included by Jones and Walsh (1988) such as a lagged variable for the franchise's city population, income, area capacity and competition in the form of other professional sports were included to account for differences in monopsony power.

After testing the variables relating to monopsony power, Jones and Walsh (1988) found that the monopsony variables are only significant as they apply to forwards.

Defensemen and goaltenders were found not to be influenced by off-ice ability to earn income. Jones and Walsh (1988) offer the explanation that the monopsony hypothesis only applies to forwards because scoring goals is regarded as "glamorous" compared to the work of defensemen and goaltenders.

Additionally, after regressing the data from the 1977-1978 NHL season, Jones and Walsh (1988) found that discrimination among French-Canadian players was non-existent in the forward and goalie position, but a significant wage difference was realized among defensemen, with French-Canadians being paid less.

Explanations as to why discrimination against French-Canadian defensemen exist put forth by Jones and Walsh (1988) are: (1) English-Canadians require a salary premium to play with French-Canadians and thus French-Canadian wages must be lowered to finance the premium; (2) the incompatibility of the French and English players on ice as it applies to communicative ability results in less productivity; and, (3) a socially acceptable quota of French-Canadian players is implicit in the NHL and thus any supply of French-Canadians in excess of this quota will result in the lowering of French wages.

Following along the lines of Lavoie, Grenier, and Coulombe (1987), McLean and Veall (1992) studied Francophone hiring discrimination in the NHL using a similar method, but with data from later seasons. Their findings were similar to that of Lavoie, Grenier and Coulombe (1987) in that evidence of performance differentials between Francophone and Anglophones were found. However, McLean and Veall found the differentials to be smaller. These authors suggest this was the case because of market pressures pertaining to winning that effectively force general managers to employ the best available players regardless of their nationality. Also, it was possible the decrease in

wage differentials was a result of the increase in the number of Francophone coaches and general managers in the National Hockey League (Lavoie and Grenier 1987).

The work of Longley (1995) was analogous to that of previous authors in terms of attempting to explain variation in salaries based on player characteristics. This study however took a different approach in examining wage discrimination by accounting for both team location and player origin. Longley used data from the 1989-90 NHL season and initially tested for wage discrimination among French-Canadians, American and European nationalities, relative to English-Canadians. He found no discrimination among Americans and Europeans existed, and discrimination among French-Canadians was significant only when reducing the level of significance to ten percent.

Longley further tested for discrimination across French-Canadians, Americans and Europeans while isolating their playing location. To accomplish this Longley introduced eleven dummy variables, such as Americans playing in the US and Europeans playing in English-Canada among others[i]. The author concluded that French-Canadians playing in English-Canada were paid 37 percent less than English-Canadians playing in English-Canada. The analysis found no evidence that English-Canadians playing in French-Canada are discriminated against. It should be noted that Longley completed this analysis only for the forward position.

The most recent NHL salary discrimination study examined was work reviewed by Lavoie (2000). In this study, Lavoie differentiated from that of Longley by using a later season (1993-1994), which included defensemen, addition player skill variables and a reduction in the number of location and nationality variables. Discrimination was examined relative to English Canadians playing in English-Canada, Americans playing

for US teams, and French-Canadians playing for French-Canadian teams. Lavoie (2000) found European forwards were discriminated when compared to French-Canadian players playing for Quebec teams. For defensemen he finds similar results with Europeans being discriminated against only when compared to French-Canadian players playing in French-Canada. Lavoie notes "a new study, based on several seasons, could provide firmer conclusions" (Lavoie 2000, pg. 410).

These studies have analyzed previous seasons of NHL data in an attempt to identify how discrimination manifests itself through a variety of forms in player salaries. The methods used in this study follow the work of the previously mentioned authors, whose work serves as a basis for comparison of this study's results.

Chapter 3: Theoretical Basis for Discrimination

To address the research question of salary discrimination in the National Hockey League, a theory that explains salary determination must be put forth. The NHL represents a labour market scenario where there is only one group of workers, represented by the National Hockey League Players Association (NHLPA). Since under the collective bargaining agreement owners can only hire players in the NHLPA, this group represents a monopoly, a single seller of hockey services to NHL team owners. Conversely, there are only a select number of buyers of players' labour, represented by the owners of the 30 NHL franchises. Essentially, this group works as a monopsony as they operate collectively in negotiating the league's collective bargaining agreement. A monopsonist is a single buyer of an input (Salvatore 2003). In this case, NHL owners can be said to be monopsonists in North America because they are the only employers who hire highly skilled hockey players. While it is recognized that there are numerous alternative North American leagues, such as the American Hockey League and the East Coast Hockey League, the NHL pays its players significantly more salary and is generally accepted as the world's premier hockey league. Thus it can be said that if North American players are assumed to be utility maximizing, they would seek the highest compensation for their skills and choose the NHL.

From a European player's perspective, NHL owners represent only one potential employer. In Europe there are many elite leagues which boast players who are have the necessary skills to play in the NHL, as evidenced by the fact that some elite league players did formerly play in the NHL (European Hockey 2006). Alternative European

leagues to the NHL include, the Russian, Swedish and Swiss Elite Leagues. These elite leagues offer a significant advantage to European players over North American players looking for hockey employment alternatives. The European leagues have higher salaries than alternative North American leagues. The American Hockey League (AHL) is the highest quality North American alternative to the NHL and salaries average about US $50 000 per year (Roberts 2004). In the European Elite Leagues, player salaries range from US$300 000 to US$700 000 per year (Szemberg 2005). To further illustrate the European Leagues' ability to pay higher salaries than the AHL, consider the case of Jaromir Jagr of the New York Rangers. During the 2004-2005 season, Jagr reportedly earned US$400 000 per month while playing for HC Rabat Kladno of the Czech Elite League (Stogaspal 2005). Thus, when examining European players it cannot be said that they face a simple monopsonistic buyer of their labour services as the NHL represents only one of a few select choices of employment for European players.

The monopoly producer of NHL games is the players, who have the necessary skill to perform at the highest level and who are members of the NHLPA. The NHLPA emerged in 1967, when players elected the first NHLPA president and demanded that the NHL owners recognize them as union. The owners obliged under the conditions that players would not strike throughout the term of the collective bargaining agreement that was employed at the time. The NHLPA on two occasions has been locked out by the NHL owners, in 1994-1995 and 2004-2005. During these times, the owners and player's union were unable to collectively bargain a solution pertaining to such things as length of contracts, age of free agency, maximum rates of compensation and the percentage of NHL revenues that are entitled to players.

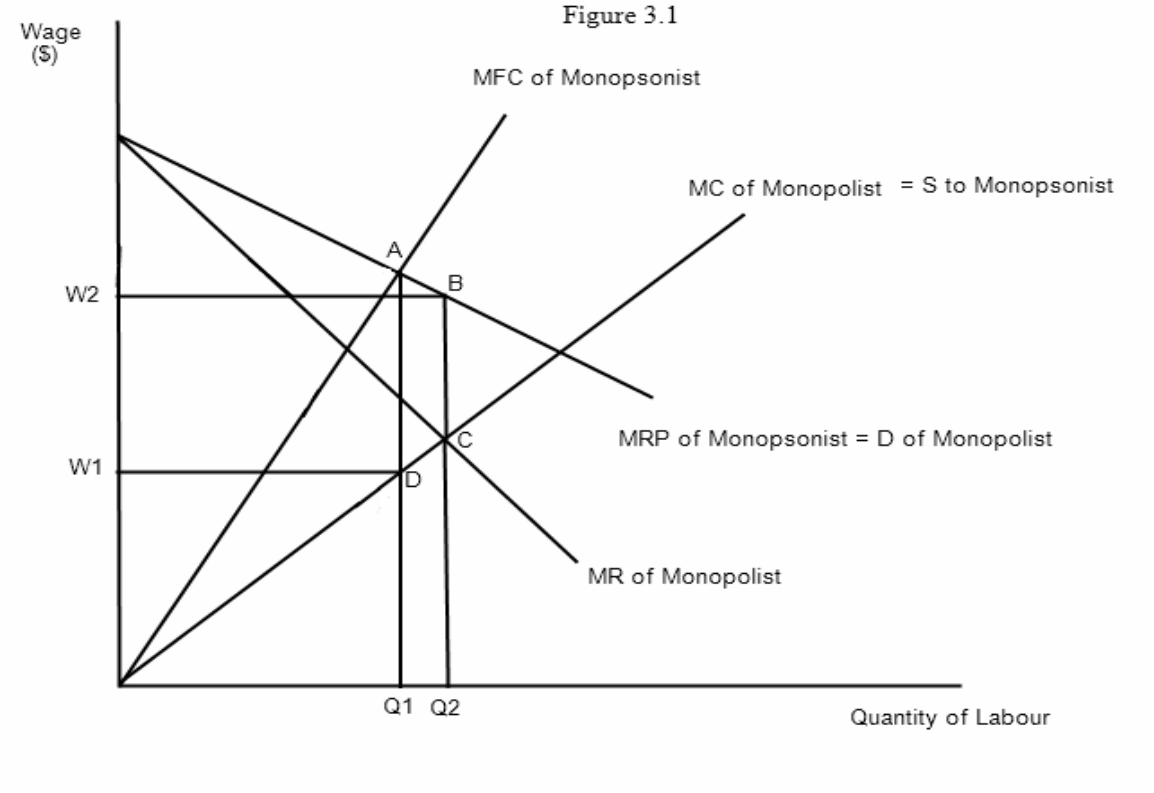
The NHLPA union differentiates itself from a typical labour union in that the collective bargaining that takes place between the NHL owners and the NHLPA implements the framework within which individual player negotiations with individual NHL owners can take place. This is different from a typical union where all workers, within a classification, receive the same compensation and all are subjected to wage increases agreed upon by the union and the employer.

Under this circumstance where NHL owners are the monopsonistic buyer of NHLPA player services and NHLPA players are the monopolistic sellers of their hockey skills to NHL owners. Such a situation is characterized as a bilateral monopoly. The characteristics that distinguish a bilateral monopoly market are best explained by Spindler (1974). "It is a matter of conventional wisdom in economics that problems of bilateral monopoly or bilateral exchange cannot be completely solved by economic techniques" (Spindler 1974, pg 463). Spindler (1974) explains that in a bilateral monopoly market place, there is no determinate equilibrium solution. In this case, the equilibrium wage paid and quantity of labour hired will depend upon the relative bargaining power and skill of the two parties involved in the negotiation.

Figure 3.1 represents the bilateral monopoly scenario where there is a monopsonist buyer of labour (NHL owners) and a monopolistic seller of labour (the NHLPA). The marginal revenue product curve (MRP) of the monopsonist represents the NHL owners' demand for player labour. The marginal revenue product curve, better know as the demand curve for labour, is formulated by multiplying marginal physical product by the marginal revenue product. This represents the demand curve because it

shows the value that NHL owners place on each unit of labour obtained as a function of that unit's ability to generate revenue.

Figure 3.1



The demand curve of the monopsonist also represents the demand curve faced by players wishing to sell their labour to NHL owners. The marginal revenue curve (MR) of the monopolist is downwards sloping, which shows that in order to sell additional units of labour, the price must be reduced. Furthermore the price must be reduced on previous units as well as any additional ones. This is why the marginal revenue curve is not equal to the demand curve.

The marginal cost of the monopolist, the NHLPA, is equal to the supply curve of the NHLPA. This is because the monopolist's marginal cost curve represents the price at which NHL players are willing to sell units of labour to the monopsonist, NHL owners.

The marginal factor cost curve (MFC) represents the cost to NHL owners of purchasing additional units of output from the players. MFC is upwards sloping, meaning that for NHL owners to increase the quantity of inputs employed, owners must pay additional units of input a higher wage than previous players as well as equalize the wage of already employed inputs. This is why the MFC is drawn with a greater slope than the supply curve (MC) of the NHL owners.

In the case of the NHL, collective bargaining between players and owners is the method by which salaries are agreed upon. Thus within the context of a bilateral monopoly, the negotiating party with the stronger collective bargaining power should be able to influence negotiations in such a way that the agreement is closer to their optimal solution.

The extreme solutions, where one party holds complete bargaining power over the other will be examined initially. In the extreme case where NHL players hold complete collective bargaining power over owners, the equilibrium wage rate and quantity produced would be W2 and Q2 respectively in Figure 3.1. This represents the monopolist NHL players' optimal labour quantity and wage because at point C, marginal revenue that a player receives in the form of a wage is equal to the marginal cost of their services. It follows that at point C, players are maximizing their utility by setting wages equal to W2 with a quantity of labour of Q2. This wage corresponds with the marginal revenue curve directly above the intersection of MC and MR. The players in this case are able to use their collective bargaining power to increase the wages received by them relative to a situation where NHL owners hold more collective bargaining power.

In the other extreme case, where NHL owners would hold complete collective bargaining power over NHL players, the equilibrium solution yielded would be at a point A in Figure 3.1. This is where the marginal factor cost for the monopsonist NHL owners is equal to the marginal revenue product received by NHL owners. At this point owners would utilize Q1 quantity of player services and pay a wage of W1. This represents a lower quantity of labour and a lower wage compared to the NHLPA optimal solution of Q2 and W2 respectively. The NHL owners, as a result of holding complete collective bargaining power, are able to lower wages to a point on their supply curve directly below the intersection of MFC and MRP. At this point NHL owners supply the players with the minimum wage needed to obtain their desired level of labour, Q1, at a wage of W1.

As Spindler (1974) and Salvatore (2003) both document, when one party does not hold complete collective bargaining power, the solution is indeterminate. As shown, NHL players optimize their wages and quantity of services produced at W2 and Q2, whereas NHL owners' optimal solution would be to pay a wage and consume a quantity of services equal to W1 and Q1 respectively. Without an equilibrium solution, the relative negotiating strengths and skills will determine the wage and quantity of NHL player services. The eventual solution can be said, however, to lie within the range of the two extreme cases described. The range of wages will be W1 to W2 and the quantity of player services will lie between Q1 and Q2.

To examine how NHL players and owners negotiate player compensation in the NHL, the previously mentioned labour market characteristics must be accounted for as they play a significant factor in determining salary. The North American hockey players will be examined followed by European players. North American hockey players of

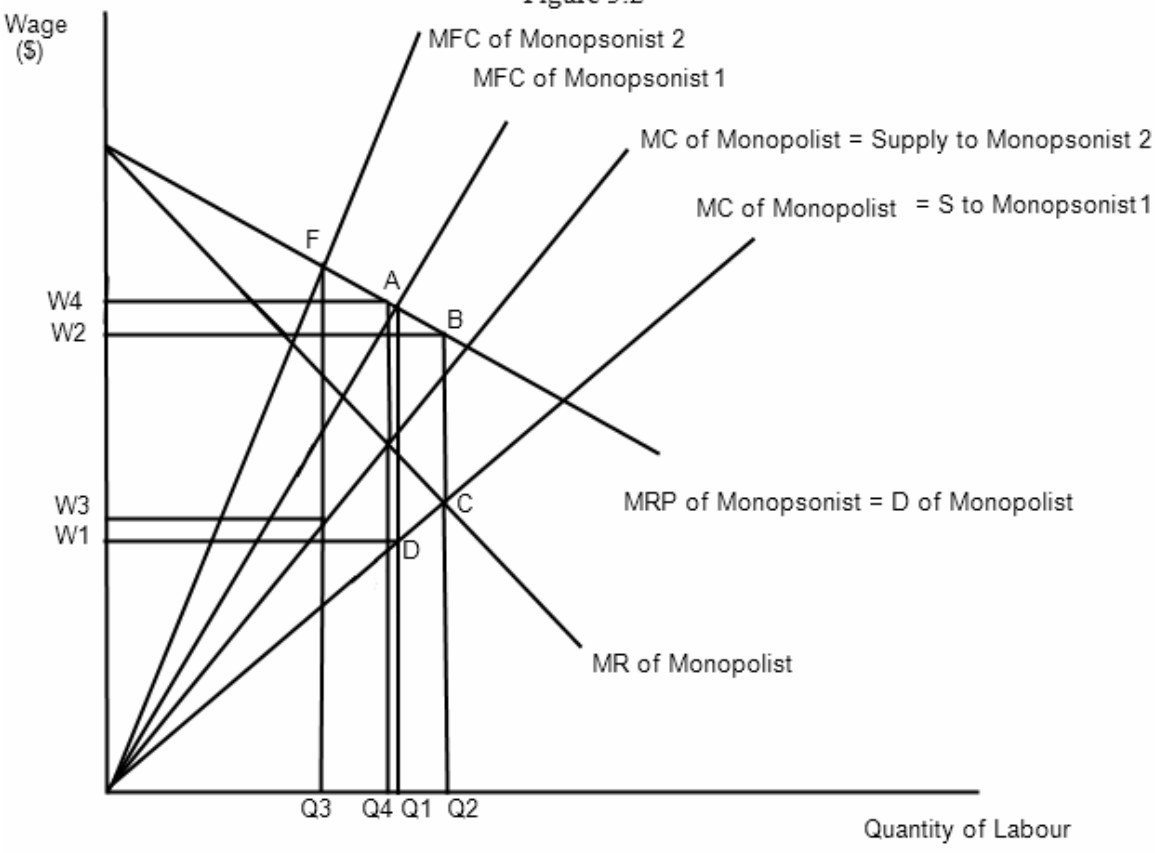
superior skill, assumed to be utility maximizing via salary maximization, are faced with the NHL being the only rational choice. North American players are able to play in Europe in the elite leagues, but very few North Americans have chosen to do so. While it is recognized that although elite leagues can pay select superstars a salary comparable to NHL teams, marginal hockey players in Europe receive far less compensation than marginal NHL players (Stogaspal 2005).

In addition, North American players are faced with many intangible factors that reduce the desirability of the European Elite Leagues. Playing in Europe would mean being overseas for the season away from their family and friends. The players alternatively could move their families to Europe, but relocation costs become a factor. Furthermore, playing in Europe means adjusting to foreign cultures where English is not the predominate language. Additionally, European travel modes and accommodations are inferior compared to NHL standards, or ever upper echelon professional hockey leagues in North America. This represents a significant adaptation for North American players who travel by chartered flights in the NHL.

The prior discussion of a bilateral monopoly market place allows for the explanation of variation in NHL player wages between North Americans and Europeans. As noted earlier, European hockey players have high paying alternative professional leagues readily available to them located within their home countries. North American players see the European Elite Leagues as less attractive than their European counterparts based on lower wages and increased cultural adjustment costs. It follows that, on average, European hockey players' opportunity cost of playing in the NHL would be greater than North American players'. Combining the earlier discussion regarding

relative negotiating power with a differential between opportunity costs of European and North American players, could lead, *ceteris paribus,* to differences in wages. This notion is further examined in Figure 3.2.

Figure 3.2



When negotiating a contract with an NHL owner, a European player can be said to have more bargaining power relative to North American players. This is represented by in increase in marginal cost from MC1 to MC2 in Figure 2. Put differently, it will take a higher wage to attract a given quantity of European players compared to their North American counterparts. This relative increase in marginal cost of the European players in comparison with North American players stems from European players having superior alternative leagues in their home countries.

The marginal factor cost of the monopolist players will also rise from MFC1 to MFC2, as MFC represents the increase in wages that must be paid to previous players hired at a lesser wage.

No determinate solution is yielded under these circumstances where divergent opportunity costs among nationalities account for differences in relative collective bargaining strength. However, the range of collectively bargained wages between North American and European hockey players in the bilateral monopoly now differ.

When players hold complete collective bargaining power, the wage paid to European players is W4, which is greater than the wage paid to North American players, W2. The quantity of European players hired, Q4 is less than the quantity of North American players hired, Q2. Under a situation where owners hold complete collective bargaining power, European players are paid a wage of W3 which is higher than the wage, W1 that North Americans are paid. The quantity of North American players hired, Q1 is greater than the quantity of European players hired, Q3.

Despite the fact that neither owners nor players hold complete collective bargaining power in the NHL context and thus an indeterminate solution follows, explanations regarding salary differentials among player nationalities can be put forth. In both extreme cases, European players are found to have a higher wage than North American players. This stems from the fact that when differing opportunity costs are imputed into the marginal cost of professional hockey labour, the marginal cost of the European players rises above the marginal costs of North American players. The differentiation in marginal costs results in Europeans being rewarded with a higher wage in the extreme cases relative to North American players. In other words, the Europeans

have a higher indeterminate range of wages relative to North American players. Based on the increased range of wage outcomes, symmetrical negotiations between the monopsony and monopoly would yield a higher wage for Europeans compared to North Americans. In other words, supposing equal power in negotiations, a wage yielded at the middle of the respective ranges results in Europeans earning a higher average salary than North American players when adjusted for differences in abilities. Thus, increased bargaining power of Europeans over North Americans when applied to negotiating an individual player contract, would result on average, with Europeans being paid more, assuming an equal player skill set.

The increased opportunity cost of European players also results in a lower quantity of European players being hired in the NHL. In the situation where the players held complete collective bargaining power, the European quantity of labour hired, Q4, is smaller than that of the North American labour hired, Q2. Under a circumstance of complete owner dominance in collective bargaining, the quantity of European players hired is represented by Q3, which is larger than the quantity of North American labour hired, Q1. The greater opportunity cost of European players, represented in a shift of MC1 to MC2, resulted in a decreased quantity of European players relative to North American players, which follows the current composition of the League.

Chapter 4: Data Analysis

In this section, the research question of whether wage differentials exist in the NHL among Canadian, American and European born players will be addressed. Evidence of wage differentials have been found to exist between French Canadian and English Canadian players in previous studies such as Lavoie and Grenier, (1988), Jones and Walsh (1988), McLean and Veall (1992) and Longley (1995). Since these investigations, the NHL has undergone significant changes in the composition of the league with respect to player origins and emergence of many new US franchises. Canadian hockey players playing in Canadian cities are selected as the basis for comparison, herein referred to as the base case. This allows for comparisons to previous studies, such as Longley (1995) where wage discrimination based on nationality and playing location was investigated.

To examine the research questions, ordinary least squares (OLS) regression analysis is used and the subsequent regressions follow the form of: $\hat{Y} = \beta_0 + X_1\beta_1 + X_2\beta_2 + X_3\beta_3 + \ldots X_i\beta_i + e_i$ where X_i, represents the explanatory variables, $\beta_{i,}$ represents the coefficient estimates of the explanatory variables, e, represents the residuals, and $\hat{Y}$, represents the estimated player salary.

Following the work of, Longley (1995) and Lavoie (2000), the regressions attempt to identify factors that explain player salaries. The data came from the 2002-2003 and 2003-2004 NHL seasons (National Hockey League 2006)(Ozanian 2004)(USA Today 2005). During these seasons, only forwards and defensemen who competed in a

minimum of twenty games were included. The result was 819 forward and 443 defensemen observations.

To ensure that the regressions were not in violation of the classical assumptions of ordinary least squares technique, two tests were completed. The first econometric performed was the White Test (Studenmund, 2001). This test was completed to ensure the classical assumption of the error term having a constant variance was met, meaning the data contained no heteroskedasticity. The White test was used as a measured of determining whether the coefficient estimators contain heteroskedasticity, which manifests itself through increased variance in the coefficient estimators. To complete the White Test, the residuals of the forward and defense equations were obtained. The residuals were then squared and used as the dependent variable in a second regression.

The explanatory variables in the new regression included the original explanatory variables, the original explanatory variables squared and the product of each original explanatory variable multiplied by every other original explanatory variable. The test statistic was obtained from this regression by multiplying the number of observations by the unadjusted r-square of the previous regression. The following test statistics were found: 41 for forwards and 80 for defensemen.

The decision rule applied here was that if the test statistic values were greater than the chi-square distribution decision value for the appropriate degrees of freedom, the models do not contain heteroskedasticity. The test statistics are greater than the chi-square value at the 5 percent level, when accounting for the appropriate degrees of freedom and thus heteroskedasticity did not detract from these models.

To investigate multicollinearity, a correlation matrix was completed for each position. Multicollinearity occurs when an independent variable is found to be a perfect linear function of other variables (Studenmund 2001). It can also be said that even if the data is not a linear function, a high degree of correlation between any of the explanatory variables will introduce significant problems with the model. To determine whether a high degree of correlation does exist among the explanatory variables related to a hockey player's skill, a correlation matrix is provided[ii]. As described by Studenmund (2001), a correlation coefficient above 0.8 presents concerns in a model about the existence of multicollinearity. As shown in Table 4.1 and 4.2, all correlations are below this level so multicollinearity is within acceptable limits.

Table 4.1 – Correlation Matrix for Forwards

	GPG	APG	ATOI	EXP	Draft	REV	PIM/G
GPG	1						
APG	0.72	1					
ATOI	0.75	0.76	1				
EXP	0.18	0.23	0.27	1			
Draft	0.16	0.14	0.17	0.10	1		
REV	0.07	0.06	0.02	0.28	0.07	1	
PIM/G	-0.24	-0.29	-0.44	-0.02	-0.08	0.04	1

Table 4.2 – Correlation Matrix for Defensemen

Defensemen	GPG	APG	ATOI	EXP	Draft	REV	PIM/G
GPG	1						
APG	0.69	1					
ATOI	0.55	0.68	1				
EXP	0.11	0.14	0.28	1			
Draft	-0.03	-0.02	0.05	0.13	1		
REV	0.10	0.12	0.00	0.21	0.02	1	
PIM/G	-0.19	-0.28	-0.34	-0.12	0.06	-0.03	1

Before the regression analysis took place, an expected signs chart was completed and is show in table 4.3. Here, a prediction was made of what the sign of each player skill variable coefficient estimated in the subsequent analysis. This was completed so as to allow for comparison between the expected and actual results.

Table 4.3 – Expected Signs of Coefficient Estimates	
Variable	Expected Sign
Points Per Game	Positive
Goals Per Game	Positive
APG	Positive
ATOI	Positive
EXP	Positive
Draft	Positive
REV	Positive
PMPG	Positive

The sign of the points per game variable was expected to be positive because as a player's points per game increase, a player can demand more salary. The goals per game coefficient estimates were predicted to be positive because as goals per game increase, it is expected a player can demand more salary. The sign was expected to be positive for the assists per game coefficient because an increase in assists per game increases player value. The average time on ice (ATOI) variable was expected to be positive because as ice time increases, a player is able to demand a greater salary. It was expected that the coefficient estimate of the years of experience (EXP) prior to the measured season variable would be positive because as seniority increases players must be compensated accordingly. Team revenue (REV) coefficient estimates were expected to be positive because as team revenues increase, it was predicted players receive a proportion of the increased revenue. Finally, the penalty minutes per game (PMPG) coefficient estimates

were predicted to be positive as penalty minutes are indicative of aggressive play and intimidation, two factors that are desirable in hockey and thus rewarded through a higher salary.

Using a model with specific explanatory variables allows for comparisons to Longley's (1995) base model. In this model he chose to use three player skill variables and three dummy variables representing a player nationality. Longley's base model was completed for forwards only, but the analysis here will cover defensemen as well. The dependent variable regressed was player salary. The regression included (PPG), (EXP), and (REV), in millions of US dollars. Points per game and years of experience were selected to measure player performance. Team revenue was selected to determine whether a relationship between player salary and team revenue existed.

In addition, two dummy variables were included which represent a player's nationality. The two variables, American (USA) and European (EUR), were equal to one for players who hail from those regions. Canadian players served as the base in this regression. The inclusion of these dummy variables was to measure differences in salary which were a direct result of player nationality.

When compared to other studies such as McLean and Veall (1992) and Lavoie (2000), the number of explanatory variables was small. Similar to Scully (1974) and Longley (1995), this method was chosen because "the variables selected above are thought to measure most precisely and efficiently the key aspects of a player's performance" (Longley 1995, 415) and the team's ability to pay.

> Since salary is always non-negative, it is more likely to be a lognormal random variable than a normal random variable. This implies an exponential relationship

between the salary variable and the independent variables, and means that the coefficient estimates measure the rate of change of salary with respect to unit changes in the independent variable (Longley 1995, 416).

The coefficient estimates pertaining to player skill variables represent percentage changes in salary consistent with a one unit increase in the explanatory variables. Coefficient estimates for the dummy variables indicate the percentage difference in salary among player nationality with respect to the Canadian base case.

The results of the initial regression are shown below. The coefficient of determination of .62 is comparable to other NHL salary studies such as McLean and Veall (1992). Longley (1995) found an r – square adjusted of .71 using career games played instead of number of years of NHL experience. All of the variables related to player performance were positive, as expected, and were statistically significant at the 1% level.

Regression 1 – Forwards		
Independent Variable	Coefficient Estimate	t-statistic
Intercept	5.3686	162.95*
PPG	0.7030	22.94*
EXP	0.0350	18.79*
REV	0.0018	4.22*
USA	0.0326	1.42
EUR	0.0866	4.68*
R^2 adjusted = .62 DF = 813 F statistic = 269		* = Significance at the 1% level

Therefore: (1) a one point per game increase was consistent with a 70% increase in salary[iii], (2) an increase of 1 year of NHL experience yielded a 3.5% increase in salary,

and (3) a one million US dollar increase in the team revenues meant a 0.2% increase in salary. Out of the two dummy variables for nationality, only the European variable was statistically significant. The positive sign indicates that with all other things equal, a European born NHL player would expect on average to make 8.6% more than a Canadian born NHL player. The player variables are consistent with Longley (1995) in terms of the coefficient estimate's sign, but the player nationality coefficient estimate signs were divergent. In Longley (1995) both the USA and European variables were statistically insignificant, meaning no salary differentials were found among the different nationalities. In Regression 1, discrimination was evident when comparing Europeans to Canadians, but not when comparing Americans to Canadians.

Using the same two NHL seasons and the same methodology as outlined previously, defensemen data was inserted into the model. The results are shown in Regression 2.

Regression 2 – Defensemen		
Independent Variable	Coefficient Estimate	t-statistic
Intercept	5.4682	122.54*
PPG	0.6248	9.30*
EXP	0.0404	16.31*
REV	0.0023	4.06*
USA	0.0163	0.511
EUR	0.0635	2.53**
R^2 adjusted = .53 DF = 437 F statistic = 99		* = Significance at the 1% level ** = Significance at the 5% level

The coefficient estimates for player statistics were of the expected signs and were all significant at the 1% level. The regression indicated: (1) a one point increase in points

per game was consistent with a 62% increase in salary, (2) a one year increase in NHL experience yielded a 4% increase in salary, and (3) a one million US dollar increase in a player's team revenues produced a 0.2% increase in salary.

Similar to the model for forwards, evidence of discrimination was present when examining Europeans relative to Canadians. The EUR variable was significant at the 5% level, indicating that European born defensemen earned 6.4% more salary than a Canadian born defenseman, when controlling for other explanatory factors. American born defensemen earned on average the same as a Canadian defenseman when holding other relevant factors constant.

Regression 3 – Forwards		
Independent Variable	Coefficient Estimate	t-statistic
Intercept	5.0966	98.11*
GPG	0.4921	4.92*
APG	0.3871	5.19*
ATOI	0.0225	6.12*
EXP	0.0322	17.88*
Draft	0.0982	7.86*
REV	0.0019	4.61*
PMPG	0.0363	2.92*
USA	0.0383	1.76***
EUR	0.0902	5.07*
R^2 adjusted = .66 DF = 809 F statistic = 180		* = Significance at the 1% level *** = Significance at the 10% level

Both Longley (1995) and Lavoie (2000) added additional explanatory variables in an attempt to increase the explained percentage variation in NHL salaries. Lavoie (2000) chose to include a multitude of player variables ranging from their draft position to their

weight. Similarly, Lavoie (2000) used dummy variables to represent nationality. This approach was repeated in Regression 3, shown on the previous page.

The adjusted r-square of .66 was analogous to Lavoie's (2000) regressions focusing on forwards. Goals per game (GPG) and assists per game (APG) were used as substitutes for the points per game variable. Scoring goals in the NHL is one of, if not, the most important aspects of a team's success and thus it was reasonable to believe that goals would have a greater positive impact on salary than that of assists.

Player's average ice time per game was added because it was assumed all teams are attempting to maximize their wins and thus it would make sense that the players regarded as the most skillful, and thus more valuable, play a greater portion of the time.[iv]

The dummy variable Draft was introduced as a measure of player skill when they enter the NHL. Draft is equal to 1 for players who were chosen during the first two rounds of the NHL entry draft, and thus may have received a salary premium as teams have high expectations of future performance for such players.

The final explanatory variable added was penalty minutes per game (PMPG) in an attempt to capture intangible characteristics associated with hard hitting and aggressive play. Such play often draws many penalties, but can help the team win.

Similar to the previous regressions, the dummy variables for USA and European born players were included again. All player quality variables were of the expected signs and were significant at the 1% level. The results indicated: (1) a one goal increase in goals per game was consistent with a 49% increase in salary; (2) a one assist increase in assists per game yielded a 38% increase in salary; (3) a one minute increase in average time on ice was consistent with a 2% increase in salary; (4) one additional year of

experience produced a 3% increase in salary; (5) being selected in the first two rounds of the NHL entry draft was consistent with a 10% increase in salary; (6) a one million US dollar increase in team revenue was consistent with a 0.2% increase in player salary; and (7) a one minute increase in penalty minutes per game was consistent with a 4% increase in salary.

The player location dummy variables were much different than those completed by Longley (1995) and Lavoie (2000). At a significance level of 10%, it can be said that on average, American born forwards earned 3.8% more than a Canadian forward when holding other relevant factors constant. For the Europeans, (significant at the 1% level) *ceteris paribus*, European born forwards earned 9% more on average than a Canadian born forward.

Using the same explanatory variables and methodology for defensemen, the results are show in Regression 4, on the following page.

The percentage in variation in NHL hockey salaries explained through this model significantly increased over the previous completed model for defensemen as a result of the inclusion of the additional variables. The goals per game variable was not statistically significant and thus was excluded from the analysis. All of the other player variable signs are consistent with what was predicted and all are significant at the 5% level with the exception of assists per game (APG) which was significant at the 10% level.

Regression 4 shows: (1) a one assist increase in assists per game was consistent with a 24% increase in salary; (2) a one minute increase in average ice time produced a 3% increase in salary; (3) an additional year of experience yielded a 3% increase in salary; (4) having been selected in round one or two of the NHL entry draft was

consistent with 8% increase in salary; (5) a one million US dollar increase in team revenue yielded a 0.3% increase in salary; and (6) a one minute increase in penalty minutes per game was consistent with a 5% increase in salary.

Regression 4 – Defensemen		
Independent Variable	Coefficient Estimate	t-statistic
Intercept	4.9138	68.14*
GPG	-0.0622	-0.239
APG	0.2378	1.93***
ATOI	0.0298	8.91*
EXP	0.0338	14.39*
Draft	0.0818	4.10*
REV	0.0031	5.96*
PMPG	0.0501	2.55**
USA	0.0172	0.59
EUR	0.0685	2.92*
R^2 adjusted = .61 DF = 433 F statistic = 79		* = Significance at the 1% level ** = Significance at the 5% level *** = Significance at the 10% level

The American birth country variable was not statistically significant, meaning under this model no wage differentials of USA defensemen relative to Canada defensemen were detected. However, being a European born defenseman was consistent with earning 6.9% more salary than Canadian defensemen of equal skill level. These findings differ from those of the previous regression using the same variables for forwards. The differences indicate that although American forwards are found to earn on average 4% more than Canadians when controlling relevant factors, there was no salary differentiation between Canadian and American defensemen. The case for European

defensemen was much the same as European forwards as they received on average 7% more salary than Canadian defensemen when accounting for other relevant factors.

In order to further explore the possibilities of pay discrimination in the NHL, the location of the franchise where a player earns his salary was included. This was done because the previous model was deficient in the sense "that it examines the discrimination issue from a league-wide perspective only, and does not consider whether discrimination may be occurring within certain sub-components of the League" (Longley 1995, 417). Again, to compare the results from the 2002-20003 and 2003-2004 seasons to Longley's results, the player skill variables were reduced to points per game (PPG) and years experience in the league (EXP). The results of this model using forwards are shown in Regression 5.

In this regression the dummy variables combining a player's nationality and playing location were added. Since there were two countries and three different player origins being examined in this study, there were six groups of players being analyzed. In this case, Canadian players playing for Canadian teams were excluded as to make them the base case. All of the player variables were significant here which follows the results from Regression 1.

The regression yielded the results: (1) a one point increase in points per game was consistent with a 72% increase in salary; (2) an additional year of NHL experience yielded a 3% increase in salary; and (3) a one million US dollar increase in team revenue produced a 0.2% increase in salary. However, the regression results pertaining to player location and player origin were much different in this study than that of Longley (1995). Firstly, with a t-statistic significant at the 1% level, it can be said that European forwards

playing in the United States (all other relevant factors being held constant), earned on average 8.4% more than Canadian forwards playing in Canada. At the 10% significance level, US players playing in the US earned on average 5.7% more than Canadian players playing in Canada. Finally, at the 10% level, European players playing in Canada on average earned 8.2% more than Canadian players playing in Canada.

Regression 5 – Forwards		
Independent Variable	Coefficient Estimate	t-statistic
Intercept	5.3776	152.26*
PPG	0.7236	23.88*
EXP	0.0339	18.38*
REV	0.0017	4.10*
US in US	0.0569	1.85***
CAN in US	0.0072	0.39
EUR in CAN	0.0824	1.77***
EUR in US	0.0840	3.56*
US in CAN	0.0139	0.17
R^2 adjusted = .62 DF = 810 F Statistic = 166		* = Significance at the 1% level *** = Significance at the 10% level

The same regression model using defensemen is shown in Regression 6, on the following page. For defensemen, all of the player skill variables were significant at the 1% level with an r-square adjusted that is the same as Regression 2. The regressions coefficient estimates indicate: (1) a one point increase in pointers per game was consistent with a 63% increase in defensemen salary; (2) an additional year of NHL experience gained was consistent with a 4% increase in salary; and (3) a one million US dollar increase in team revenue was consistent with a 0.2% increase in player salary. The

dummy variables relating to player location and player origin were all statistically insignificant.

Regression 6 – Defensemen		
Independent Variable	Coefficient Estimate	t-statistic
Intercept	5.4906	104.27*
PPG	0.6250	9.25*
EXP	0.0401	16.16*
REV	0.0024	4.21*
US in US	-0.0015	-0.03
CAN in US	-0.0363	-1.01
EUR in CAN	-0.0080	-0.14
EUR in US	0.0446	1.18
US in CAN	-0.104	-1.23
R^2 adjusted = .53 DF = 434 F Statistic = 62		* = Significance at the 1% level

Following the model designed by Longley (1995) to observe pay differentials for forwards, the following conclusion were drawn. Defensemen, regardless of their nationality or location of their NHL team, were paid on average the same salary as a Canadian defensemen playing in Canada with an equal skill level. The findings using this set of explanatory variables showed differences among forward and defensemen salaries. American forwards playing in the US earned on average 6% more than equally skilled Canadian forwards playing in Canada. American defensemen playing in the US were paid on average the same as Canadian defensemen playing in Canada. European defensemen playing in Canada were compensated on average the same as a Canadian defensemen playing in Canada, whereas a European forward playing in Canada realized an 8% increase in salary on average over a Canadian forward playing in Canada. Lastly,

European forwards playing in the US were paid on average 8% more than Canadian forwards playing in Canada. This differed from the findings among the defensemen where no wage differentials were found between nationalities.

Further analysis, combining the methods of Longley (1995) and Lavoie (2000), were then undertaken. Regression 7 mirrors Lavoie (2000) in the number and type of non-nationality variables included. The elements of Longley's study employed were the dummy variables representing player nationalities and the country where their NHL team is located. The results for the combined methods are shown below in Regression 7.

Regression 7 – Forwards		
Independent Variable	Coefficient Estimate	t-statistic
Intercept	5.0968	93.63*
US in US	0.0459	1.53
CAN in US	0.0012	0.05
EUR in CAN	0.0717	1.97**
EUR in US	0.0946	3.50*
US in CAN	0.0039	0.07
GPG	0.4937	4.91*
APG	0.3927	5.23*
ATOI	0.0222	6.00*
EXP	0.0322	17.86*
Draft	0.0996	7.88*
REV	0.0019	4.61*
PMPG	0.0353	2.83*
R^2 adjusted = .66 DF = 806 F Statistic = 135		* = Significance at the 1% level ** = Significance at the 5% level

The r-square adjusted for this regression is comparable with Lavoie's (2000) regressions done on forwards accounting for team locations. All of the variables related to player on ice performance and team revenue were significant (at the 1% level) and had

the expected signs. Thus, it can be said that (1) a one goal per game increase produced a 49% increase in salary; (2) a one assist per game increase was consistent with a 39% increase in salary; (3) a one minute increase in the average time on ice was consistent with a 2% increase in salary; (4) an additional year of NHL experience yielded a 3% increase in salary; (5) being a round one or two draft pick was consistent with a 9% increase in salary; (6) a one million US dollar increase in a player's team revenues was consistent with a 0.2% increase in salary; and (7) a one penalty minute per game increase was consistent with a 4% increase in salary.

Again, Canadians playing for Canadian teams were used as the basis for comparison with all other groups being accounted for through the dummy variables. There were only two nationality and location coefficient estimates that were significant. First, at the 10% level, European forwards playing in Canada, all other relevant factors held constant, on average earned 7.2% more than Canadian forwards playing in Canada. Second, at the 1% level, European forwards playing in the US on average earned 9.5% more that Canadian forwards playing in Canada. These findings are consistent with the results of Regression 5 where playing locations and player origins are accounted for.

The process of combining the two methods from Longley (1995) and Lavoie (2000) was again applied below to the case of defensemen. The results are shown in Regression 8 on the following page.

After including the location variables pertaining to player nationalities and playing locations, the adjusted r-square was consistent with Regression 4 where an expanded skill variable set and limited location variables were introduced.

Regression 8 – Defensemen		
Independent Variable	Coefficient Estimate	t-statistic
Intercept	4.9226	62.88*
US in CAN	-0.0814	-0.97
CAN in US	-0.0109	-0.33
EUR in CAN	0.0168	0.33
EUR in US	0.0497	1.91***
US in US	0.0181	0.46
GPG	-0.0830	-0.32
APG	0.2509	2.03**
ATOI	0.0297	8.86*
EXP	0.0335	4.06*
Draft	0.0996	7.88*
REV	0.0032	6.10*
PMPG	0.0474	2.36**
R^2 adjusted = .62 DF = 432 F Statistic = 60		* = Significance at the 1% level ** = Significance at the 5% level *** = Significance at the 10% level

The findings of Regression 8 were that for defensemen goals continued to be an insignificant variable. All of the other skill variables were significant although the assists and penalty minutes per game variables were significant at the 5% level rather than 1%. This allow for the conclusion that (1) a one assist per game increase was consistent with a 25% increase in player salary; (2) a one minute increase in average time on ice for a player yielded a 3% increase in salary; (3) an additional year of NHL experience was consistent with a 3% increase in salary; (4) being a first or second round draft pick produced a 10% increase in salary; (5) a one million US dollar increase in team revenue yielded a 0.3% increase in player salary; and (6) a one penalty minute per game increase was consistent with a 5% increase in salary. This regression, using Canadian defensemen

playing in Canada as the basis for comparison found no wage differentials among defensemen with the exception of European born defensemen playing in the US. At the 10% level of significance, European born defensemen playing in the US earn on average 5% more than a Canadian defensemen with the same skill set playing for a Canadian team.

Beginning with a model similar to Longley (1995) and developing the model through the addition of explanatory variables related to player skill as in Lavoie (2000), additional regressions were completed. Regression 1 indicated that European forwards are paid on average 9% more than Canadian when holding all other relevant factors constant. This finding was contrary to the results of Longley (1995) where European forwards received no wage premiums compared to Canadians throughout each of the forward regressions. Following the same methodology the regression process was repeated for defensemen. European defensemen were found to earn 6% more on average than Canadian defensemen with an equal skill set. This finding, however, was not consistent throughout the study.

The model was later manipulated to merge the methods of Longley (1995) and Lavoie (2000). When each player was accounted for according to their nationality and NHL team location, the findings were again different from the previous studies. In the analysis completed using data from the 2002-2003 and 2003-2004 seasons, European forwards playing in Canada were found to earn on average 7% more than Canadian forwards playing in Canada when controlling other relevant factors. Longley (1995) found that the variable for European forwards playing in English Canadian cities was insignificant and negative. Lavoie (2000) found that European forwards salary does not

differ on average from that of an English Canadian forward playing in English Canada. Similarly, European forwards playing in the US were found to earn on average 9% more than Canadian forwards playing in Canada assuming equal skill sets. This find was again different than the findings of Longley (1995) who found no difference in salary between European forwards playing in the US and Canadians in English Canadian cities, although the sign in Longley (1995) was as predicted.

When accounting for playing locations as well as nationalities for defensemen, the results were distinctive from other studies. Longley (1995) did not include defensemen in his work and thus we were unable to make comparisons directly to his model. Compared to Lavoie (2000), the findings were divergent. Lavoie (2000) found there were no wage differentials between American and European defensemen relative to English Canadians playing in English Canadian cities. In Regression 8, the only significant salary differential between any combination of nationality and playing location relative to Canadian defensemen playing in Canada were European defensemen playing in the US. Here the regressions indicated that European defensemen playing in the US can expect to see a 5% increase in salary over Canadian defensemen playing in Canada.

Chapter 5: Concluding Summary

Chapter 1 defined discrimination and discussed the evolving diversification of NHL player nationalities. The research questions were also introduced.

Chapter 2 outlined the previous literature of economic discrimination, beginning with Becker (1957). The work of Scully (1974) related to monopsonistic exploitation in the context of Major League Baseball was reviewed. Beginning with the early work of Lavoie, Grenier and Coloumbe (1987), regression analysis studies on NHL player salary determinants and discrimination were examined. The work of Longley (1995) and Lavoie (2000) were reviewed in depth as their methodologies served as a guide for this study.

In Chapter 3, a theoretical basis for discrimination was put forth. The bilateral monopoly model was outlined in the context of the NHL where owners are monopsonists and players are monopolists. No determinate solution can be achieved in this model with wages being dependant upon the relative bargaining power of the two parties. When examining the collective bargaining power between Europeans and North Americans, the marginal cost of supplying player services differed as a result of divergent opportunity costs. The existence of the European Elite Leagues was theorized to be the factor explaining the difference in the marginal costs of supplying player services between North American and European players.

Chapter 4 examines the data collected from the 2002-2003 and 2003-2004 NHL seasons. The data was analyzed using OLS regression techniques and the results are

presented. An explanation of each regression and the meaning of the coefficient estimates were provided. The coefficient estimate signs were interpreted and compared to the expected signs.

Chapter 4 outlined conclusions based on the regression results. It was found that after correcting for player skill attributes, Europeans, with the exception of defensemen (Regression 6), were paid more salary on average than Canadians. In later analysis where playing location was included, it was found that Europeans playing in the US and Canada earned more salary on average than Canadians playing in Canada, assuming an equal player skill set. It was also found that in Regression 3, American forwards earned more salary on average than Canadians and in Regression 5, American forwards playing in the US were found to earn more salary on average than Canadians forwards playing in Canada, assuming an equal player skill set.

This research provided additional insights regarding wage differentials among nationalities in the NHL. The limitations of this study were that it was completed prior to the NHL entering a new collective bargaining agreement where team payrolls are capped. Placing a budget constraint on each team will likely change the wage determination formula and consequently the nature of discrimination likely changes as well. Additionally, this study was completed for two seasons and could be expanded upon by comparing the results of future seasons where the composition of players in the league will evolve. Finally, a study similar using data for more than two NHL seasons, and employing lagged independent variables in addition to the previously stated ones could provide increased knowledge regarding wage discrimination.

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Notes

[i] For a complete list of dummy variables used, see Longley 1995.

[ii] It should be noted that the exclusion of the dummy variables was made the case here so as to simplify the correlation matrixes. Correlation among these variables is not a concern, as players only have one country and playing location, and thus no linear function follows.

[iii] While a 70% increase in salary resulting from a one point per game increase seems large, the group of players who are capable of obtaining a 1 point per game average is extremely small.

[iv] It should be noted that like most other inputs, diminishing returns will occur at a certain threshold here too.