The Effects of Discrimination, Performance and Franchise Structure On 2001-2002 National Hockey League Salaries

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This paper considers the impact of discrimination in salary determination in the National Hockey League. Salary determination is studied for the 2001-2002 and a regression model empirically examines the extent to which discrimination, skills and monopoly and monopsony conditions determine player salaries by player position (forward and defense). The major conclusions are that salaries are determined by skill variables that proxy marginal productivity, and for defensemen and forwards there is possible salary discrimination against Francophone Canadians while there appears to be some evidence of reverse discrimination against Eastern European defensemen.

Based on the existing research available, it is evident that there has been much growth on the economics of professional sports over the past twenty-five years. The study of these sports leagues provides an opportunity to focus on the behavior of the league as a cartel and the degree of competition and profit maximizing behavior within. In addition, the increased frequency, availability and current range of performance statistics available to measure individual marginal productivity has allowed researchers to consider professional sports leagues as significant industries for the study of labor markets. Lawrence Kahn (1991) points out that this is the advantage of professional sports data. Outside of the sport labor market, the major difficulty in estimating the extent of discrimination is the problem of measuring productivity. This problem is usually handled by using variables such as education and experience as proxies for productivity (Kahn, 1991, 396). Kahn provides a survey of the sports literature up to 1989 and indicates that these studies include far more extensive controls for individual ability and performance than typical studies of non-sport industry that use labor force data.

The sport labor market has been used as grounds for testing racial and ethnic discrimination theories, entry, hiring or customer on the one hand, and salary discrimination along with salary determination on the other hand, and to a lesser extent gender differences in pay.[1] Focus on sports permits us to estimate the extent of forms of discrimination besides that based simply on wages (Kahn, 1991, 396). Here the focus is on salary discrimination along with salary determination in the National Hockey League.

There has been some debate over the extent to which a player salary is determined. The relative importance of skills, the structure of the monopoly and monopsony conditions in the respective players market along with discrimination have been considered to play a role (Jones and Walsh, 1988). In view of past evidence, performance characteristics, for the most part, explain salary differentials for professional hockey players. Having player skill variables, along with additional attribute and demographic information in accordance with player salary information, allows us an opportunity to test salary discrimination in the NHL. We can identify with confidence whether any variation outside of performance characteristics can be attributable to discriminatory behavior.

With the globalization of the game of hockey and the increasing number of Europeans filling traditionally North American jobs in the NHL throughout the 1990's, the potential for salary discrimination against the European player becomes more

[1] Lawrence Kahn (1991) looked at Grand Slam tennis tournaments and found that the money prize was smaller for women than for men despite evidence that women's matches draw at least as much revenue as the men's.

palpable. In 2001-2002, Europeans held 32.2% of the jobs in the NHL (see Table 2 below).[2]

Table 1
Top Ten Salaries, National Hockey League 2001-2002

NAME	TEAM	SALARY	COUNTRY
Peter Forsberg	COLORADO AVALANCHE	$11,000,000	*Europe**
Keith Tkachuk	ST. LOUIS BLUES	$11,000,000	United States
Nicklas Lidstrom	DETROIT RED WINGS	$10,500,000	*Europe**
Paul Kariya	MIGHTY DUCKS OF ANAHEIM	$10,000,000	Canada
Pavel Bure	NEW YORK RANGERS	$10,000,000	*Europe**
Joe Sakic	COLORADO AVALANCHE	$9,832,727	Canada
Robert Holik	NEW YORK RANGERS	$9,600,000	*Europe**
Chris Pronger	ST. LOUIS BLUES	$9,500,000	Canada
Robert Blake	COLORADO AVALANCHE	$9,285,194	Canada
Doug Weight	ST. LOUIS BLUES	$9,000,000	United States

Note: *Europe** = Scandinavia, Poland, Slovakia, Romania, Czechoslovakia, Latvia, Belarus, Ukraine, Russia.

Of the top ten player salaries in the NHL during the 2001-2002 season, Table 1 shows that four were salaries held by European players. These European imports are traditionally known as "skill" players in the sense that they are highly skilled offensively thus they should receive compensation relative to their performance skills on the ice. If offensive points are considered to significantly explain salary differentials then nationality should not explain any variance in salary.

The object of this paper is to test for the existence of salary discrimination by player position based on player and team cross-section data for the 2001-2002 season. Studies have focused on possible discrimination against Francophone Canadians and, for the most part, have only incidentally explored discrimination against the NHL's other minority groups, that is, the Americans and Europeans. In testing for salary discrimination, we can concurrently measure the extent to which differences in skills and

[2] This number is up dramatically from 11.2% in 1990-91, 6.7% in 1980-81 and 2.6% in 1970-71 (The Hockey News, Nov. 10, 2000, 11).

franchise characteristics affected salary determination in the NHL during the 2001-2002 season, as has been done in past studies of NHL salary differentials.

The paper begins by examining different sources and forms of team discrimination. The next section is a survey of those studies that use statistical evidence to explore whether salary discrimination exists in the National Hockey league. The third section looks at mean attributes of players by position and ethnicity, and the three subsequent sections describe the linear regression model, determinants of pay, and the empirical results and conclusions. The central outcome of the study is that salary discrimination is still occurring in the NHL, especially with reference to Francophone Canadians who seem to be significantly affected most. Furthermore, there is evidence of possible reverse discrimination for Eastern European defensemen.

SALARY DISCRIMINATION

Salary discrimination takes the "form of either differential pay to players with similar productivities or of equal compensation despite dissimilar performance" (Mogul, 1981, 109). A racial and ethnic discrimination argument stems on whether there is any significant evidence for any one of the groups tested, indicating that one or more are being paid less or more than the remaining groups based on similar marginal productivities.

It is important to recognize and understand potential sources of discrimination when attempting to assess its presence in the labor market. One possible source of discrimination could involve "production frictions" (McManus et al. 1983, 104). This tends to exist when there is a language barrier.[3] Given the predominance of the English language amongst the thirty NHL teams, of which twenty-five are located in the United States, a unilingual Francophone Canadian or a non English speaking European player may be unable to communicate effectively, thus significant language and cultural barriers may exist. Employing a language other than English as their mother tongue may impede a players ability to learn and communicate effectively with co-workers.[4] If learning and communication are considered important in a hockey teams success, then the ability of a player to comprehend other players and coaching instructions is necessary to increase the overall team performance. Thus, overall performance can suffer which ultimately will affect team revenues. Considering this linguistic deficiency, Francophone Canadian and European players may be offered smaller salaries in order to offset any potential losses in revenue.

Another possible source of discrimination involves customer discrimination, which derives directly from the fans buying the tickets.[5] As far as hockey goes, it is of popular belief that when athletes are of equal skills, selection will go to the local player (Tremblay, 1984, 213). Since we assume that NHL teams maximize profit, and the home fan is the ultimate provider of that revenue through ticket receipts, memorabilia purchases, and concessions, it may be standard practice to take the local boy over the foreign player if that is going to generate supplementary revenues. This discrimination

[3] Language costs specific to Francophone hockey players were first proposed by Curtis and Loy (1978) to explain Francophone under representation in the NHL.
[4] This linguistic fluency thesis is hotly debated in the literature. Krashinsky (1989) first developed the thesis while Lavoie, Grenier and Coulombe (1989) and Longley (1995) implicitly/explicitly attempt to deny it.
[5] Neil Longley (1995) suggests that customer discrimination hinged on historical tensions may explain salary differentials between Francophone and Anglophone Canadian players.

thesis for the most part implies that customer demands are a function in the signing decision faced by teams when negotiating new player contracts.[6]

A third possible source is the "style of play" thesis resulting from unofficial player quotas that may exist. With European players gaining hockey experience in their home countries and then coming to North America where the size of the ice surface, caliber and style of hockey are different, and with the "local boy" demands by the fans and local media, there is a potential for teams to have unspoken quotas sequentially affecting marketability for those players. The style of play thesis is assumed by a lot of sports writers in the media. It implies that Francophone Canadian and European players are taught a different style of play in their minor leagues than are Anglophone Canadian and American players. Additional investment in coaching and training may be required to facilitate the unaccustomed new team players and this ancillary training requires more resources to achieve the same increment in skill and team play as familiarized players. These barriers may limit the player's popularity with the local media and fans, and thus lessen the value of that player to the team and home city.[7]

PREVIOUS RESEARCH

There have been a wide number of economic studies that have been conducted involving professional sports and their players, owners and customers. The standard

[6] Several studies outside of hockey have found empirical evidence of forms of customer discrimination. Scott, Long and Somppi (1985) find that customers of professional basketball discriminated in favor of Blacks from 1978 through 1981. Kahn and Sherer (1988) concluded that customers preferred to watch white players between 1980 and 1986. Scully (1974a) reports that Black pitchers lower attendance and Scully (1974b) concludes further that black players lower team revenues. Irani (1996) argues that there was customer discrimination in baseball during the period 1972-1991 although the level declined over time. Several papers investigate the prices of trading cards in professional baseball and basketball and their relationship to the race of the players depicted on them. Nardinelli and Simon (1990) analyze baseball card prices and find customer discrimination against Latin Americans while Anderson and LaCroix (1991) find customer-based discrimination only against blacks using similar data.

[7] The "Style of Play" thesis is to be found most developed in Walsh (1992) and there is a reply to it by Lavoie, Grenier and Coulombe (1992).

view followed by most in the literature on pro sports is that, in the absence of discrimination and franchise effects, performance characteristics are the chief determinant of salary variation across players. The empirical evidence in the past has shown the significance of skill attributes in salary determination, but the evidence confirming the existence of discriminatory practices has varied. Lawrence Kahn (1991) surveys the literature up to 1989 on discrimination in professional sports with respect to salaries, hiring, positions assigned and customer preferences. His review uncovers anecdotal patterns of discrimination in professional sports. He finds little evidence of salary or hiring discrimination by major league baseball and no evidence of customer discrimination on team revenues since the introduction of free agency. Furthermore, he finds no significant evidence involving positional segregation. In contrast to baseball, Kahn finds evidence of salary discrimination and customer prejudice in basketball. There is limited evidence for football, although what little evidence is available does reveal some segregation by position. For hockey, Kahn finds evidence that Francophone Canadians are subject to salary discrimination at the defense position, hiring discrimination, and positional segregation. He points out that there is some evidence to support the notion of customer discrimination in hockey also.

Considering the findings of Kahn (1991), the majority of the empirical research on salary discrimination has come from baseball and basketball, while football and hockey have received less attention. Fewer data for football and the lack of interest for ice hockey in the United States are two possible reasons why there has been limited empirical study. Along with data limitations, one might speculate that the lack of a large racial and ethnic mix in the NHL may well account for this, although the ethnic mix in the NHL is rapidly changing with the increasing number of European (Scandinavia, East and West Europe, Russia) players coming to North America.[8] Until 1990, the relevant salary information to warrant investigation was not widely available to researchers, as it was for baseball and basketball.

Other than discrimination, franchise characteristics have been thought to play a part in the determination of professional sports salaries. The monopoly-monopsony hypothesis implies that "in addition to the skill differences, the spatial monopoly-monopsony structure of the typical league franchise system has a positive-negative impact on salaries" (Scully, 1974b, 925-26). To date, there has been only limited evidence to support the monopoly-monopsony hypothesis. The statistical support that is available covers only particular leagues and within those leagues only certain player positions.[9]

Jones and Walsh (1988), hereafter JW, conduct an empirical investigation to examine the extent to which discrimination, skill differences and monopoly-monopsony conditions determine salaries in the NHL. They focus on salaries by player position in the NHL for the period 1977-78. The salary discrimination hypothesis is based on the existing Francophone Canadian population versus the rest of the league in the NHL during the 1977-78 season.[10] They contend that with the functioning World Hockey

[8] A survey of Oct. 5, 2000 opening night rosters showed there were 228 players from outside North America compared to 143 at the start of 1997-98. That's a 59 percent increase in three years. With the introduction of the four new expansion teams in the last three seasons, 94 more NHL jobs were created. Of the 94 new openings, the number of rest of world players (European and those from eastern bloc countries) has risen by 85 while the number of U.S.- born players has risen by five and Canadian-born players by four (The Hockey News, Oct. 20, 2000, 9).

[9] Scully (1974b, 926-27) finds support for monopoly effects for hitters, but not pitchers, in baseball. Jones and Walsh (1988, 598-99) find evidence of the monopoly effect for forwards but not defensemen or goalies.

[10] This group was the only sizeable minority as there were few Americans and even fewer Europeans to allow a quantitative analysis.

Association (1972-79), the market for players was fairly competitive and created good conditions for measuring the relationship between skills and salary. In addition, every franchise is a monopolist is so far as they have their own revenue potential. Additionally, each of these franchises has a degree of monopsony power since each team has a draft choice, options and compensation restrictions limiting player mobility. Thus, JW believed the NHL was a good market to test the monopoly and monopsony proposal.

The JW results for their salary discrimination variable were somewhat mixed. Forwards and goaltenders showed no indication of salary discrimination while Francophone Canadian defensemen appeared to be paid 10 percent less than non-Francophone Canadian defensemen[11] (Jones and Walsh, 1988, 598-601). Based on their results, JW found that skills, with respect to some variation among positions, were very significant in determining salaries. Furthermore, their findings suggest that the monopoly and monopsony influences were insignificant in so far as determining salaries for defensemen and goalies, but they found evidence in support of the monopoly hypothesis for forwards (Jones and Walsh, 1988, 598-99). These mixed results cannot confirm that consistent salary discrimination across all positions existed in the NHL during the 1977-78 season as they did not test for salary discrimination involving other minority groups being U.S. and European players.

Lavoie and Grenier (1992) test for entry discrimination by looking at attributes and performance differentials between groups of players of various ethnic origins. First for the 1989-1990 season; second for the 1977-1978 and 1989-1990 seasons compared utilizing a smaller set of explanatory variables than the first test. They build a model

[11] JW claim that the small size of the sample data set for Francophone Canadian players (11 out of 89 defensemen) could effect the salary discrimination coefficient.

with lagged performance characteristics as the independent variables and the natural log of salary as the dependent variable. On the issue of salary discrimination, they contend that previous work of their own and by Jones and Walsh (1988) have established that during the late 1970's, salary discrimination against Francophone Canadian defensemen did exist. From the 1989-1990 season data, they show that Francophone Canadian forwards and defensemen were underpaid compared to Anglophone Canadians, but the discrepancy was not statistically significant. They claim that whatever salary discrimination did exist had disappeared by 1990. For the other two minority groups the Europeans and Americans, they found no evidence to support the notion that the former are overpaid and the later underpaid, as had been presented by some in the literature and media.[12]

Upon review of the analysis provided by McLean and Veall (1992), one can see that they present calculations and use a methodology employing NHL data for the 1989-1990 season similar to that of Lavoie and Grenier (1992). Of particular relevance are their tests for salary discrimination including all minority groups of Francophone Canadian, American and Europeans (Scandinavia, East and West Europe), which were not included by Jones and Walsh (1988). Similar to the findings of Lavoie and Grenier (1992) and after attempting a wide variety of specifications, they find no statistically significant negative coefficients for their Francophone dummy variable. However, the coefficients for the American and European variables were negative and significant, which could be interpreted as salary discrimination (McLean and Veall, 1992, 74).

[12] Don Cherry, a colorful commentator with the Canadian Broadcasting Corporation, along with other hockey analysts, believes that European players are overvalued and are stealing jobs away from North American players. Bruce Hood (1999), a former referee in the NHL, contends that Europeans are "underachievers" and are "liabilities to their teams", due to defensive weaknesses.

Therefore, McLean and Veall show little evidence of salary discrimination against Francophone Canadians but do show that European players may be outperforming the Anglophone Canadian players and the possibility of salary discrimination may exist for European players based on these results.

Similarly, in testing their hypothesis that there is minority ethnic discrimination in the National Hockey League, Jones, Nadeau and Walsh (1999) use data on 388 players from the 1989-1990 season. A regression model explaining salary is constructed that allows for a measure of discrimination. They examine whether skilled players are rewarded for talent and whether the market structure affects salary while using proxy variables that measure ethnic influence. In line with other works, their results indicate that salary differences are primarily determined by differences in skill. Further, they find some evidence suggesting the presence of labor market discrimination against European players although it is not statistically significant.

Contrary to the results of Lavoie and Grenier (1992) and McLean and Veall (1992), Longley (1995) finds evidence, using the same 1989-1990 season data that Francophone Canadians do suffer from significant salary discrimination but that it is not league wide. He is able to isolate the discrimination only to Francophone Canadians playing for Anglophone Canadian teams based in Anglophone Canada. Longley shows that, unless one controls for team location, the hypothesis that Francophone Canadians do not suffer from salary discrimination may be incorrectly rejected (Longley, 1995, 474). He claims that the sources of the discrimination can only be found by looking at differences in the composition of the fans and the media, and overall differences in the origin of coaches and general managers. From his regression results for forwards, he contends that fans or general managers in Anglophone Canada were prejudiced against Francophone Canadian players, where by Americans were not. Longley takes the position that historic tensions between Anglophone Canadians and Francophone Canadians may be the cause of the salary discrimination. He also looked at whether Anglophone Canadians playing for Francophone Canadian teams were discriminated against but found no significant evidence to that effect.

Similarly, accounting for team location in his salary regressions, Lavoie (2000) finds some evidence that salary discrimination based on team location appears to be prevalent. Contrary to Longley (1995), Lavoie cannot find any significant evidence that Francophone Canadian players on Anglophone Canadian teams have been discriminated against. Although the statistical results are heterogeneous in that the signs on the coefficients are sometimes wrong or statistically insignificant, Lavoie concludes that there is some evidence of discrimination against foreign, non-local players, particularly in Anglophone Canada.

With the salary discrimination evidence to date, based on the most recent set of data being from the 1993-1994 NHL season (Lavoie, 2000), and considering the array and quantity of European players competing in the NHL labor market during the 2001-2002 season, it would seem sensible to test for salary discrimination based on the more recent statistical data. This study provides an updated analysis of the NHL labor market testing for the existence of salary discrimination by player position. The paper continues the study of discrimination and focuses on the NHL's other minority groups, that is, the Americans and Europeans, with particular emphasis on European player salaries.

MEAN ATTRIBUTES, SKILLS AND SALARIES

With the progress of computers and the world-wide-web, the variety and availability of sports statistics and related information has increased immensely. With a click of the mouse, one can have a wealth of data on any professional sport and its players. The 2000-2001 performance, attribute and career data for this study were gathered from more than one source. The time on ice statistics were compiled from www.betterstatistics.com while the remaining salary and player performance and attribute information were collected from the National Hockey League Players Association (NHLPA) website. The data for this study are quite extensive and robust covering over 550 players across 30 teams participating in the 2001-2002 NHL season. In compiling the data, the most ambiguous task was to assign player origin. All the origin decisions were based on player province/country of birth.[13] This was the most efficient means of achieving a solution for assigning a proxy for nationality. The categories for this study are: Anglophone Canadian, Francophone Canadian, American, Scandinavian (Norway, Sweden, Finland), Eastern European (Lithuania, Belarus, Ukraine, Russia), Western European (Poland, Slovakia, Romania, Czechoslovakia) with the remainder falling under the category of Other (Britain, France, Germany). These categories reflect the relative overall population of skaters from across the NHL labor market and these groupings will allow for a vigorous cross sectional comparison.

Players were considered according to two positions being forward and defense while goalies were not considered. Statistics considered to capture salary variation were gathered and mean values are shown below in Table 2. Only players that played ten

[13]Francophone players were assimilated with Quebec players regardless of surname. Here it is assumed, due to incomplete information, that a player birth province/country is where he played his minor hockey and was his location of residence during childhood.

games or more during the 2001-2002 season were included in the analysis. Lastly, the career data includes statistics up to and including the 2000-2001 season, and the season data, such as time-on- ice is based on 2000-2001 season only.

Let us examine Table 2, starting with the position of forward. The largest group is that of Anglophone Canadians, which account for over 46% of the NHL population followed by American players at 14%. The remaining players in the league are divided relatively evenly across the residual groups, each of which representing roughly 10% of the NHL population with the exception of the Other category at less than 1%. When we compare the physical characteristics of players, we see that the Eastern European players are the tallest followed by the players of Scandinavian descent while the Francophone Canadian players are the heaviest on average followed by the Eastern European group. It appears the Eastern European group is the largest aggregate group in size making use of height and weight as a proxy for overall size. Aside from the Other group as the sample size is small, Francophone Canadian forwards are the veteran group of the NHL with an average of 499 games played per capita followed by the Anglophone Canadians at 476 games. The European forwards dominate career points per game. The Eastern Europeans average 0.59 points per game followed by the Western Europeans at 0.56 points per game. The Francophone Canadians round out the top three at 0.53 points per game followed closely by another non-North American group, the Scandinavians, at an average of 0.52 points per game. In terms of infractions and physical play, the Francophone Canadians appear to spend the most time in the penalty box averaging 1.21 minutes per game followed by the Anglophone Canadians at 1.12 minutes per game. The Eastern, Western and Scandinavian players spend less than half of their time serving penalties than that of Anglophone and Francophone players. Taking into account the average time a player spends on the ice as representative of playing demand by the coaching staff and team, the Eastern and Western European and Scandinavian players seem to have some of the highest time-on-ice totals. Bearing in mind that these same groups produce some of the highest point totals on average, their marginal performance should come at a higher cost if high point totals are considered to constitute winning.

Table 2

Average NHL Career Attributes and Lifetime Performance By Position and Birth Origin

POSITION	Anglophone Canadian	Francophone Canadian	American	Scandinavia[1]	Western Europe[2]	Eastern Europe[3]	Other[4]	Totals
All Positions								
Number of Players	252	49	74	64	65	51	4	559
Percentage	45.08%	8.77%	13.24%	11.45%	11.63%	9.12%	0.72%	100%
Mean Salary	$1,655,765	$1,575,245	$2,237,682	$1,819,499	$1,697,167	$2,206,083	$893,750	$1,726,455
Height (inches)	73.25	72.88	72.70	73.16	73.28	73.20	73.25	73.1
Weight (pounds)	205.63	204.08	201.74	202.28	204.14	205.53	201.25	203.52
Career Games Played	473.24	485.02	491.68	374.47	316.09	431.35	622.00	456.26
Career Pts Per Game	0.37	0.44	0.44	0.44	0.44	0.49	0.54	0.45
Career PIM[5] Per Game	1.18	1.08	0.78	0.55	0.62	0.67	0.77	0.81
Time On Ice (2001/02)	15.43	15.22	17.08	17.29	17.57	18.17	15.75	16.64
FORWARD								
Number of Players	168	34	51	37	39	31	3	363
Percentage	46.28%	9.37%	14.05%	10.19%	10.74%	8.54%	0.83%	100%
Mean Salary	$1,634,856	$1,725,059	$2,236,697	$1,935,620	$2,058,162	$2,121,379	$1,025,000	$1,819,539
Height (inches)	72.77	72.71	72.49	72.78	72.77	72.97	71.67	72.59
Weight (pounds)	201.96	203.68	199.57	198.22	199.28	202.84	192.67	199.75
Career Games Played	476.45	498.71	459.45	354.11	339.41	429.19	587.33	449.24
Career Pts Per Game	0.44	0.53	0.48	0.52	0.56	0.59	0.60	0.53
Career PIM[5] Per Game	1.12	1.21	0.69	0.49	0.56	0.51	0.73	0.76
Time On Ice (2001/02)	13.98	13.87	15.58	15.72	15.91	16.81	15.99	15.41
DEFENCE								
Number of Players	84	15	23	27	26	20	1	196
Percentage	42.86%	7.65%	11.73%	13.78%	13.27%	10.20%	0.51%	100%
Mean Salary	$1,697,584	$1,235,667	$2,239,867	$1,660,370	$1,155,673	$2,337,375	$500,000	$1,546,648
Height (inches)	74.21	73.27	73.18	73.67	74.04	73.55	78.0	74.27
Weight (pounds)	212.96	205	206.57	207.85	211.42	209.70	227.0	211.5
Career Games Played	466.82	454	563.13	402.37	281.12	434.7	726.0	475.45
Career Pts Per Game	0.23	0.23	0.36	0.32	0.28	0.35	0.39	0.31
Career PIM[5] Per Game	1.30	0.79	0.97	0.63	0.71	0.91	0.90	0.89
Time On Ice (2001/02)	18.35	18.28	20.40	19.43	20.07	20.29	15.0	18.83

[1]Scandinavia: Norway, Sweden, Finland, Denmark
[2]Western Europe: Poland, Slovakia, Romania, Czechoslovakia
[3]Eastern Europe: Ukraine, Belarus, Lithuania, Russia
[4]Other: Britain, France, Germany
[5] PIM – Penalty in Minutes

For the defense position, the averages paint a slightly different picture. Once again, player representation is similar to that of the forwards with the exception of the Scandinavian group having the second highest percentage of players at 14%. The Anglophone Canadians are the tallest and heaviest group of players, followed by the Western Europeans, while the Americans are the shortest. Here, the Americans are the veterans averaging 563 games each and they come out on top averaging 0.36 points per game followed by the Eastern European defensemen at 0.35 points per game. Anglophone Canadians spend the most time serving penalties followed by the American players. Again, the Americans come out on top, in time on ice, skating on average over 20 minutes per game; they are followed closely by the Eastern Europeans and the Western Europeans.

Pooling all position data, the Anglophone Canadian and Eastern and Western European players check in as the largest players on average while the American players seem to have the superiority in games played, followed by the Anglophone Canadians. Eastern European players ring up to most points per game at 0.49 and the Anglophone and Francophone players are the roughest serving on average over 1 minute in the penalty box per game. Finally, Eastern and Western European players dominate time on ice.

Based on the above player and performance statistics, inferences about mean salary allocation in Table 1 are mixed. Apart from the Other category, the Western and Eastern European forwards have the highest point and time on ice averages per game, while the Francophone Canadian forwards followed by Anglophones have the highest seniority in terms of average games played. American forwards, with less than average statistics, are paid the highest average salary. Furthermore, the Eastern European players are the tallest and second heaviest group, indicating that their size does not hinder performance, if performance is to be measured by points and time spent on the ice.

For defensemen, the numbers are a little more compelling. The Americans, who averaged the most games played, have racked up the most average points per game based on the data and spent the most time on ice, are paid the highest, followed by the Eastern

European players and the Anglophone Canadian players. Again, as was the case with forwards, the Francophone players were paid the second lowest salary on average.

To look for signs of salary discrimination following a similar approach as Jones and Walsh (1988), McLean and Veall (1992) and Longley (1995), it would seem appropriate to employ econometric modeling adopting an Ordinary Least Squares regression approach to attempt to control for all variables which may influence salary. Aside from traditional modeling, by introducing dummy variables for six of the seven origin groups and holding the Anglophone Canadian group as the reference group, we can essentially proxy salary discrimination.

THE MODEL

The model is based on the earnings function approach of human capital theory and is a quite standard approach in the literature on salary differentials and salary determination (Scully, 1974; Jones and Walsh, 1988; McLean and Veall, 1992 and Longley, 1995). I set up a regression model relating player salaries, expressed in U.S. dollars, to skill elements, a measure of discrimination and franchise characteristics. I include skill elements, dummy variables that proxy ethnicity, and franchise variables that are intended to measure monopoly-monopsony effects.

The model follows a semi-logarithmic form with the dependent variable player salaries expressed in its natural logarithmic form and the explanatory variables in their raw absolute form. A log-log form, which takes the natural log of both the dependent and independent variables, would not seem appropriate as this transformation would bare that equal percentages of performance increases would produce equal percentage increases in salary. For example, a $1 million a year player who scores 30 goals instead of 20 goals may see his salary double to $2million the following year. It would be irrational to expect the same 200% increase from scoring 10 extra goals for a player currently earning $6 million a year. It is for this reason that a semi-log form is adopted where a percentage change in salary is explained by a raw absolute change in the explanatory variables.

The model follows the assumption that a player salary is related to his marginal revenue product (henceforth MRP). It captures the two basic factors that influence a player salary: his own individual productivity, and the revenue generating potential of the team for which he plays (Longley, 1995, 108). Moreover, dummy variables are introduced to proxy salary discrimination:

$$
\begin{aligned}
(1)\quad \text{LNSALARY} = {} & \beta_0 + \beta_1\,\text{HEIGHT} + \beta_2\,\text{WEIGHT} + \beta_3\,\text{DRAFT} \\
& + \beta_4\,\text{NODRAFT} + \beta_5\,\text{GAMES} + \beta_6\,\text{GAMES2} \\
& + \beta_7\,\text{POINTS} + \beta_8\,\text{PIMGAME} + \beta_9\,\text{PLUSMINUS} \\
& + \beta_{10}\,\text{TOI} + \beta_{11}\,\text{STAR} + \beta_{12}\,\text{TPM} \\
& + \beta_{13}\,\text{POP} + \beta_{14}\,\text{INCOME} + \beta_{15}\,\text{ARENA} \\
& + \beta_{16}\,\text{TEAMS} + \beta_{17}\,\text{REVENUE} + \beta_{18}\,\text{CF} \\
& + \beta_{19}\,\text{EE} + \beta_{20}\,\text{O} + \beta_{21}\,\text{S} + \beta_{21}\,\text{US} + \beta_{23}\,\text{WE} + \epsilon.
\end{aligned}
$$

The coefficients β_1 to β_{12} measure the effect of player attributes and skills on salary, β_{13} to β_{17} measure the monopoly-monopsony characteristics of each respective franchise market and β_{18} to β_{23} characterize the salary effects of place of birth. Table 3 outlines the Specific definitions of the variables.

Table 3
Variable Definitions

LNSALARY	Natural log of salary by player for the 2002-2003 season. Includes deferred salary properly discounted.
Skill Variables	
HEIGHT	Height, in inches.
WEIGHT	Weight, in pounds.
DRAFT	Round drafted.
NODRAFT	Dummy variable equal to one if the player was not drafted, zero otherwise.
GAMES	Career games played, regular season.
GAMES2	Career games played squared, regular season.
POINTS	Career points per game during the regular season.
PIMGAME	Career penalty minutes per game, regular season.
PLUSMINUS	Player plus-minus from previous year.
TOI	Last season time on ice per game.
STAR	The number of career NHL trophies + the number of NHL all-star appearances.
TPM	Team plus-minus from previous year.
Discrimination Variables	
CF	Dummy variable equal to one if the player was Francophone Canadian born, zero otherwise.
EE	Dummy variable equal to one if the player was Latvia, Belarus, Ukraine, Russia born, zero otherwise.
O	Dummy variable equal to one if the player was British, France or German born, zero otherwise.
S	Dummy variable equal to one if the player was Scandinavian born, zero otherwise.
US	Dummy variable equal to one if the player was American born, zero otherwise.
WE	Dummy variable equal to one if the player was Poland, Slovakia, Romania, Czech bom, zero otherwise.
Franchise Characteristics	
POP	Lagged population for each team.
INCOME	Lagged income per capita for the state or province in which the franchise is located.
ARENA	Lagged arena-seating capacity.
TEAMS	Lagged number of other professional sports teams in the franchise city (MLB, NBA, NFL, CFL).
REVENUE	Lagged team annual revenue (regressed on salary in place of POP, INCOME, ARENA, TEAMS).

Sources: SALARY and all performance and player attributes: www.nhlpa.com.
ARENA: http://www.angelfire.com/journal/hockeydevs/special_features_links/nhlarenas.html. POP and INCOME: U.S. Bureau of Census; Statistics Canada. TEAMS: www.mlb.com, www.nba.com, www.nfl.com, www.cfl.com. TOI: www.betterstatistics.com. TPM: www.usatoday.com. REVENUE: www.forbes.com.

MODEL SPECIFICATION

Two different model specifications using: (a) the joint variables POP, INCOME, ARENA, TEAMS, and (b) the variable REVENUE, are individually applied using the same set of skills and ethnic variables and the statistical results are presented in Table 4.

Skills

Due to the nature of hockey's main positions, forward and defense, one variable is unlikely to capture the skill attributes for both positions as forwards tend to gain recognition for goal scoring and point production while defensemen tend to be valued for their ability to stop goals or break up scoring plays from the opposing team. For forward and defense, POINTS, TOI and PLUSMINUS are intended to proxy skills for all skaters. It must be noted that it is difficult to measure all skills for both offense and defense with one variable; thus time on ice and plus minus are introduced.

Since it is primarily the forwards' responsibility to score goals, the POINTS coefficient is expected to be larger when estimating the equation for forwards than when estimating for defensemen. The skill variable POINTS is expected to be positively correlated with salaries for both forwards and defensemen. From the regression results in Table 4, the POINTS coefficient for forwards is highly significant and larger than the insignificant coefficient for Defensemen. Similarly, it can be expected that some of the remaining skill variables that capture superior defensive play will show stronger salary effects for defensemen than forwards. I included POINTS squared in specifications for both forwards and defensemen prior but could not arrive at a statistically significant coefficient with explanatory power. Thus, there does not seem to be any optimal level of points where by salary peaks at a maximum.

Table 4
OLS Output By Position

	Forward (a)	Forward (b)	Defense (a)	Defense (b)
CONSTANT	11.274 (11.64)***	11.063 (12.26)***	11.516 (9.78)***	11.786 (10.66)***
Skill Variables				
HEIGHT	0.0053 (0.33)	0.0076 (0.48)	-0.007 (0.37)	-0.792-03 (0.04)
WEIGHT	0.0014 (0.63)	0.0015 (0.62)	0.002 (0.71)	0.981-03 (0.38)
DRAFT	-0.019 (2.17)**	-0.017 (2.00)**	-0.02 (2.31)**	-0.019 (2.15)**
NODRAFT	-0.238 (3.21)***	-0.228 (3.07)***	-0.028 (0.34)	-0.031 (0.37)
GAMES	0.002 (9.17)***	0.002 (9.05)***	0.003 (10.52)***	0.003 (10.16)***
GAMES2	-0.116-05 (6.68)***	-0.115-05 (6.60)***	-0.202-05 (8.05)***	-0.196-05 (7.64)***
POINTS	1.42 (7.92)***	1.44 (7.99)***	0.276 (1.15)	0.246 (1.00)
PIMGAME	0.158 (4.92)***	0.160 (4.96)***	0.059 (1.27)	0.054 (1.16)
PLUSMINUS	0.0025 (1.09)	0.003 (1.22)	0.002 (1.01)	0.0013 (0.59)
TOI	0.053 (5.95)***	0.052 (5.71)***	0.058 (7.46)***	0.058 (7.27)***
STAR	0.0011 (0.08)	0.002-02 (0.12)	0.102 (5.18)***	0.107 (5.36)***
TPM	0.003 (3.48)***	0.002 (3.18)***	0.536-03 (0.62)	0.246-03 (0.30)
Discrimination Variables				
CF	-0.13 (1.86)*	-0.15 (2.06)**	-0.16 (1.81)*	-0.164 (1.79)*
EE	-0.018 (0.24)	-0.005 (0.07)	0.118 (1.43)	0.168 (2.04)**
O[1]	-0.490 (2.24)**	-0.471 (2.14)**	-1.05 (3.16)***	-1.05 (3.11)***
S	0.048 (0.67)	0.046 (0.64)	0.040 (0.52)	0.022 (0.29)
US	0.018 (0.29)	0.025 (0.41)	-0.037 (0.49)	-0.032 (0.41)
WE	0.096 (1.36)	0.083 (1.17)	-0.107 (1.38)	-0.111 (1.41)
Franchise Characteristics				
POP	0.387-08 (0.57)	-------	0.441-08 (0.55)	-------
INCOME	-0.152-04 (1.61)	-------	-0.168-04 (1.52)	-------
ARENA	0.148-04 (0.96)	-------	0.505-04 (2.94)***	-------
TEAMS	0.017 (0.63)	-------	0.022 (0.68)	-------
REVENUE	-------	0.269-09 (0.64)	-------	0.655-09 (1.35)
R^2adj	0.8054	0.8029	0.8347	0.8270
F	69.11	78.64	45.768	50.055
DF	22	19	22	19
N	363	363	196	196

* Significant at the 10% Level, ** Significant at the 5% Level, *** Significant at the 1% Level
Absolute t-statistics in parenthesis
Note: [1](O) Other Country – 4 players in sample (3 forward, 1 defense).

Although scoring and setting up goals is the ultimate objective in ice hockey, special teams (power play teams and penalty kill teams) and players that fit a certain role (enforcer, checker, etc…) are an intricate part of the success of a franchise. It is not unusual that during a physical game, or a game filled with penalties, that certain role players receive more ice time than prolific goal scorers or set-up men. The TOI variable reflects the amount of time that a skater, regardless of offensive scoring ability, spends on the ice. From the output in Table 4, TOI is positive and highly significant for both forward and defense although it explains salary differentials more so for defense. Here, TOI is indicative of a player worth as salary increases with the more time the player spends on the ice. Again considering the difficulty of measuring offense and defense with one variable, PLUSMINUS provides a measure of player productivity in relation to the overall success of the team as a plus is rewarded for being on the ice when a goal is scored for and a negative if on the ice for a goal against; thus, is a partial measure of the defensive ability of a player. This statistic provides a measure of a player's net contribution to offense and defense as it is intended to capture balanced play. The PLUSMINUS coefficient is positive and slightly larger for forwards, but is insignificant in both cases. TPM is a participating players team plus minus from the previous season. It is of belief that along with the individual PLUSMINUS, that a teams overall success from the previous year can factor into salary determination for the following year The TPM is the average plus-minus of all skaters that played during the respective season. Although the value is small at less than 1% for the forwards, the TPM seems to explain some of the variation in salary, as the value is significant while for defense the coefficient is insignificant.

From the literature, and across labor markets, it is standard to observe that on average skill and pay increases with experience. Navin and Sullivan (2002) look at bargaining power and show that salary increases as players advance through the system of Group I players, restricted free agents, with and without access to arbitration, and unrestricted free agents. Since unrestricted free agency comes with seniority, GAMES played is expected to have a positive impact on salary. From the results in Table 4, GAMES is highly significant across both positions and appears to explain variation in salary more for defensemen than forwards, as the coefficient is slightly larger. I test for non-linearity by including GAMES2, which is simply the square of GAMES. From the evidence, GAMES2 is highly significant for both forward and defense indicating that there is an optimal level of games that a player may reach at which point his salary will be at its maximum.

Jones, Nadeau and Walsh (1997) argue that NHL teams provide employment opportunities for two distinguishable categories of player: grunts and non-grunts. Penalty minutes are anticipated to capture some of the variation in salaries as penalties are expected to capture intensity and generally "crowd pleasing" violence as well as defensive play. Here the PIMGAME coefficient is positive and significant for forward where as the coefficient for defense is insignificant thus explaining more of the variation in salary for forward than defense. These effects are similar to those of Jones and Walsh (1988), Lavoie and Grenier (1992) and more recently Lavoie (2000). This could reflect the crowd demand for aggressive play when in puck pursuit by the forwards.

The variables HEIGHT and WEIGHT represent attributes that are considered to provide an advantage for players assuming size equates to an advantage in the game.

The extra reach and height, up to an optimal level, should allow players to accomplish more on the ice. These variables are intended to proxy a scale of quality of play not otherwise captured by the model. HEIGHT is positive for forwards and negative for defensemen although none of the coefficients are statistically significant. Again, WEIGHT is insignificant for both forwards and defense with the coefficients carrying a positive sign for both positions. It appears that where as HEIGHT and WEIGHT played a part in explaining salary differentials for both forwards and defensemen in the past[14], it does not appear to provide any explanations for salary determination in these specifications.[15]

The STAR variable is used to identify star players and for each player the variable represents the aggregate number of trophies and all-star appearances combined. Trophies and all-star appearances are accreditation of success and outstanding performance as voted on by judges, critics, media and fans. The STAR coefficient for the forward position is negative and statistically insignificant, and positive for defensemen and highly significant. These results are parallel to some of the evidence found in past studies.[16] It is quite rational to believe that more trophies should lead to an increase in recognition and value and thus salary. Star status appears to have a positive effect on salary for defense increasing salary by 10% for each additional trophy received and/or all-star appearance. DRAFT and NODRAFT are variables that are intended to account for players with star potential. DRAFT is captured in its raw form, thus a player

[14] See Jones and Walsh (1988) and Lavoie (2000) for evidence of this.
[15] Previous specifications included variables for HEIGHT and WEIGHT squared but none of the coefficients were significant.
[16] Jones and Walsh (1988); Jones, Nadeau and Walsh (1999) and Lavoie (2000) appear to arrive at coefficients that are similar in sign and magnitude. There seems to be a greater influence on salary for defensemen who have all-star appearances and trophies under their belt.

drafted in the first round will receive a one, second round a two, etc… while NODRAFT is a dummy variable which equals one if the player was not drafted and zero otherwise. The DRAFT coefficient is negative and significant for both forward and defense. The sign on the coefficients reaffirms that as the draft round becomes larger, player salary is anticipated to become smaller. The NODRAFT coefficient is negative for both forward and defense, but it seems to have a greater impact for forward as the value is larger and significant. This shows that forwards not being drafted, should expect to receive approximately 23% less in salary than those forwards that go in a draft round.

Monopoly-Monopsony Characteristics

It is anticipated that each franchise yields different monopoly revenues. The monopoly hypothesis follows that with the monopoly power, and the supposed ability of players/agents to negotiate and bargain, players may capture some of this monopoly revenue through negotiations. Hence, there should be a positive relationship between monopoly revenues and salaries across the league. Under the monopsony hypothesis, player movement among teams is somewhat limited[17] and each franchise city offers different opportunities to pursue outside income through endorsements and appearances. With each city's increased ability to offer outside income, that cities franchise is in a better position to negotiate smaller salaries so there should be an inverse relationship with salaries. The monopoly-monopsony hypotheses can be present at the same time, but the effect of one can eliminate the other. Overall, it is expected that since player mobility is very restricted, a player marginal revenue product and thus salary will be influenced by

[17] Limited in the sense that free agency is a luxury earned only after meeting certain experience criteria.

the revenue generating power of the team he is employed by and the city he is employed in.

Under the monopoly hypothesis the increase in population (POP), per capita income (INCOME) and arena capacity (ARENA) should have a positive effect on salary for the player while the number of competing professional sports teams (TEAMS) in the same city should have a negative effect on salary. The variables POP, INCOME, ARENA and TEAMS seem to be standard in most salary determination models (Jones and Walsh, 1988, 1997 and Scully, 1974a,b). The opposite of this is the monopsony hypothesis where it is expected that monopsony power will vary with franchise characteristics, and therefore, will exert a negative influence on player salaries. The REVENUE alternative is applied in place of the joint effects of population, per capita income, arena capacity and competing franchises. The REVENUE variable is applied to capture the direct effect of team revenue on salaries, which is generally a function of city population, per capita income, arena capacity and competing franchises, and has more recently been used by Longley (1995). All of the franchise characteristics are lagged one year as it is assumed they are predetermined prior to salary negotiations taking place in the current year.

From the evidence, the monopoly-monopsony coefficients are the least agreeable with economic theory as there is some ambiguity with the signs of the coefficients. The coefficients for POP and ARENA are all positive with only the ARENA coefficient being statistically significant for defense, which supports the monopoly hypothesis. As arena capacity increases it is expected to have a positive effect on salary supporting the notion that a larger arena will have larger revenue generating potential if filled to capacity.

Although insignificant, the coefficients for TEAMS and INCOME are positive and negative respectively which supports the monopsony hypothesis. It is apparent that hockey is clearly not one of the top three spectator sports in the United States where 5/6 of the NHL teams are located. With the INCOME coefficient having a negative sign, it would be interesting to look at average ticket prices for all professional sports in the United States and the price elasticity of demand for hockey tickets in the U.S. to assess whether Americans substitute away from hockey when they experience a gain in income. However, this is beyond the scope of the present study. It is not clear what the monopoly-monopsony results show. It could be said that the monopoly-monopsony effects cancel each other out thus no real effect on salary is obvious.

The REVENUE coefficients, although insignificant, are positive for both forward and defense supporting the notion that an increase in team revenue should equate to an increase in player salary. The insignificance of the REVENUE coefficient for both positions is not surprising considering the NHL collective bargaining agreement specifically states that it is forbidden to use the financial situation of the team in arbitration negotiations.[18] Consequently team revenues do not appear to have any significant impact on salary determination.

Jointly, the franchise characteristics do not reveal any significant economic information in view of the monopoly-monopsony hypothesis. The signs on the INCOME coefficient and the TEAMS coefficient are opposite of those expected under the monopoly hypothesis, while the only coefficient with some explanatory power is the ARENA coefficient for defense. Although they are insignificant, the REVENUE

[18] Article 12.5 section (F) sub section (iii) says: The following categories of evidence are inadmissible and shall not be considered by the Arbitrator: The financial condition of the Club or the League (point 8).

coefficients are positive for both forward and defense. Generally, there is no strong evidence that monopoly-monopsony behavior contributed in part to the determination of 2001-2002 player salaries based on these franchise characteristics.

Discrimination

To examine the effects of salary discrimination, I test for salary differences between Francophone Canadians, Americans, Scandinavians, Eastern and Western Europeans while holding the Anglophone Canadian group as the reference category. If any type of salary discrimination exists against these groups, which taken all together constitute the majority of the players in the NHL, I expect the dummy variable to have a negative effect on player salary. From Table 4, while disregarding the Other category coefficients due to sample size limitations, the coefficients for Francophone Canadian forwards and Eastern European forwards are negative, which is evidence of possible salary discrimination, with the Francophone coefficient only being significant. Considering both specification (a) and (b), Francophone forwards seem to be paid 14% less than their Anglophone Canadian counterparts. For defensemen, the Francophone, Western European and US coefficients all carry negative signs, with the Francophone coefficient being the only one that is statistically significant. As in the past, there appears to be evidence of salary discrimination against Francophone Canadian defensemen compared to Anglophone Canadians with the former being paid approximately 16% less than the later.

For defensemen, Jones and Walsh (1988) find a significant negative relationship between their Quebec born variable and salary based on 1977-1978 data. They find that the salaries of Francophone Canadian defensemen are approximately 10% lower than those of non-Francophone Canadian defensemen. Lavoie and Grenier (1992) find that Francophone defensemen in the NHL were underpaid during the 1977-1978 season also but their estimate was around 12%. The main difference being LG compare Francophone Canadians to Anglophone Canadians while JW compare Francophone Canadians to the rest of the league. Furthermore, LG find that Francophone Canadian forwards were underpaid by approximately 7% and defensemen 11% during the 1989-1990 season although these values were not significant. From this evidence, the salary discrimination that did exist in the 1970's had disappeared by 1990, but the problem seems to have resurfaced based on the evidence using the 2001-2002 data and it has resurfaced with greater magnitude as the salary differences for Francophone forward and defense are 14% and 16% respectively.

Of particular interest is the Eastern European defense coefficient as it is positive and significant. It appears that Eastern European defensemen are paid 17.1% more than Anglophone Canadian defensemen while being outperformed. This is evidence of reverse salary discrimination and may be support for the notion European players underachieve and are over paid compared to Anglophone Canadians.

CONCLUSION

The preceding evidence suggests three conclusions. First, the model specifications have shown that the coefficients for the skill variables provide similar results to those of past researchers. They seem to be the chief determinant of salary. Secondly, the franchise characteristics are very much inconclusive in their signs and relative magnitude. The franchise coefficients from specification (a) did not support the notion that the monopoly state of the franchise has a positive affect on salaries. Although the coefficient was statistically insignificant, the franchise coefficient from specification (b) indicated that the monopoly revenue of the team has a positive impact on salary determination for the player. There appears to be no solid explanation or consistent pattern relative to franchise size or location over time. If the monopoly hypothesis were true then salaries would tend to be higher where the monopoly franchise exists. Players for that respective franchise would tend to have higher average salaries and salary demands as they desire, as a profit maximizer, a greater cut of monopoly revenues. These results are not inconsistent with those found by Jones and Walsh (1988) who found limited support for the hypothesis that the monopoly position of the franchise system has a positive impact on salaries for certain player positions (Jones and Walsh, 1988, 602). Similarly, there is a lack of statistical evidence in support of the monopsony hypothesis. If the monopsony hypothesis holds[19], then NHL teams may try to use monopsony power in so far as to negotiate lower salaries for its players on the presumption that these players can gain outside income from other sources or other forms of non-hockey related income. This does not appear to be the case with the 2001-2002 market in the NHL.

Finally, there appears to be some statistically significant evidence of salary discrimination against Francophone defensemen and forwards with reference to Anglophone Canadian players. This was a problem that was evident in the late 1970's, disappeared by 1990, but seems to have played a role in determining salaries for the 2001-2002 season. If more data were compiled on the seasons between 1990 and 2002, it would be interesting to map the discrimination measures to see if any significant pattern develops. Furthermore, the negative sign on the United States and Western European defense coefficients are signs of salary discrimination. This means that there

[19] The monopsony hypothesis was evident in Jones et al. (1997).

is some weak evidence of salary discrimination against United States and Western European defensemen although the US coefficient is very small. On the contrary, it appears that Eastern European defensemen may benefit from some statistically significant form of reverse discrimination. Similarly, Western European forwards nearly statistically benefit from reverse discrimination also. Thus, Eastern European defensemen and Western European forwards may have been overpaid. This evidence is in line with some of the ideas shared by hockey analysts like Don Cherry and Brian Hood. It is often said that Europeans are over paid, underachievers who lack the discipline to play the "two-way complete game" like the prototypical North American fans expect from their domestic players.

There does not seem to be any one fundamental explanation for the salary discrimination results. Once again, Francophone players seem to be suffering the most while some European players, by position, seem to be overpaid; thus the language thesis does not support these results. If a communication barrier, customer discrimination or evidence of the "style of play" thesis does exist; there should be more statistical signs of salary discrimination on the ethnicity coefficients for the European players. There appears to be no statistically significant evidence of salary discrimination against European players, although the coefficient is nearly statistically significant for Western European defensemen.

APPENDIX

OLS Output – Forward Specification (a)

```
R-SQUARE =    0.8172      R-SQUARE ADJUSTED =    0.8054
 VARIANCE OF THE ESTIMATE-SIGMA**2 =  0.13783
 STANDARD ERROR OF THE ESTIMATE-SIGMA =  0.37125
 SUM OF SQUARED ERRORS-SSE=   46.862
 MEAN OF DEPENDENT VARIABLE =   14.030
 LOG OF THE LIKELIHOOD FUNCTION = -143.508

 MODEL SELECTION TESTS - SEE JUDGE ET AL. (1985,P.242)
  AKAIKE (1969) FINAL PREDICTION ERROR - FPE =      0.14656
     (FPE IS ALSO KNOWN AS AMEMIYA PREDICTION CRITERION - PC)
  AKAIKE (1973) INFORMATION CRITERION - LOG AIC =  -1.9205
  SCHWARZ (1978) CRITERION - LOG SC =              -1.6737
 MODEL SELECTION TESTS - SEE RAMANATHAN (1998,P.165)
  CRAVEN-WAHBA (1979)
     GENERALIZED CROSS VALIDATION - GCV =           0.14715
  HANNAN AND QUINN (1979) CRITERION =               0.16164
  RICE (1984) CRITERION =                           0.14783
  SHIBATA (1981) CRITERION =                        0.14546
  SCHWARZ (1978) CRITERION - SC =                   0.18755
  AKAIKE (1974) INFORMATION CRITERION - AIC =       0.14654

                      ANALYSIS OF VARIANCE - FROM MEAN
                       SS         DF          MS                     F
 REGRESSION          209.56       22.        9.5253
69.109
 ERROR               46.862      340.       0.13783                 P-
VALUE
 TOTAL               256.42      362.       0.70834
0.000

                      ANALYSIS OF VARIANCE - FROM ZERO
                       SS         DF          MS                     F
 REGRESSION          71664.       23.        3115.8
22606.537
 ERROR               46.862      340.       0.13783                 P-
VALUE
 TOTAL               71711.      363.        197.55
0.000


 VARIABLE    ESTIMATED   STANDARD   T-RATIO          PARTIAL
STANDARDIZED ELASTICITY
   NAME     COEFFICIENT    ERROR     340 DF    P-VALUE CORR.
COEFFICIENT  AT MEANS

 HEIGHT     0.52511E-02 0.15968E-01  0.32885      0.7425 0.0178
0.12586E-01  0.27222E-01
 WEIGHT     0.14711E-02 0.23308E-02  0.63114      0.5284 0.0342
0.26032E-01  0.21087E-01
```

```
CF       -0.13282      0.71574E-01  -1.8557     0.0644-0.1001 -
0.46045E-01 -0.88671E-03
EE       -0.18284E-01 0.77035E-01 -0.23735     0.8125-0.0129 -
0.60799E-02 -0.11129E-03
O        -0.49012      0.21905      -2.2375     0.0259-0.1205 -
0.52794E-01 -0.28870E-03
S         0.48340E-01 0.71666E-01   0.67452     0.5004 0.0366
0.17402E-01  0.35119E-03
US        0.18053E-01 0.61458E-01   0.29375     0.7691 0.0159
0.74644E-02  0.18078E-03
WE        0.96399E-01 0.70925E-01   1.3592      0.1750 0.0735
0.35518E-01  0.73819E-03
DRAFT    -0.18622E-01 0.85674E-02  -2.1736      0.0304-0.1171 -
0.60850E-01 -0.40038E-02
NODRAFT  -0.23797      0.74123E-01  -3.2104     0.0015-0.1715 -
0.90566E-01 -0.19624E-02
GAMES     0.19783E-02 0.21581E-03   9.1669      0.0000 0.4452   0.73990
0.62864E-01
GAMES2   -0.11624E-05 0.17412E-06  -6.6757      0.0000-0.3404 -0.53166
-0.24654E-01
POINTS    1.4183       0.17913      7.9176      0.0000 0.3946   0.46028
0.49499E-01
PIMGAME   0.15793      0.32122E-01  4.9165      0.0000 0.2576   0.15293
0.10023E-01
PM        0.25097E-02 0.23092E-02   1.0868      0.2779 0.0588
0.31175E-01  0.10816E-03
TOI       0.53392E-01 0.89697E-02   5.9525      0.0000 0.3072   0.26909
0.56456E-01
STAR      0.10651E-02 0.13931E-01  0.76452E-01 0.9391 0.0041
0.28897E-02  0.57927E-04
TPM       0.27224E-02 0.78323E-03   3.4759      0.0006 0.1852   0.11182
-0.11386E-03
POP       0.38726E-08 0.67624E-08   0.57266     0.5673 0.0310
0.27858E-01  0.16268E-02
INCOME   -0.15208E-04 0.94695E-05  -1.6060      0.1092-0.0868 -
0.43048E-01 -0.24876E-01
ARENA     0.14838E-04 0.15454E-04   0.96010     0.3377 0.0520
0.23709E-01  0.19767E-01
TEAMS     0.17359E-01 0.27496E-01   0.63132     0.5283 0.0342
0.31356E-01  0.33368E-02
CONSTANT  11.274       0.96832      11.643      0.0000 0.5339   0.0000
0.80358
```

```
DURBIN-WATSON = 2.0345    VON NEUMANN RATIO = 2.0401    RHO = -0.01767
 RESIDUAL SUM = -0.30803E-12  RESIDUAL VARIANCE =  0.13783
 SUM OF ABSOLUTE ERRORS=   100.14
 R-SQUARE BETWEEN OBSERVED AND PREDICTED = 0.8172
 RUNS TEST:  178 RUNS,  191 POS,    0 ZERO,  172 NEG  NORMAL STATISTIC
= -0.4219
 COEFFICIENT OF SKEWNESS =  -0.4290 WITH STANDARD DEVIATION OF 0.1280
 COEFFICIENT OF EXCESS KURTOSIS =   1.4764 WITH STANDARD DEVIATION OF
0.2554

 JARQUE-BERA NORMALITY TEST- CHI-SQUARE(2 DF)=   42.3902 P-VALUE= 0.000
```

```
      GOODNESS OF FIT TEST FOR NORMALITY OF RESIDUALS - 30 GROUPS
 OBSERVED  2.0   2.0   2.0   2.0   3.0   3.0   5.0   8.0   9.0 15.0 11.0 29.0
20.0 32.0 29.0 31.0 34.0 30.0 32.0 18.0
          17.0   7.0 11.0   3.0   2.0   2.0   1.0   0.0   2.0   1.0
 EXPECTED  0.9   0.8   1.3   2.1   3.2   4.8   6.9   9.4 12.5 15.8 19.3 22.7
25.5 27.6 28.8 28.8 27.6 25.5 22.7 19.3
          15.8 12.5   9.4   6.9   4.8   3.2   2.1   1.3   0.8   0.9
 CHI-SQUARE =    30.4273 WITH   5 DEGREES OF FREEDOM, P-VALUE= 0.000


REQUIRED MEMORY IS PAR=     203 CURRENT PAR=    2000
 DEPENDENT VARIABLE = LNSALARY        363 OBSERVATIONS
 REGRESSION COEFFICIENTS
   0.525110177457E-02  0.147107363012E-02 -0.132822059517      -
0.182841771125E-01
  -0.490117144929      0.483400306389E-01  0.180533435702E-01
0.963994866508E-01
  -0.186219156698E-01 -0.237967340462      0.197829925394E-02 -
0.116239603614E-05
    1.41826245783      0.157928666070      0.250969065824E-02
0.533917586685E-01
   0.106505658212E-02  0.272242180485E-02  0.387256368649E-08 -
0.152077099931E-04
   0.148375385030E-04  0.173586528896E-01   11.2743264186

 RAMSEY RESET SPECIFICATION TESTS USING POWERS OF YHAT
   RESET(2)=   16.756      - F WITH DF1=   1 AND DF2= 339 P-VALUE= 0.000
   RESET(3)=   43.941      - F WITH DF1=   2 AND DF2= 338 P-VALUE= 0.000
   RESET(4)=   34.742      - F WITH DF1=   3 AND DF2= 337 P-VALUE= 0.000

 DEBENEDICTIS-GILES FRESET SPECIFICATION TESTS USING FRESETL
  FRESET(1)=   44.510      - F WITH DF1=   2 AND DF2= 338 P-VALUE= 0.000
  FRESET(2)=   28.302      - F WITH DF1=   4 AND DF2= 336 P-VALUE= 0.000
  FRESET(3)=   19.893      - F WITH DF1=   6 AND DF2= 334 P-VALUE= 0.000

 DEBENEDICTIS-GILES FRESET SPECIFICATION TESTS USING FRESETS
  FRESET(1)=   11.060      - F WITH DF1=   2 AND DF2= 338 P-VALUE= 0.000
  FRESET(2)=   6.1972      - F WITH DF1=   4 AND DF2= 336 P-VALUE= 0.000
  FRESET(3)=   4.9778      - F WITH DF1=   6 AND DF2= 334 P-VALUE= 0.000
```

OLS Output – Forward Specification (b)

```
R-SQUARE =    0.8133     R-SQUARE ADJUSTED =    0.8029
 VARIANCE OF THE ESTIMATE-SIGMA**2 =   0.13958
 STANDARD ERROR OF THE ESTIMATE-SIGMA =   0.37360
 SUM OF SQUARED ERRORS-SSE=    47.876
 MEAN OF DEPENDENT VARIABLE =    14.030
 LOG OF THE LIKELIHOOD FUNCTION = -147.393

 MODEL SELECTION TESTS - SEE JUDGE ET AL. (1985,P.242)
  AKAIKE (1969) FINAL PREDICTION ERROR - FPE =      0.14727
     (FPE IS ALSO KNOWN AS AMEMIYA PREDICTION CRITERION - PC)
  AKAIKE (1973) INFORMATION CRITERION - LOG AIC =  -1.9156
  SCHWARZ (1978) CRITERION - LOG SC =              -1.7010
 MODEL SELECTION TESTS - SEE RAMANATHAN (1998,P.165)
  CRAVEN-WAHBA (1979)
     GENERALIZED CROSS VALIDATION - GCV =          0.14772
  HANNAN AND QUINN (1979) CRITERION =              0.16036
  RICE (1984) CRITERION =                          0.14822
  SHIBATA (1981) CRITERION =                       0.14642
  SCHWARZ (1978) CRITERION - SC =                  0.18249
  AKAIKE (1974) INFORMATION CRITERION - AIC =      0.14725

                      ANALYSIS OF VARIANCE - FROM MEAN
                       SS          DF           MS                 F
 REGRESSION          208.54         19.         10.976
78.636
 ERROR               47.876        343.        0.13958            P-
VALUE
 TOTAL               256.42        362.        0.70834
0.000

                      ANALYSIS OF VARIANCE - FROM ZERO
                       SS          DF           MS                 F
 REGRESSION          71663.         20.         3583.2
25671.154
 ERROR               47.876        343.        0.13958            P-
VALUE
 TOTAL               71711.        363.         197.55
0.000


 VARIABLE    ESTIMATED   STANDARD   T-RATIO         PARTIAL
STANDARDIZED ELASTICITY
   NAME     COEFFICIENT    ERROR     343 DF    P-VALUE CORR.
COEFFICIENT  AT MEANS

 HEIGHT    0.76439E-02 0.15985E-01  0.47818     0.6328 0.0258
0.18321E-01  0.39626E-01
 WEIGHT    0.14521E-02 0.23305E-02  0.62306     0.5337 0.0336
0.25696E-01  0.20815E-01
 CF       -0.14702     0.71490E-01  -2.0564     0.0405-0.1104 -
0.50965E-01 -0.98146E-03
 EE       -0.50289E-02 0.77092E-01 -0.65233E-01 0.9480-0.0035 -
0.16722E-02 -0.30610E-04
```

```
 O        -0.47067     0.21992      -2.1402      0.0330-0.1148 -
0.50699E-01 -0.27725E-03
 S          0.45874E-01 0.71916E-01  0.63789     0.5240 0.0344
0.16514E-01  0.33327E-03
 US         0.25477E-01 0.61705E-01  0.41288     0.6800 0.0223
0.10534E-01  0.25512E-03
 WE         0.83336E-01 0.71127E-01   1.1717     0.2422 0.0631
0.30705E-01  0.63816E-03
 DRAFT    -0.16995E-01 0.85007E-02  -1.9992     0.0464-0.1073 -
0.55532E-01 -0.36539E-02
 NODRAFT  -0.22845     0.74490E-01  -3.0669     0.0023-0.1634 -
0.86945E-01 -0.18840E-02
 GAMES      0.19767E-02 0.21840E-03   9.0509     0.0000 0.4391  0.73929
0.62812E-01
 GAMES2   -0.11535E-05 0.17474E-06  -6.6013     0.0000-0.3357 -0.52759
-0.24466E-01
 POINTS     1.4435      0.18068       7.9894     0.0000 0.3961  0.46848
0.50381E-01
 PIMGAME   0.16008      0.32297E-01   4.9564     0.0000 0.2585  0.15501
0.10159E-01
 PM         0.28194E-02 0.23189E-02   1.2159     0.2249 0.0655
0.35023E-01  0.12151E-03
 TOI        0.51678E-01 0.90489E-02   5.7110     0.0000 0.2947  0.26045
0.54644E-01
 STAR       0.16408E-02 0.14028E-01  0.11697     0.9070 0.0063
0.44519E-02  0.89243E-04
 TPM        0.23291E-02 0.73235E-03   3.1804     0.0016 0.1692
0.95663E-01 -0.97410E-04
 REVENUE    0.26871E-09 0.41843E-09  0.64217     0.5212 0.0347
0.16794E-01  0.30079E-02
 CONSTANT   11.063      0.90272       12.255     0.0000 0.5518   0.0000
0.78851


DURBIN-WATSON = 2.0039    VON NEUMANN RATIO = 2.0094    RHO = -0.00281
 RESIDUAL SUM = -0.31009E-12  RESIDUAL VARIANCE =  0.13958
 SUM OF ABSOLUTE ERRORS=   100.74
 R-SQUARE BETWEEN OBSERVED AND PREDICTED = 0.8133
 RUNS TEST:  176 RUNS,  187 POS,     0 ZERO,  176 NEG  NORMAL STATISTIC
= -0.6664
 COEFFICIENT OF SKEWNESS =  -0.4015 WITH STANDARD DEVIATION OF 0.1280
 COEFFICIENT OF EXCESS KURTOSIS =    1.3926 WITH STANDARD DEVIATION OF
0.2554

 JARQUE-BERA NORMALITY TEST- CHI-SQUARE(2 DF)=   37.5251 P-VALUE= 0.000

      GOODNESS OF FIT TEST FOR NORMALITY OF RESIDUALS - 30 GROUPS
 OBSERVED  2.0   3.0   0.0   5.0   1.0   3.0   4.0   6.0 14.0 14.0 11.0 26.0
22.0 32.0 33.0 32.0 28.0 35.0 24.0 24.0
          12.0 10.0   9.0   5.0   1.0   3.0   1.0   0.0   1.0   2.0
 EXPECTED  0.9   0.8   1.3   2.1   3.2   4.8   6.9   9.4 12.5 15.8 19.3 22.7
25.5 27.6 28.8 28.8 27.6 25.5 22.7 19.3
          15.8 12.5   9.4   6.9   4.8   3.2   2.1   1.3   0.8   0.9
 CHI-SQUARE =   37.1762 WITH  8 DEGREES OF FREEDOM, P-VALUE= 0.000
```

```
REQUIRED MEMORY IS PAR=      193 CURRENT PAR=     2000
 DEPENDENT VARIABLE = LNSALARY        363 OBSERVATIONS
 REGRESSION COEFFICIENTS
   0.764387338572E-02  0.145205956672E-02 -0.147015147373      -
0.502893743899E-02
  -0.470667900371      0.458741928557E-01  0.254767509697E-01
0.833359872245E-01
  -0.169945555221E-01 -0.228452112206      0.197666829141E-02 -
0.115350659784E-05
    1.44354236435      0.160078001205      0.281944273609E-02
0.516782633406E-01
   0.164083249103E-02  0.232911690238E-02  0.268705354834E-09
11.0628661050

 RAMSEY RESET SPECIFICATION TESTS USING POWERS OF YHAT
   RESET(2)=    15.199      - F WITH DF1=   1 AND DF2= 342 P-VALUE= 0.000
   RESET(3)=    44.429      - F WITH DF1=   2 AND DF2= 341 P-VALUE= 0.000
   RESET(4)=    33.445      - F WITH DF1=   3 AND DF2= 340 P-VALUE= 0.000

 DEBENEDICTIS-GILES FRESET SPECIFICATION TESTS USING FRESETL
  FRESET(1)=    44.598      - F WITH DF1=   2 AND DF2= 341 P-VALUE= 0.000
  FRESET(2)=    27.934      - F WITH DF1=   4 AND DF2= 339 P-VALUE= 0.000
  FRESET(3)=    19.351      - F WITH DF1=   6 AND DF2= 337 P-VALUE= 0.000
```

OLS Output – Defense Specification (a)

```
R-SQUARE =    0.8534      R-SQUARE ADJUSTED =    0.8347
 VARIANCE OF THE ESTIMATE-SIGMA**2 =  0.90293E-01
 STANDARD ERROR OF THE ESTIMATE-SIGMA =  0.30049
 SUM OF SQUARED ERRORS-SSE=   15.621
 MEAN OF DEPENDENT VARIABLE =   14.052
 LOG OF THE LIKELIHOOD FUNCTION = -30.2191

 MODEL SELECTION TESTS - SEE JUDGE ET AL. (1985,P.242)
  AKAIKE (1969) FINAL PREDICTION ERROR - FPE =     0.10089
     (FPE IS ALSO KNOWN AS AMEMIYA PREDICTION CRITERION - PC)
  AKAIKE (1973) INFORMATION CRITERION - LOG AIC =  -2.2948
  SCHWARZ (1978) CRITERION - LOG SC =              -1.9101
 MODEL SELECTION TESTS - SEE RAMANATHAN (1998,P.165)
  CRAVEN-WAHBA (1979)
     GENERALIZED CROSS VALIDATION - GCV =          0.10230
  HANNAN AND QUINN (1979) CRITERION =              0.11776
  RICE (1984) CRITERION =                          0.10414
  SHIBATA (1981) CRITERION =                       0.98402E-01
  SCHWARZ (1978) CRITERION - SC =                  0.14806
  AKAIKE (1974) INFORMATION CRITERION - AIC =      0.10078

                     ANALYSIS OF VARIANCE - FROM MEAN
                      SS          DF            MS                  F
 REGRESSION        90.915         22.         4.1325
45.768
 ERROR             15.621        173.       0.90293E-01            P-
VALUE
 TOTAL             106.54        195.       0.54634
0.000

                     ANALYSIS OF VARIANCE - FROM ZERO
                      SS          DF            MS                  F
 REGRESSION        38790.         23.         1686.5
18678.422
 ERROR             15.621        173.       0.90293E-01            P-
VALUE
 TOTAL             38806.        196.         197.99
0.000


 VARIABLE    ESTIMATED   STANDARD   T-RATIO          PARTIAL
STANDARDIZED ELASTICITY
   NAME      COEFFICIENT    ERROR     173 DF    P-VALUE CORR.
COEFFICIENT  AT MEANS

 HEIGHT   -0.69384E-02 0.18549E-01 -0.37405     0.7088-0.0284 -
0.17475E-01 -0.36477E-01
 WEIGHT    0.18100E-02 0.25358E-02  0.71378     0.4763 0.0542
0.33045E-01  0.27107E-01
 CF       -0.16123     0.89073E-01  -1.8101     0.0720-0.1363 -
0.58139E-01 -0.87815E-03
 EE        0.11830     0.82903E-01   1.4269     0.1554 0.1079
0.48570E-01  0.85906E-03
```

```
 O          -1.0524      0.33285      -3.1617      0.0019-0.2337 -0.10170
-0.38212E-03
 S           0.39823E-01 0.77018E-01  0.51706      0.6058 0.0393
0.18616E-01  0.39041E-03
 US        -0.37475E-01 0.76361E-01 -0.49075      0.6242-0.0373 -
0.16359E-01 -0.31296E-03
 WE        -0.10726      0.77461E-01  -1.3847      0.1679-0.1047 -
0.49349E-01 -0.10126E-02
 DRAFT     -0.19964E-01 0.86410E-02  -2.3103      0.0221-0.1730 -
0.81977E-01 -0.47116E-02
 NODRAFT  -0.28084E-01 0.83553E-01 -0.33612      0.7372-0.0255 -
0.11530E-01 -0.20394E-03
 GAMES      0.31804E-02 0.30225E-03   10.523      0.0000 0.6247   1.3524
0.99967E-01
 GAMES2   -0.20173E-05 0.25069E-06  -8.0469      0.0000-0.5219  -1.0373
-0.42116E-01
 POINTS    0.27635      0.24113       1.1461      0.2534 0.0868
0.63743E-01  0.54184E-02
 PIMGAME   0.58777E-01 0.46204E-01   1.2721      0.2050 0.0963
0.48523E-01  0.42390E-02
 PM        0.22696E-02 0.22371E-02   1.0145      0.3118 0.0769
0.36953E-01  0.17100E-03
 TOI       0.57673E-01 0.77272E-02   7.4636      0.0000 0.4935  0.34445
0.78573E-01
 STAR      0.10185      0.19668E-01   5.1787      0.0000 0.3664  0.24590
0.36612E-02
 TPM       0.53646E-03 0.86500E-03  0.62018      0.5360 0.0471
0.24878E-01 -0.62136E-04
 POP       0.44071E-08 0.80551E-08  0.54712      0.5850 0.0416
0.38910E-01  0.20332E-02
 INCOME   -0.16772E-04 0.11045E-04  -1.5186      0.1307-0.1147 -
0.53073E-01 -0.27365E-01
 ARENA     0.50511E-04 0.17160E-04   2.9435      0.0037 0.2184
0.94111E-01  0.67145E-01
 TEAMS     0.22420E-01 0.33158E-01  0.67615      0.4998 0.0513
0.48212E-01  0.44203E-02
 CONSTANT   11.516      1.1781        9.7751      0.0000 0.5965   0.0000
0.81954


DURBIN-WATSON = 2.0174    VON NEUMANN RATIO = 2.0277    RHO = -0.02977
 RESIDUAL SUM =  0.58387E-12  RESIDUAL VARIANCE =  0.90293E-01
 SUM OF ABSOLUTE ERRORS=   43.218
 R-SQUARE BETWEEN OBSERVED AND PREDICTED = 0.8534
 RUNS TEST:  109 RUNS,    97 POS,     0 ZERO,    99 NEG  NORMAL STATISTIC
=  1.4339
 COEFFICIENT OF SKEWNESS =  -0.1479 WITH STANDARD DEVIATION OF 0.1736
 COEFFICIENT OF EXCESS KURTOSIS =   0.1344 WITH STANDARD DEVIATION OF
0.3456

 JARQUE-BERA NORMALITY TEST- CHI-SQUARE(2 DF)=    0.7859 P-VALUE= 0.675

      GOODNESS OF FIT TEST FOR NORMALITY OF RESIDUALS - 30 GROUPS
 OBSERVED  0.0   1.0   0.0   2.0   3.0   2.0   3.0   4.0   5.0   4.0   9.0 15.0
10.0 23.0 18.0 15.0 19.0 13.0 12.0 11.0
           5.0   8.0   5.0   3.0   1.0   4.0   1.0   0.0   0.0   0.0
```

```
 EXPECTED  0.5   0.4   0.7   1.1   1.7   2.6   3.7   5.1   6.7   8.5 10.4 12.2
13.8 14.9 15.5 15.5 14.9 13.8 12.2 10.4
           8.5   6.7   5.1   3.7   2.6   1.7   1.1   0.7   0.4   0.5
 CHI-SQUARE =   22.1816 WITH  5 DEGREES OF FREEDOM, P-VALUE= 0.000


REQUIRED MEMORY IS PAR=     116 CURRENT PAR=    2000
 DEPENDENT VARIABLE = LNSALARY       196 OBSERVATIONS
 REGRESSION COEFFICIENTS
  -0.693836772376E-02  0.181002140279E-02 -0.161233968701
0.118297205785
   -1.05238947751      0.398230178108E-01 -0.374745447777E-01 -
0.107262236821
  -0.199635221941E-01 -0.280835297843E-01  0.318039032807E-02 -
0.201731014485E-05
   0.276352487908      0.587774172925E-01  0.226960507023E-02
0.576730029932E-01
   0.101852203529      0.536457149343E-03  0.440711605156E-08 -
0.167721388507E-04
   0.505106960947E-04  0.224196973212E-01   11.5157327323

 RAMSEY RESET SPECIFICATION TESTS USING POWERS OF YHAT
   RESET(2)=   18.878      - F WITH DF1=   1 AND DF2= 172 P-VALUE= 0.000
   RESET(3)=   12.497      - F WITH DF1=   2 AND DF2= 171 P-VALUE= 0.000
   RESET(4)=   8.2891      - F WITH DF1=   3 AND DF2= 170 P-VALUE= 0.000

 DEBENEDICTIS-GILES FRESET SPECIFICATION TESTS USING FRESETL
  FRESET(1)=   11.888      - F WITH DF1=   2 AND DF2= 171 P-VALUE= 0.000
  FRESET(2)=   6.5198      - F WITH DF1=   4 AND DF2= 169 P-VALUE= 0.000
  FRESET(3)=   4.2977      - F WITH DF1=   6 AND DF2= 167 P-VALUE= 0.000

 DEBENEDICTIS-GILES FRESET SPECIFICATION TESTS USING FRESETS
  FRESET(1)=   3.3338      - F WITH DF1=   2 AND DF2= 171 P-VALUE= 0.038
  FRESET(2)=   3.8917      - F WITH DF1=   4 AND DF2= 169 P-VALUE= 0.005
  FRESET(3)=   3.2481      - F WITH DF1=   6 AND DF2= 167 P-VALUE= 0.005
```

OLS Output – Defense Specification (b)

```
R-SQUARE =    0.8438     R-SQUARE ADJUSTED =   0.8270
 VARIANCE OF THE ESTIMATE-SIGMA**2 =  0.94527E-01
 STANDARD ERROR OF THE ESTIMATE-SIGMA =  0.30745
 SUM OF SQUARED ERRORS-SSE=   16.637
 MEAN OF DEPENDENT VARIABLE =   14.052
 LOG OF THE LIKELIHOOD FUNCTION = -36.3953

 MODEL SELECTION TESTS - SEE JUDGE ET AL. (1985,P.242)
  AKAIKE (1969) FINAL PREDICTION ERROR - FPE =      0.10417
    (FPE IS ALSO KNOWN AS AMEMIYA PREDICTION CRITERION - PC)
  AKAIKE (1973) INFORMATION CRITERION - LOG AIC =  -2.2624
  SCHWARZ (1978) CRITERION - LOG SC =              -1.9279
 MODEL SELECTION TESTS - SEE RAMANATHAN (1998,P.165)
  CRAVEN-WAHBA (1979)
    GENERALIZED CROSS VALIDATION - GCV =            0.10527
  HANNAN AND QUINN (1979) CRITERION =               0.11920
  RICE (1984) CRITERION =                           0.10665
  SHIBATA (1981) CRITERION =                        0.10220
  SCHWARZ (1978) CRITERION - SC =                   0.14545
  AKAIKE (1974) INFORMATION CRITERION - AIC =       0.10410

                      ANALYSIS OF VARIANCE - FROM MEAN
                        SS          DF          MS                F
 REGRESSION           89.899        19.        4.7315
50.055
 ERROR                16.637       176.       0.94527E-01        P-
VALUE
 TOTAL                106.54       195.       0.54634
0.000

                      ANALYSIS OF VARIANCE - FROM ZERO
                        SS          DF          MS                F
 REGRESSION           38789.        20.        1939.5
20517.440
 ERROR                16.637       176.       0.94527E-01        P-
VALUE
 TOTAL                38806.       196.        197.99
0.000


 VARIABLE    ESTIMATED   STANDARD   T-RATIO          PARTIAL
STANDARDIZED ELASTICITY
   NAME      COEFFICIENT    ERROR     176 DF    P-VALUE CORR.
COEFFICIENT  AT MEANS

 HEIGHT   -0.79159E-03 0.18467E-01 -0.42864E-01 0.9659-0.0032 -
0.19937E-02 -0.41616E-02
 WEIGHT    0.98112E-03 0.25663E-02  0.38231      0.7027 0.0288
0.17912E-01  0.14693E-01
 CF        -0.16355     0.91257E-01  -1.7922     0.0748-0.1339 -
0.58973E-01 -0.89074E-03
 EE         0.16842     0.82580E-01   2.0394     0.0429 0.1519
0.69149E-01  0.12230E-02
```

O	-1.0514	0.33759	-3.1143	0.0022	-0.2285	-0.10160	-0.38174E-03
S	0.22223E-01	0.77147E-01	0.28806	0.7736	0.0217	0.10389E-01	0.21787E-03
US	-0.32251E-01	0.78013E-01	-0.41341	0.6798	-0.0311	-0.14079E-01	-0.26934E-03
WE	-0.11140	0.78843E-01	-1.4129	0.1595	-0.1059	-0.51252E-01	-0.10516E-02
DRAFT	-0.18833E-01	0.87646E-02	-2.1487	0.0330	-0.1599	-0.77333E-01	-0.44447E-02
NODRAFT	-0.30880E-01	0.83653E-01	-0.36915	0.7125	-0.0278	-0.12679E-01	-0.22425E-03
GAMES	0.31464E-02	0.30967E-03	10.160	0.0000	0.6080	1.3379	0.98898E-01
GAMES2	-0.19607E-05	0.25674E-06	-7.6369	0.0000	-0.4989	-1.0082	-0.40934E-01
POINTS	0.24575	0.24686	0.99549	0.3209	0.0748	0.56685E-01	0.48184E-02
PIMGAME	0.53528E-01	0.46270E-01	1.1569	0.2489	0.0869	0.44189E-01	0.38604E-02
PM	0.13281E-02	0.22540E-02	0.58923	0.5565	0.0444	0.21624E-01	0.10006E-03
TOI	0.57614E-01	0.79259E-02	7.2691	0.0000	0.4805	0.34410	0.78492E-01
STAR	0.10666	0.19913E-01	5.3565	0.0000	0.3744	0.25752	0.38342E-02
TPM	0.24639E-03	0.81655E-03	0.30175	0.7632	0.0227	0.11426E-01	-0.28539E-04
REVENUE	0.65521E-09	0.48401E-09	1.3537	0.1776	0.1015	0.46280E-01	0.74623E-02
CONSTANT	11.786	1.1057	10.660	0.0000	0.6264	0.0000	0.83879

DURBIN-WATSON = 2.0267 VON NEUMANN RATIO = 2.0371 RHO = -0.03624
RESIDUAL SUM = 0.57582E-12 RESIDUAL VARIANCE = 0.94527E-01
SUM OF ABSOLUTE ERRORS= 43.883
R-SQUARE BETWEEN OBSERVED AND PREDICTED = 0.8438
RUNS TEST: 101 RUNS, 98 POS, 0 ZERO, 98 NEG NORMAL STATISTIC = 0.2864
COEFFICIENT OF SKEWNESS = -0.1925 WITH STANDARD DEVIATION OF 0.1736
COEFFICIENT OF EXCESS KURTOSIS = 0.4051 WITH STANDARD DEVIATION OF 0.3456

JARQUE-BERA NORMALITY TEST- CHI-SQUARE(2 DF)= 2.2761 P-VALUE= 0.320

GOODNESS OF FIT TEST FOR NORMALITY OF RESIDUALS - 30 GROUPS
OBSERVED 1.0 1.0 1.0 1.0 0.0 3.0 4.0 4.0 4.0 3.0 11.0 14.0
17.0 13.0 21.0 22.0 10.0 22.0 6.0 12.0
4.0 9.0 3.0 3.0 2.0 4.0 1.0 0.0 0.0 0.0
EXPECTED 0.5 0.4 0.7 1.1 1.7 2.6 3.7 5.1 6.7 8.5 10.4 12.2
13.8 14.9 15.5 15.5 14.9 13.8 12.2 10.4
8.5 6.7 5.1 3.7 2.6 1.7 1.1 0.7 0.4 0.5
CHI-SQUARE = 32.9156 WITH 8 DEGREES OF FREEDOM, P-VALUE= 0.000

```
REQUIRED MEMORY IS PAR=      109 CURRENT PAR=     2000
 DEPENDENT VARIABLE = LNSALARY        196 OBSERVATIONS
 REGRESSION COEFFICIENTS
  -0.791585994681E-03  0.981120274379E-03 -0.163546481700
0.168417763729
   -1.05135374487      0.222231299440E-01 -0.322513502886E-01 -
0.111396627209
  -0.188327189494E-01 -0.308802436785E-01  0.314637433320E-02 -
0.196070151997E-05
   0.245750853899      0.535278700266E-01  0.132811101261E-02
0.576138126145E-01
   0.106664692291      0.246391509527E-03  0.655211690960E-09
11.7862366035


 RAMSEY RESET SPECIFICATION TESTS USING POWERS OF YHAT
   RESET(2)=    15.072      - F WITH DF1=   1 AND DF2= 175 P-VALUE= 0.000
   RESET(3)=    10.057      - F WITH DF1=   2 AND DF2= 174 P-VALUE= 0.000
   RESET(4)=    6.6681      - F WITH DF1=   3 AND DF2= 173 P-VALUE= 0.000

 DEBENEDICTIS-GILES FRESET SPECIFICATION TESTS USING FRESETL
  FRESET(1)=    9.1775      - F WITH DF1=   2 AND DF2= 174 P-VALUE= 0.000
  FRESET(2)=    5.4474      - F WITH DF1=   4 AND DF2= 172 P-VALUE= 0.000
  FRESET(3)=    3.5955      - F WITH DF1=   6 AND DF2= 170 P-VALUE= 0.002

 DEBENEDICTIS-GILES FRESET SPECIFICATION TESTS USING FRESETS
  FRESET(1)=    3.3722      - F WITH DF1=   2 AND DF2= 174 P-VALUE= 0.037
  FRESET(2)=    2.4939      - F WITH DF1=   4 AND DF2= 172 P-VALUE= 0.045
  FRESET(3)=    2.0274      - F WITH DF1=   6 AND DF2= 170 P-VALUE= 0.065
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REFERENCES

Anderson, T. and S.J. LaCroix (1991) 'Customer Racial Discrimination in Major League Baseball.' Economic Inquiry, 29, 665-677

Brender, M. (2000) new World order. *The Hockey News* 54(10), 10-11

Costello, B. (2000) Europeans take NHL by storm. *The Hockey News* 54 (7), 9

Curtis, J.E. and J.W. Loy (1978) 'Race/Ethnicity and Relative Centrality of Playing Positions in Team-Sports.' *Exercise and Sport Sciences Reviews* 6, 285-313

Gujarati, D.N. (1995) *Basic Econometrics, Third Edition* (United States: McGraw Hill, Inc.)

Hill, J.R. and W. Spellman (1984) 'Pay Discrimination in Baseball: Data from the Seventies.' *Industrial Relations* 23, 103-12

Hood, B. (1999) The good of the game: Recapturing hockey's greatness. Toronto Canada: Stodard

Irani, D. (1996) 'Estimating Customer Discrimination in Baseball Using Panel Data' in John Fizel, Elizabeth Gustafson and Lawrence Hadley (eds.) *Baseball Economics: Current Issues* (Westport, Conn.: Greenwood Publishing Group, 1996)

Jones, J.C.H., S. Nadeau and W.D. Walsh (1999) 'Ethnicity, Productivity and Salary: Player Compensation and Discrimination in the National Hockey League.' *Applied Economics* 31(5), 593-608

Jones, J.C.H., S. Nadeau and W.D. Walsh (1997) 'The Wages of Sin: Employment and Salary Effects of Violence in the National Hockey League.' *Atlantic Economic Journal* 25(2), 191-206

Jones, J.C.H. and W.D. Walsh (1988) 'Salary Determination in the National Hockey League: The Effects of Skills, Franchise Characteristics, and Discrimination.' *Industrial and Labor Relations Review* 41, 592-604

Kahn, L. and P. Sherer (1988) 'Racial Differences in Professional Basketball Players' Compensation.' *Journal of Labor Economics*, 6, 40-61

Kahn, L. (1991) 'Discrimination in Professional Sports: A Survey of the Literature.' Industrial and Labor Relations 44(3), 395-418

Krashinsky, M. (1989) 'Do Hockey Teams Discriminate Against Francophone Canadians?: A Comment.' *Canadian Public Policy - Analyse de Politiques* 15, 94-97

Lavoie, M. (in press) 'The Entry Draft in the National Hockey League: Discrimination, style of play and team location.' *American Journal of Economics and Sociology.*

Lavoie, M. (2000) 'The Location of Pay Discrimination in the National Hockey League.' *Journal of Sports Economics*, 1(4), 401-411

Lavoie, M. and G. Grenier (1992) 'Discrimination and Salary Determination in the National Hockey League: 1977 and 1989 Compared.' *Advances in the Economics of Sport*, Greenwich : JAI Press, 153-177

Lavoie, M., G. Grenier and S. Coulombe (1989) 'Discrimination Versus Anglophone Proficiency in the National Hockey League: A Reply.' *Canadian Public Policy – Analyse de Politiques* 15(1), 98-101

Lavoie, M., G. Grenier and S. Coulombe (1987) 'Discrimination and Performance Differentials in the National Hockey League.' *Canadian Public Policy – Analyse de Politiques* 13, 407-22

Longley, N. (2000) 'Salary Discrimination in the National Hockey League: The Effects of team location.' *Canadian Public Policy* 21(4), 470-475

Longley, N. (1995) 'Salary Discrimination in the National Hockey League: The Effects of Team Location.' *Canadian Public Policy - Analyse de Politiques* 21, 413-22

Lundhal, M. and E Wadensjo (1984) *Unequal Treatment: A Study in the Neoclassical Theory of Discrimination* (London: Croom Helm)

McKenzie, B. (1999) Bottom line on salaries. *The Hockey News* 53(9), 8-10

McLean, R.C. and M.R. Veall (1992) 'Performance and Salary Differentials in the National Hockey League.' *Canadian Public Policy – Analyse de Politiques* 18, 470-75

McManus, W., W. Gould and F. Welch (1983) 'Earnings of Hispanic Men: The Role of Anglophone Language Proficiency.' *Journal of Labor Economics* 1, 101-30

Mogul, R.G. (1981) 'Salary Discrimination in Professional Sports.' *Atlantic Economic Review* 9, 106-10

Nardinelli, C. and C. Simon (1990) 'Customer Racial Discrimination in the Market for Memorabilia: The Case of Baseball.' *Quarterly Journal of Economics*, 105, 575-596

Navin, J., Sullivan, T. (2002) 'The Relationship Between Bargaining Power and Salary: Evidence From the National Hockey League.' Southern Illinois University Edwardsville (www.siue.edu)

Pascal, A.H. and L.A. Rapping (1972) 'The Economics of Racial Discrimination in Organized Baseball.' In A.H. Pascal (ed.) *Racial Discrimination in Economic Life* (Lexington, Mass: Lexington Books)

Scott, F.A., Jr., J.E. Long and K. Somppi (1985) 'Salary vs. marginal Revenue Product Under Monopsony and Competition: The Case of Professional Basketball.' *The Atlantic Economic Journal*, 13, 50-59

Scully, G.W. (1974a) 'Discrimination: The Case of Baseball.' in R. Noll, ed., *Government and the Sports Business*, Brookings, Washington D.C., 221-273

Scully, G.W. (1974b) 'Pay and Performance in Major League Baseball.' *The American Economic Review* 64, 915-30

Tremblay, R. (1984) 'Un Temoignage,' in M. Amyot (ed.) *Les activités socio-économiques et le français au Québec* 1, (Québec: Editeur officiel du Québec)

Walsh, W.D. (1992) 'The Entry Problem of Francophones in the National Hockey League: A Systemic Interpretation.' *Canadian Public Policy*, 18(4), 443-460

www.angelfire.com/journal/hockeydevs/special_features_links/nhlarenas.html

www.betterstatistics.com

www.cfl.com

www.forbes.com.

www.mlb.com

www.nba.com

www.nfl.com

www.nhlpa.com

www.unix.oit.umass.edu/~splaw488/nhl/nhllist.htm

www.usatoday.com