

SALARY DETERMINATION IN THE NATIONAL HOCKEY LEAGUE

A STUDY OF THE 1990/91 AND 1991/92 SEASONS

by

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Introduction

This paper examines the various factors involved in the determination of player salaries in the National Hockey League (NHL) for the 1990/91 and 1991/92 seasons. Recent publications of players' wages by the Players' Association allow for a reliable, in-depth study of how player salaries are decided. A model is constructed using a simple variation on the earnings function approach of human capital theory, with the natural logarithm of player salary as the dependent variable, to test several hypotheses which might explain what is involved in deciding wages. Performance measures, player attributes and ethnic origin enter as the independent variables to be examined in the model. The two seasons will be considered separately and then later compared, in an attempt to evaluate the robustness of the wage determination process. A summary of the major results will be given in the conclusion. First, however, a review is given of past studies of the labour economics of professional ice hockey and some insights are provided into the recent developments in the pay structure of the NHL.

1.0 Background and Objectives

There has emerged a vast amount of literature regarding the price tag of professional sporting teams over the last two years. Of particular interest has been the structure of player salaries in the National Hockey League. Information on the NHL's top wage earners for 1991/92, released in November 1991, indicates that 20 players, more than twice as many as a year earlier, earn at least one million dollars. League-reported average annual salaries for 1991/92 rose 19 per cent over the previous year and there is a projected increase of between 25 and 30 per cent for the 1992/93 season.¹ The reports indicate who makes the money, but fail to indicate why. Only since 1990 has the NHL and the Players Association disclosed yearly player salaries with sufficient details to make analysis possible.² The availability of these figures to the general public has sparked much interest and raised the question of not only why salaries have been escalating, but also how an individual's salary is determined. The advantage of the availability of this data on individual salaries and player statistics is that it allows one to look closely at determination issues, where as in the past this was not possible. Nevertheless, one must be careful not to believe that the task is made easier than before given this abundance of information, as it would seem that the entire process of salary determination is evolving. The factors which affect salary determination in the NHL are becoming increasingly numerous and complex.

¹ Mackenzie, Bob, "The Reasons Behind the Boom", The Ottawa Citizen, C1, Nov 1, 1991.

² With the exception of the 1977/78 season. Salaries for this year were disclosed in the Toronto Globe and Mail, March 14, 1978.

A model can be constructed which attempts to explain wage differentials by variations in labour quality, player attributes, and, to some extent, discrimination. Previous studies by Jones and Walsh (1988) and Lavoie and Grenier (1991) have concluded that the major factor of salary determination has been performance, with some evidence supporting the other two. Although not all performance indicators were significant, many did show high levels of significance. Some evidence which indicated discrimination at the entry level was found in a study by Lavoie, Grenier and Coulombe (1987) with a good significance level. Their findings suggest positions where it is difficult to assess a player's qualities or expected talents at the entry level may be prone to some discrimination.³

The research supporting this paper was not directed specifically to determine if there is player discrimination, but rather to try to provide some explanation of how indeed the salary structure is determined. Discrimination elements are tested, however, as are other factors which appear important or have proven significant in past studies.

The task of reducing these factors to a satisfactory and workable number is a difficult one, but previous research provides good guidelines as to what is useful or not. For example, variables which represent franchise characteristics may be left out of the model. Past research has shown franchise characteristics provided the least satisfactory results with few exceptions.⁴ It is possible the insignificance may be due to the difficulty in finding

³ In particular, the defencemen possess qualities which are more laborious to assess than forwards. It is sometimes difficult to determine if it is in fact discrimination and not some immeasurable skill that is responsible for wage differentials between two defencemen of seemingly equal talents.

⁴ For example, these were the findings of Jones and Walsh (1988) and Lavoie and Grenier (1991).

good measures which would be consistent with the models. Measures of franchise characteristics are often complex to define and tend to overlap, creating problems of multicollinearity within the model. In any case, there is no reason to expect different results for franchise characteristics in the 1990/91 and 1991/92 seasons.

Variables which have proven significant in the past will certainly be included in the testing, as well as those which may be of particular interest when compared to previous studies. Salaries for the 1990/91 and 1991/92 seasons will be used to develop a model to examine how NHL player salaries are decided. The two seasons will be dealt with separately, but the results from each will be compared to try to get a clearer idea of what is involved in salary determination. The approach taken by Lavoie and Grenier (1991) will be used. Current salaries are regressed with indicators from previous seasons. Salaries for the 1990/91 season will be used with data from the 1989/90 season and likewise 1991/92 salaries with 1990/91 data.⁵ We should expect much of the same results as in past studies with a strong correlation between the skill characteristics and player earnings.

⁵ The data source will be the 1990/91 and 1991/92 editions of "The Official Guide and Record Book", published by the National Hockey League. 1990/91 salaries were published in The Ottawa Citizen, Jan 23, 1990 and 1991/92 salaries in The Toronto Star, Nov 1, 1991. All salaries are defined as the base salary of the season in question, plus any portion of signing bonuses or guaranteed monies allocated that year.

2.0 The Model

We can start by assuming that team owners pay the same wage for labour units of equal quality.⁶ Each unit of labour will be described as fully as possible by a vector of objectively measured characteristics including performance indicators, personal attributes (eg. height, weight, age etc.) and a player's ethnic origin. A variation on the earnings function approach of human capital theory will be employed, using the natural logarithm of player salary as the dependent variable. It is important to understand that players are not all paid in the same currency. American teams pay their players in US dollars and Canadian teams in Canadian dollars. Also, some players who are traded to Canadian teams continue to receive their salaries in American denominations. The annual salary report indicates who these individuals are. To be able to make a good comparison between Canadian and American players, a proxy of 1.15 is used for the exchange rate for both years under investigation to express all salaries in Canadian funds.⁷

Only selective variables which best contribute to a player's salary will be used in the model. Although there is considerable information available on the players, it is best to limit the amount used in the final analysis in order to get better results and to avoid the possibility

⁶ This is assuming no discrimination, with the exception of possible discrimination against some ethnic groups which is also taken into account.

⁷ Only for the 1991/92 season were the Canadian club players, who received their salaries in American funds, disclosed. It is assumed those same players received payment in American currency for the 1990/91 season as well. No American team players were paid in Canadian dollars. This proxy of 1.15 may be less realistic given that the value of the Canadian dollar has increased relative to that of the American dollar.

of independent variables having a strong effect on one another. For this reason not all of the information on the athletes will be used in the final models.⁸ The same model will be used for both of the seasons in question. It is important to maintain consistency between the two years so as to make results comparable. Although it is much easier to find a good "fit" for each individual year, it is better to find one model suitable for both years for analysis purposes.

The possible independent variables that can be used in the model are numerous. Many of these have been put in the data set to allow for a greater selection of possible variables for analysis. However, when tested, a good number proved inappropriate for this particular study. The variables used in the final model will be explained in detail and reasons will be given as to why some of the seemingly more important ones were excluded.

Using one set of characteristics for all positions would not be a favourable approach to investigating the question of salary determination. Obviously, the skill attributes of goaltenders will be quite different from those of both forwards and defencemen. A separate set of independent variables must be constructed to discern how netminders' salaries are decided. Goaltenders are treated separately by using a new set of independent variables with the same model.

There may also exist differences in skill attributes between forwards and defencemen. Performance attributes which may show a high level of play for a forward may not

⁸ A good example of a seemingly more important variable which has been left out of the models is the plus/minus statistic. The validity of this statistic is hard to ascertain. Since good players are usually matched against their best opponents, it is very likely the quality of a player, measured by the plus/minus, may be distorted. For the purpose of this study it is best to exclude this widely used statistic from the model.

necessarily demonstrate that level of play for a defencemen. For example, defencemen are not expected to be high point scorers, but rather are expected to play an important part in preventing goals against their teams.⁹ When determining the quality of a player one would expect a greater emphasis put on points scored for a forward than for a defenceman. For this reason the two shall be examined separately. The same independent variables will be used for both the 1990/91 and 1991/92 seasons, although it is expected that estimates will differ.

The forwards can be further broken down into three positions : leftwingers, centres and rightwingers. It might be argued that in fact there are certain distinctions among the indicators of the three forward positions. However, it would be a difficult task to identify clearly these distinctions. In any case, it is assumed that the differences will be negligible, and the results similar, if they are grouped together. Furthermore, it must be recognized that there are indeed players who switch from one forward position to another in the course of the year or who may rotate positions in certain game situations.

In summary, therefore, the model will examine the league salary structures for two seasons, 1990/91 and 1991/92 under three categories : forwards, defencemen, and goaltenders. The general form of the model is illustrated in Appendix II. Individual characteristics which will used at each position can now be explained.

⁹ It is true many defencemen today are offensive-minded and are high point scorers. For example, in the 1990/91 season, Ray Bourque of the Boston Bruins scored more points than any other player on his team, including forwards and will earn over \$2,000,000 this season. However, in general, points scored provide a better indication of a forward's performance than that of a defenceman.

3.0 Characteristics and Expectations

The characteristics of the forwards and defencemen can be grouped into six categories which best exemplify the performance attributes of both. If it is assumed that there exists no extraneous influences and that salaries are based solely on the quality of a player, these six appear to be the most relevant.¹⁰

The DRAFT and NODRAFT variables will be used together to capture a player's potential upon entering the league. Players who were drafted receive a zero for NODRAFT and their actual draft number for DRAFT. Free agents are assigned a one for NODRAFT and a zero for DRAFT. Both of these variables will be used at all positions. If team owners expect the quality of a player to be relatively high, even though he has not yet proven himself in the league, the player is likely to be rewarded with a larger initial salary. Teams will draft a player high in the entry draft if they recognize this potential. It is expected, therefore, that players with low overall draft numbers will receive a more generous initial wage, hence the DRAFT variable estimate to be negative.

A problem exists when players enter the NHL as free agents and have no draft number. This is why a NODRAFT dummy variable must be used with the DRAFT variable to deal with the reality of this. Negative estimates would be anticipated for both draft variables at all positions. High draft picks reflect a greater degree of potential, so as the draft number

¹⁰ There does exist other types of variables that influence wages, in the literature, but they have been disregarded due to either lack of information available or difficulty to measure. ie. compensating differentials, rents, unions etc.

increases, a reduction in wages should be the consequence.¹¹ Free agents have usually been overlooked upon entry and tend to be associated with lower potential. Also, their bargaining position may not be as strong. For these reasons, free agents should generally make less than those who have been drafted. It is expected that the impact of the draft variables will be greatest for the forward positions. It has traditionally been the most glamorous position and probably the easiest in which to recognize a player's potential. Goaltenders should prove to have the least significant draft measures. They tend not to be drafted as early as forwards, as it seems that their abilities are the most difficult to assess upon entering the league. Teams are not willing to take a chance of giving up early round picks for players for which they have no reasonable guarantees of success. It is more important for defencemen and goalies to prove themselves once they are in the league.

The importance of capturing the entry draft in the model lies in the effect it has on both initial salaries and future payments. Few players have recorded salary cuts if their performances were not up to standards, and more frequently, bonuses are received if they do in fact meet expectations. Although teams reserve the right to downgrade a player's pay if he fails to perform, they will usually choose to punish the player later with small or zero increases in salary when his contract is re-negotiated, or in extreme cases, with termination.

The experience variable has always proved to be very important in explaining salaries in the past. The number of lifetime games a player has played (LGAMES) will be used for the forward and defence positions. Lifetime games seem to be a better measure of experience

¹¹ A high draft pick refers to a player who has been chosen in the early rounds of the draft and therefore having a low draft number.

than the number of seasons a player has played. Both were tested and lifetime games proved to provide stronger results for skaters. This result should not be surprising. A total seasons variable completely overlooks the games that are part of the playoffs.¹² It is logical to include playoff games in the experience variable since players can play up to 28 extra games per year on top of the regular season. These are games played under the same conditions as regular season games and usually with fierce competition, where valuable experience is gained. Also, a total seasons variable may not be able to properly capture the experience of players who only play a minimum number of games per season in the NHL and spend most of their time in the minor leagues. Skaters gain little experience when they do not play.

Goaltenders, on the other hand, tend to play few games in their first years in the league. They do a form of apprenticeship with the veteran goalies until they become fit to play on a regular basis. The total number of seasons (TSEASONS) that a goalie plays might be a more appropriate measure of experience when compared to lifetime games played. Due to the nature of the position, they are able to gain valuable experience just working with their goalie teammates.

It is expected that for players of all positions, estimates for the experience variables will be both positive and highly significant. An experience squared variable will also be used to ascertain that experience is rewarded but, less so in a player's senior years. It should increase at a decreasing rate showing a negative experience squared estimate.

¹² Past studies which have made use of the lifetime number of games a player has participated in as a measure of experience, do not include playoff games in their statistic. This would not seem justified, since it is difficult to argue that no experience is gained in post season play.

Player size has always proved to be a factor in professional sports. For pro hockey this is no exception. A measure of height or weight can be used to get an indication of the aggressiveness of a player. Generally, it can be argued that the larger players are superior because they are stronger and less prone to injury. For hockey, weight is probably a better indication of size effectiveness than height, thus a WEIGHT variable will be used in the regression which should prove to be positive.¹³ It is expected to be of greater significance for defencemen than forwards since forwards tend to be smaller, more agile players. A size measure will not be used for goaltenders. A goalie's ability really is not influenced by weight or height. It may be argued that a large netminder may cover more of the net, but he will not enjoy the same quickness of a smaller player. This may also be true for skaters, but not to the same extent.

For skaters, a lifetime penalty minutes per game variable (LPENGAME) will also be included to capture the aggressiveness of a player. Past studies have shown that players who have been more penalized make more robust players, especially at the defence position. It may be an indication of how hard a player is willing to play for his team, which may be rewarded with a higher salary. Although penalties in fact hurt the team by causing short-handed situations, they are a part of the game and the intimidation element may be necessary to win. Regardless, a positive impact on salaries is expected, with a greater degree of significance for defencemen than forwards.

¹³ Although height and weight are both excellent measures of size, they should not be used together in the same model. The problem of multicollinearity arises because generally heavier players are also taller. It is better to use only one of the indicators. In this case, WEIGHT, expressed in lbs, is employed.

Both skaters and goaltenders can gain star status with a high level of play. A dummy variable, TROPHY, will be used for all players. It records the number of individual trophies a player has acquired over the course of his career in the NHL and the number of times he has been named to either the first or second all-star team. A value of one will be given to a player for each trophy he has obtained and each year he has been on the all-star lineup. The best players will be recognized for their outstanding performance, and it is expected the TROPHY indicator to have a strong positive influence on salaries.

The performance indicators will naturally be different for skaters and goaltenders. Traditionally the average number of points per game over a single season or lifetime career were used as a proxy for a skaters on-ice ability. Both indicators were tested in both seasons with only satisfactory results. A new variable is introduced, lifetime points per season (LPTSS), which proves to be a good performance measure and provides us with a better "fit" than our other indicators.¹⁴ There are various factors which could explain why this is so. Each team will recognize their good players and naturally pay them more generous wages. It follows that these players will enjoy more ice time and have more opportunities to score points. As a player becomes increasingly competent over his career, he will have the chance of increasing his points scored per season indicator. Also, the results will be less distorted by those players who do well in scoring their first few seasons but play only a minimum

¹⁴ The Hockey News in Nov, 1991 published an article, "Points versus Paycheck", which lists all 1991/92 players' salaries against the number of points that each player scored (excluding goaltenders) the season before. Although lifetime points per season over their career is not used in the article, this major authority on professional hockey recognizes the importance of points per season. "...it gives perspective to earnings".

number of games. These players will have a relatively low salary but the points per game indicator will be high.

Thirdly, this new variable may also be able to capture an injury element of the game. Good players who do well in the games they do play but are prone to injury and miss many games will have a lower score with this indicator than with the lifetime points per game variable. Obviously a good player who is frequently injured is less of an asset to the team than one who is healthy and consistently playing a full season. It is expected the number of points scored per season to be positive and highly significant for all skaters.

For goaltenders, the lifetime number of goals allowed per game (LAVG) will be used as an indication of performance. Goalies who consistently keep the puck out of the net will have a lower lifetime average and usually enjoy a greater salary, hence, a negative estimate is expected. Lifetime games per season (LGAMEPS) will also be used. Values for this variable will indicate which goaltenders each team feel possess the best ability to prevent goals. A positive estimate is expected.

Finally, the discrimination element in the NHL will be examined. The league will be divided into four groups based on place of birth: Quebec born, non-Quebec Canadian born, American born, and European born. Although there exist some players who may not have grown up where they were born, it is difficult to recognize who these players are. Since it is the best information available, place of birth will be a satisfactory indication of player status. QBORN, ABORN and EBORN will be used as dummy variables which will receive a one if a player was a native of that region and a zero otherwise. Russian hockey players will, of course, be grouped with Europeans. The estimates will indicate which groups are paid more

or less as a whole than English Canadian hockey players, which will be used as the reference group. It is expected that less evidence of discrimination will be found than in past studies. The availability of information makes it much more difficult today to exploit a particular group of players.

Appendix I and II provide a summary of the definitions of the variables employed in the model, as well as the expected effects these variables should have on player salaries. Table I gives a comparison of the average attributes and performance indicators by position for the 1990/91 and 1991/92 seasons.

4.0 Results and Interpretation

The results from the regressions performed on player salaries are presented in Tables II, III and IV. All regressions are presented in semi-logarithmic form and the significance levels are indicated. The R^2 is good for all regressions but seem to be lower for each of the three categories in the second season. A comparison of the two seasons will be later made in order to offer some possible reasons why this is so. First, each position, in both years, will be examined.

4.1 Forwards

The estimations for the draft status of forwards reveal negative coefficients for the draft number variables for each of the seasons in question, which is consistent with one's expectations. The later a forward is chosen in the entry draft, the greater the negative impact on his salary. The estimates appear to be of little significance, which may be explained by the fact that the results are distorted to some extent by those players who are not drafted. These players are given a zero for their draft number which in theory makes them appear to have been drafted before those who were drafted number one. Free agents really do not earn a predominately higher wage when compared to the rest of the forwards so these results are somewhat misleading.¹⁵ This is why the NODRAFT variable must be used simultaneously with the DRAFT variable to obtain a better interpretation of the impact of

¹⁵ It is possible to leave out those players who were not drafted, but as Table I indicates, this represents approximately 15% of forwards, which is too significant to omit.

draft status on salaries. The results show a negative coefficient for both seasons, suggesting that forwards who are drafted generally earn a higher wage than free agents. This evidence confirms that assigning a zero entry for players, who have entered the league on their own, to the DRAFT variable causes this estimate to decrease in absolute terms and reduces its level of significance. The difficulty of properly representing the role the entry draft plays in explaining salaries is exemplified in the results for forwards. Only for the NODRAFT estimate in the 1991/92 season does a draft variable show any significance.

Consistent with results from past studies of professional hockey, the experience ingredient of the model is both positive and highly important at the forward position in each year under investigation. The more experience a player has acquired, the more he can expect to earn. The negative experienced squared estimates indicate that although player experience is positively correlated with salary, it occurs at a decreasing rate with a high degree of certainty.

Player size for forwards does have a positive influence on wages but not to any great extent. The significance level is only good for the 1991/92 season. The positive coefficient suggests there is still some room for intimidation and perhaps, to some degree, those players may be less prone to injury.

The lifetime penalty minutes per game coefficients prove to be positive, which may manifest that aggressive play still has a place in hockey for the forward position. Consistently low levels of significance in both seasons suggests that the intensity of play at which a forward competes, measured by penalty minutes, is certainly an asset to the team

but, it may suggest that high levels of play to be achieved without spending time in the penalty box.

The most convincing results are found in the estimates for lifetime points a player has scored per season in the NHL. It is of particular interest for the forwards since their primary duty is to score points. As predicted it is positively correlated to wages. Similar magnitudes of the coefficients, along with high significance levels in both seasons, indicate the robustness and importance of the new variable introduced.

Players at the forward position who have gained all-star status or received trophies for their outstanding performances are rewarded with higher wages, indicated by positive and high significance levels for the TROPHY coefficients in both years under investigation. This is consistent with results found in all previous studies on professional hockey. Not surprisingly, players who have proved themselves as the foremost performers are the high salary earners.

The results show very little evidence in support of discrimination in the case of forwards in either season. Europeans seem to be the only group whose wage may be less than the rest of the league. The figures are significant for European players, at a 10% confidence level, for the 1991/92 season, and are roughly 12% less than a Canadian born player estimate in both years. This may be the result of the recent migration of Russian born players who have entered the NHL in the last few years. These players are categorized under European born and may have caused a decrease in this estimate. Russians, and to some extent other East European hockey players, are often exploited by NHL teams who take advantage of their lack of experience in negotiating contracts, often resulting in a lower salaries than deserved.

They frequently are content to accept the new extraordinary lifestyle in the western world and settle for a lower pay than their level of play might dictate. Also, in 1991/92 bad economic conditions in Russia induced many to leave at any cost.

Whether there exists discrimination against Russian players is difficult to ascertain. Although many of these players have proved themselves in the World Championships, there are no guarantees that they will perform at the same level of play in a league with an entirely different style of play. Many teams are hesitant to sign large contracts with these "Russian superstars". The evidence in support of discrimination against European forwards is not strong enough, however, to draw any conclusions that it exists with any degree of certainty.

American forwards are shown to have earned more than their English Canadian counterparts, but again with only a small level of significance in one of the seasons, 1991/92. This result may not be particularly credible, but it is interesting to compare these outcomes to regression performed in past studies. Previous work have suggested Americans players are paid less than Canadians players. This trend may have reversed in the last two years. Hockey is becoming more popular in the United States, and American teams are putting a great deal of money into the sport. Considering that in the NHL the ratio of American to Canadian players is greater for American teams and that eleven of the top thirteen highest team average salaries belong to American clubs, it should not be surprising they earn a higher pay.¹⁶

No conclusions can be generated from the estimations for French Canadian forwards.

¹⁶ Fischler, Stan, "Big Spenders", Inside Sports, Annual Sports Salaries Section, Apr 1992, pg.85 .

4.2 Defencemen

The most difficult position to find a good "fit", for both seasons, was at the defencemen position. Of the three groups it has the lowest R^2 . This suggests that it is not easy to determine what attributes or skills make a player a good defenceman. There are simply too many relevant factors which cannot be measured. Many of the statistics available provide a good proxy for the "offensive" side of the position, but there are few that measure defensive play. It is difficult to measure goals prevented by skaters at both positions. A defenceman's ability to clear the puck out of his end of the rink, his reaction to a two-on-one or a three-on-one situation or his proficiency in keeping the front of the net clear of opponents, may all be vital skills to the position but they are next to impossible to measure objectively. The variables used for defencemen particularly reflect the offensive style of play, with the exception of WEIGHT. Therefore, the results may favour the offensive-minded players. Defencemen with late draft numbers earn less than players picked in early rounds. Likewise, free agents as a whole are paid less than drafted players. The draft factor for defencemen shows little significance in the 1991/90 season only, suggesting that the draft plays only a small role in salary determination. The reasoning is much the same as it is for the forwards. This may also indicate that a player's reputation matters.

The experience factor, once again, shows good significance and has the expected positive signs on the lifetime number of games coefficient and negative values for the squared terms. The estimates for defencemen have slightly higher numbers, suggesting experience may be

more important for this position than for forwards.¹⁷ These results are not as trivial as they appear. Higher experience estimates for defencemen illustrate the difficulty in determining the skill of players at this position. Teams are more reluctant to offer large pay cheques to defencemen until they have had time to assess their abilities in NHL play which often requires more time than forwards. The wages of defencemen are generally more dependent on the experience they have gained than are the earnings of the forwards.

Surprising results were found for the size estimates. Although one would expect a defenceman's size to be an important ingredient of a solid player, the level of significance on the WEIGHT variables is weak, but do show a 10% confidence level in the 1990/91 season. Weight is still positively correlated to salary.

Intimidation and aggression has always played a key role in determining an efficient defencemen. The lifetime penalty minutes per game numbers, for both seasons, show this continues to hold true.¹⁸ Penalty minutes possess a positive impact on salaries for defencemen and have moderately higher estimates than for forwards. Defencemen are the last skating line of defense and must be willing to sometimes take a penalty to keep their opponents from scoring situations.

¹⁷ Higher numbers for defencemen may not be so obvious due to the experience squared term. The derivative at the mean at each position for both seasons was also tested and compared which also supports experience is of a greater importance for defencemen than for forwards.

eg. $y = a + b (\text{LGAMES}) + c (\text{LGAMES})^2$

$$dy/d(\text{LGAMES}) = b + 2c (\text{LGAMES}) \quad (\text{at the mean})$$

¹⁸ These were also the findings of Jones and Walsh (1988) and Lavoie and Grenier (1991).

The number of lifetime points per season is not as important for deciding salaries as for the forwards, but do demonstrate good significance levels in both years. This is the best measure of offensive talent a defenceman possesses in the model. Although the primary duty of a defenceman has traditionally been to prevent goals being scored against his team, today there are many more offensive-minded players in the game. Good defencemen who have the ability to successfully take calculated risks in leaving their position to participate in goal scoring are being rewarded with generous salaries. Since the best "offensive" defencemen are put on the ice in power play situations, their chances of scoring are much greater than their teammates who remain on the bench. High lifetime points per season numbers for defencemen usually means fatter pay cheques.

The best indicator of a defenceman's ability on the ice is given by his trophy status. It is the league and top sportscasters who recognize the best defencemen, and they are not necessarily the players who have scored the most points. Players who have won the James Norris Memorial trophy, an annual award that goes to the defense player who demonstrates throughout the season the greatest all-round ability in the position, are the highest paid at that position. The defensive all-stars are also recognized by the league, the media, the players and the fans as top performers. It is not surprising the regressions show the TROPHY variables to have a sizeable, positive influence on salaries in both seasons.

Negative estimates on the Quebec born dummy variable in both seasons suggest French Canadian defencemen may be paid less than their English born counterparts. The significance level of only 10% in one of the seasons, 1991/92, makes it difficult to ascertain to what extent this is valid. This is consistent with past results (Lavoie and Grenier 1988)

which found some evidence of discrimination against French Canadian defencemen.¹⁹ Due to the nature of the position and the difficulty in assessing a player's abilities, it is the most likely place to find discrimination. Low significance levels and a relatively weak R^2 , for both seasons, render the results unreliable. It is best to say there exists no evidence in support of discrimination against Quebec born defencemen. The results indicate American defencemen are paid better than English Canadian defencemen. Again, weak significance levels offer little support to this conclusion. No inference can be made from the numbers shown for European defencemen.

4.3 Goaltenders

Generally speaking, the draft status of goaltenders, whether they sign as free agents or are drafted, has negligible influence on their earnings. For both years the DRAFT coefficients show positive signs, which is unusual. However, since almost one fourth of goalies in the study signed as free agents in both years, these results may be misleading. In any case, the regression indicates the DRAFT and NODRAFT variables have no real statistical significance. As with defencemen, goaltenders must prove themselves capable of their position after they have entered the league, if they are to reach high salary levels. It also would suggest that reputation has only a small effect for this position.

One would expect experience to be an important ingredient of a quality goaltender. However, although the estimates have the desired positive signs, a significance level of 5% is

¹⁹ Grenier and Lavoie (1991) found French Canadian defencemen to be underpaid with some statistical significance. Their conclusions suggest that any discrimination that existed in the past has disappeared. Jones and Walsh (1988) also had similar results.

seen only for the second season. A possible explanation may be that this is the result of the new wave of young goalies who have recently signed unusually large contracts with only a few seasons under their belts.²⁰ A significant number of outliers may have distorted the importance of the EXPERIENCE estimates.

The measure which provides the most satisfactory performance results, at this position, is lifetime games per season. The most proficient goaltenders, on each team, will play more games per season and enjoy higher salaries. This is a good indication of which players each team feels are the best. Goaltenders who have just entered the NHL will not likely see much icetime. They are generally worked into the system until the team has enough confidence in them to let them play a full season.

Consistent with the other positions, outstanding performers recognized by the TROPHY variables, significantly earn higher wages. Similar values for the estimates in both years indicate this is a convincing result. The TROPHY variable for goalies has the highest estimates of all three positions. Acquiring a good trophy status is clearly most important for goaltenders if they are to realize high salaries.

Lifetime average measures how well a goaltender is able to consistently keep the puck out of the net. The results reveal the expected negative signs, but, the statistics suggest that the effects are weak. It is not surprising that lifetime average is not a powerful measure of goalie performance, since it is possible for the best, highest paid goaltenders to play for the

²⁰ Ed Belfour of the Chicago Blackhawks will earn over US \$1,000,000 in the 1991/92 season with only 3 seasons of experience.

weaker teams.²¹ These teams may not be effective in their own end and allow many more shots on goal per game than their opponents. Another explanation is that some teams choose to play an offensive style of hockey, as did the Edmonton Oilers throughout the eighties, in hopes of defeating their opponents in a high scoring shootout. A high lifetime average does not necessarily indicate a marginal player.

Discrimination does not seem to exist at this position. The results show no evidence which might suggest that ethnic origin has any influence on goaltenders' salaries. Although no statistically significant evidence of discrimination exists at the goaltender position, high negative estimates in both seasons demonstrate Quebec born goalies may be underpaid.

²¹ This is the case with Grant Fuhr, who has proved himself as one of the finest goalies in hockey with four Stanley Cups to his name, but now plays for a team that did not make it to the playoffs in 1991, the Toronto Maple Leafs.

Conclusion

The results of the study on the 1990/91 and 1991/92 seasons suggest wage differentials in the NHL can be best explained by variations in labour marginal product. Consistent with all past work on salary determination in professional hockey, this investigation affirms that player performance plays the greatest role in deciding payment. This holds true for both seasons at all positions.

The existence of any discrimination, at any position, cannot be affirmed. At various positions, some ethnic group players are shown to be paid more or less than English Canadian players of equal quality, but most likely wage differentials can be attributed to a host of other factors and should not immediately be dubbed discrimination.

It is important to note that although significant levels of discrimination against any group is not shown by the results, estimates for QBORN players received negative values in five of the six regressions. Given this information, the possibility that Quebec born players are in fact underpaid cannot be ruled out. Similar findings in past studies (Jones and Walsh (1988) and Lavoie and Grenier(1991)) can be used with these findings to confirm Quebec born players do exhibit salary differences. Discrimination against Quebec born hockey players appears to still exist.

European forwards may also be shown to be underpaid, but less certainty. This result may be the outcome of the introduction of East European and Russian players into the league in the last two years. The uncertainty of these players' ability to perform in the NHL is an

acceptable notion. Lower wages for Russians and other East European players can be justified until there is more exposure to their style of play.

It is possible that this was the case in the past with American hockey players whom, it was generally assumed, received lower salaries. The results of this study suggest, if anything, that the trend has reversed. American players have proven themselves proficient in a game where it was thought only Canadians could excel. Today, teams are no longer reluctant to sign large contracts with players whose origin is the United States.

Discrimination against French Canadian hockey players in professional hockey appears to have all but disappeared.

The R^2 and adjusted R^2 statistics are an indication of the amount of players' salary that can be explained by the model. The results show a better "fit" at all positions for the 1990/91 season, suggesting the model is more appropriate for this year, than for 1991/92. There are several possible explanations why this is so. Conceivably, the entire pay structure in the NHL has evolved and is becoming increasingly difficult to narrow salary determination into a sizeable number of factors. Although a trend towards a more complicated system of deciding wages is likely, there is really no way to verify this phenomena with only a two season study.

More likely, the results differ between the years as a consequence of outliers. Twenty players will earn more than one million dollars by the end of the 1991/92 season, almost twice as many as a year before.²² An individual's bargaining position has substantially

²² Wayne, James, "Where' All This NHL Money?", The Financial Post, Oct 17, 1991, pg.43.

increased in the last couple of years as a result of the availability of information regarding the salaries of his competitors. There has also been a new wave of young players signing huge contracts, and it would not be surprising if this were the trend of the future.

The recent "explosion" of pay hikes in the NHL has many enthusiasts wondering who is responsible. In other major sports, significant salary increases for athletes coincide with huge revenue increases, usually in broadcasting.²³ But in the NHL, broadcasting revenues are in fact shrinking. More than often owners and general managers blame the players and make desperate threats about the responsibility of the players to behave reasonably. Some owners blame particular teams for their current spending sprees whose impact are likely to have serious implications. Such is the case with the St. Louis Blues.²⁴ Although the St. Louis Blues may have skewed the salary scale, owners and general managers still could have said no to the players who reacted with demands of wage increases.

Another plausible explanation for the incredible increases in earnings is proposed by Lavoie and Grenier (1991). The salary hike throughout the league may be an attempt to discourage the introduction of rival professional major hockey leagues in Europe and North America which would potentially lure away many talented players from the NHL. If this were the case, it would be in the NHL's best interest to pay the talented players more than they deserve to ensure the league continues to possess the top players in the business.

²³ MacKenzie, Bob, "The Reasons Behind the Boom", The Ottawa Citizen, Nov 1, 1991, c1.
Note: No figures were given.

²⁴ The St. Louis Blues recently signed Brett Hull to a four-year, US\$ 7.1 million deal and followed by acquiring free agent Scott Stevens for one million dollars plus a year.

Throughout the past, the NHL appeared to have a good, tight circle of fiscally responsible people in charge. However their jobs were made easy given the climate of almost full salary secrecy before annual reports regarding wages were disclosed. In any case, it is likely the stars of the game will continue to receive large pay cheques and the lesser known players will further fall behind them. It is quite possible we will see a lot more teams bring in low-priced 20 and 21 year old players to replace the older veterans who receive more money. This has been the trend in professional baseball, in the last few years, and is soon becoming a reality in the NHL.

Models can be developed which try to explain why individual players are paid the salaries they receive and in some ways, attempt to follow the logic of team owners and general managers on their player decisions. Constructing such a model for professional ice hockey can be exceedingly delicate. Sometimes an acceptable explanation as to why a star player gets a million-dollar deal, or an unproven fringe player receives his \$300,000 a year, just does not exist. The tendency is to simply believe the team is just being shrewd and calculating.

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Appendix I

Variable Definitions

SAL	Salary by player for the 1990/91 and 1991/92 seasons, expressed in Canadian dollars.
NODRAFT	Dummy variable equal to one if the player was not drafted in entry draft, zero otherwise.
DRAFT	The actual draft number of a player in the entry draft. Those not drafted receive a zero.
LGAMES	The number of career games played, including playoffs.
SQLGAMES	The square of LGAMES.
WEIGHT	Weight, expressed in inches.
LPENGAME	Career penalty minutes per game, regular season.
LPTSS	Career points per regular season.
TROPHY	Number of NHL trophies plus number of 1st and 2nd NHL All-Star selections.
TSEASONS	The total number of regular seasons played.
SQTSEASONS	The square of TSEASONS.
LGAMEPS	The number of lifetime games per season played.
LAVG	Goaltenders lifetime goals against per game average in regular season play.
QBORN	Dummy variable equal to one if the player was born in Quebec, zero otherwise.
EBORN	Dummy variable equal to one if the player was born in Europe or Russia, zero otherwise.
ABORN	Dummy variable equal to one if the player was born in the United States, zero otherwise.

Sources: SAL: The Ottawa Citizen (1990a) and The Toronto Star (1991). All other variables: The Official Guide and Record Book (1990/91 and 1991/92).

Appendix II

The Models

(i) Forwards and Defencemen

$$\begin{aligned} \ln \text{SAL} = & \beta_0 \\ & + \beta_1 \text{ NODRAFT} \\ & + \beta_2 \text{ DRAFT} \\ & + \beta_3 \text{ LGAMES} \\ & + \beta_4 \text{ SQLGAMES} \\ & + \beta_5 \text{ WEIGHT} \\ & + \beta_6 \text{ LPENGAME} \\ & + \beta_7 \text{ LPTSS} \\ & + \beta_8 \text{ TROPHY} \\ & + \beta_9 \text{ QBORN} \\ & + \beta_{10} \text{ EBORN} \\ & + \beta_{11} \text{ ABORN} \\ & + \epsilon \end{aligned}$$

(ii) Goaltenders

$$\begin{aligned} \ln \text{SAL} = & \alpha_0 \\ & + \alpha_1 \text{ NODRAFT} \\ & + \alpha_2 \text{ DRAFT} \\ & + \alpha_3 \text{ TSEASONS} \\ & + \alpha_4 \text{ SQTSEASONS} \\ & + \alpha_5 \text{ LGAMEPS} \\ & + \alpha_6 \text{ LAVG} \\ & + \alpha_7 \text{ TROPHY} \\ & + \alpha_8 \text{ QBORN} \\ & + \alpha_9 \text{ EBORN} \\ & + \alpha_{10} \text{ ABORN} \\ & + \epsilon \end{aligned}$$

Expected Signs of Estimates

$$\begin{aligned} \beta_1 & < 0 \\ \beta_2 & < 0 \\ \beta_3 & > 0 \\ \beta_4 & < 0 \\ \beta_5 & > 0 \\ \beta_6 & > 0 \\ \beta_7 & > 0 \\ \beta_8 & \langle \rangle 0 \\ \beta_9 & \langle \rangle 0 \\ \beta_{10} & \langle \rangle 0 \\ \beta_{11} & \langle \rangle 0 \end{aligned}$$

$$\begin{aligned} \alpha_1 & < 0 \\ \alpha_2 & < 0 \\ \alpha_3 & > 0 \\ \alpha_4 & < 0 \\ \alpha_5 & > 0 \\ \alpha_6 & < 0 \\ \alpha_7 & > 0 \\ \alpha_8 & \langle \rangle 0 \\ \alpha_9 & \langle \rangle 0 \\ \alpha_{10} & \langle \rangle 0 \end{aligned}$$

Table I

Average attributes and performance indicators by position
Comparison of 1990/91 and 1991/92 seasons

	FORWARDS		DEFENCEMEN		GOALTENDERS	
	1990/91	1991/92	1990/91	1991/92	1990/91	1991/92
# OF PLAYERS	276	301	157	158	42	40
AVG SALARY (CAN \$)	293,811	374,364	263,739	343,391	302,007	334,803
% DRAFTED	84.4	84.7	91.1	91.2	85.7	82.5
%NOT DRAFTED	15.6	15.3	8.9	8.8	14.3	17.5
% QBORN	8.7	11.6	12.1	12.7	11.9	15.0
% ABORN	21.4	17.6	24.2	19.6	14.3	25.0
% EBORN	9.8	10.6	12.7	10.1	2.4	5.0
AVERAGES						
DRAFT #	54.8	56.1	53.3	54.3	60.7	54.6
TSEASONS	5.8	5.8	5.8	6.2	6.0	5.8
WEIGHT (LBS)	192.6	193.3	200.1	200.6	-	-
LPENGAME	1.2	1.3	1.6	1.7	-	-
LPTSS	36.8	35.8	20.9	22.2	-	-
TROPHY	0.34	0.32	0.30	0.33	0.70	0.87
LGAMES	-	-	-	-	31.6	2.8
LAVG	-	-	-	-	0.367	0.362

Table II

Salary regression for forwards
Comparison of 1990/91 and 1991/92 seasons
Dependent variable: log of salary

INDEPENDENT VARIABLE	<u>1990/1991 SEASON</u>		<u>1991/1992 SEASON</u>	
	COEFFICIENT	STANDARD ERROR	COEFFICIENT	STANDARD ERROR
SAMPLE SIZE	276		301	
R SQUARE	0.7137		0.6247	
ADJ R SQUARE	0.7017		0.6105	
INTERCEPT	11.314***	0.209	11.0951***	0.341
NODRAFT	-0.249***	0.0561	-0.209***	0.066
DRAFT	-0.002E-4	0.0003	-0.00057	0.00039
LGAMES	0.0014***	0.0003	0.00151***	0.00029
SQLGAMES	-0.13E-5***	0.285E-6	-0.15E-5***	3.113E-7
WEIGHT	0.0017	0.001	0.0046***	0.0018
LPENGAME	0.0146	0.0179	0.0103	0.0194
LPTSS	0.0127***	0.001	0.0123***	0.0011
TROPHY	0.031***	0.009	0.0478***	0.0111
QBORN	0.064	0.066	-0.024	0.0682
EBORN	-0.111	0.067	-0.126*	0.0757
ABORN	0.033	0.047	0.085	0.0582

Significantly different from zero at the * 10% level, ** 5% level, *** 1% level.

Table III

Salary regressions for defencemen
Comparison of 1990/91 and 1991/92 seasons
Dependent variable: log of salary

	<u>1990/1991 SEASON</u>		<u>1991/1992 SEASON</u>	
SAMPLE SIZE	157		158	
R SQUARE	0.6559		0.5680	
ADJ R SQUARE	0.6297		0.5360	
INDEPENDENT VARIABLE	COEFFICIENT	STANDARD ERROR	COEFFICIENT	STANDARD ERROR
INTERCEPT	10.96***	0.397	12.0267***	0.506
NODRAFT	-0.173	0.091	-0.141	0.0996
DRAFT	-0.0004	0.0005	-0.001*	0.00053
LGAMES	0.0019***	0.0003	0.00186***	0.00016
SQLGAMES	-0.156E-5***	0.308E-6	-0.17E-6***	0.39E-7
WEIGHT	0.0037*	0.0019	0.00078	0.0024
LPENGAMES	0.033**	0.0157	0.0295**	0.0126
LPTSS	0.011***	0.0019	0.0066***	0.00151
TROPHY	0.089***	0.021	0.0556***	0.022
QBORN	-0.075	0.079	-0.153*	0.0851
EBORN	0.129	0.08	0.085	0.0956
ABORN	0.039	0.061	0.1197*	0.072

Significantly different from zero at the * 10% level, ** 5% level, *** 1% level.

Table IV

**Salary regression for goaltenders
Comparison of 1990/91 and 1991/92 seasons
Dependent variable: log of salary**

	<u>1990/1991 SEASON</u>		<u>1991/1992 SEASON</u>	
SAMPLE SIZE	42		40	
R SQUARE	0.823		0.711	
ADJ R SQUARE	0.761		0.61	
INDEPENDENT VARIABLE	COEFFICIENT	STANDARD ERROR	COEFFICIENT	STANDARD ERROR
INTERCEPT	12.129***	0.131	11.443***	0.734
NODRAFT	0.21	0.131	0.27	0.196
DRAFT	0.0012	0.001	0.0016	0.002
TSEASONS	0.066	0.045	0.177**	0.086
SQTSEASONS	-0.0032	0.0029	-0.013**	0.006
LGAMEPS	0.01***	0.003	0.0015**	0.0075
LAVG	-0.001	0.0007	-0.013	0.0017
TROPHY	0.153***	0.0273	0.154***	0.037
QBORN	-0.148	0.125	-0.163	0.177
EBORN	0.209	0.114	0.139	0.333
ABORN	-0.028	0.114	0.096	0.15

Significantly different from zero at the * 10% level, ** 5% level, *** 1% level.