THE ECONOMICS OF THE NATIONAL HOCKEY LEAGUE: EXPANSION, RELOCATION, AND SURVIVAL

by

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ABSTRACT

In 1984 the U.S. courts held that teams, not leagues could determine franchise relocation. Since this time there have been many attempts to introduce legislation in the U.S. Congress to establish the criteria under which professional sports franchises could relocate and the conditions under which leagues could expand. The current criteria regulating team relocation and league expansion are mainly location-dependent; however, existing evidence suggests that economic viability is a function of both locational and game attributes.

The object of this thesis is to model team demand for one league sport, the National Hockey League, and use it to estimate the relative importance of location specific and team specific attributes and to determine their effect on economic viability. Also, the object is to ascertain the economic viability of expansion locations for the National Hockey League.

The short and long run team demands are modelled to determine the relative importance of location and team specific attributes for attendance revenue generated at existing and potential locations, with particular emphasis on Canadian and American differences. Teams are treated as local monopolists and demand is determined by a two equation model in which price and attendance are endogenous, and location specific and game specific attributes are exogenous. Then, profits and viability in existing and potential locations are determined by adding estimated revenue from other sources (playoffs, media) to the estimated attendance revenue and subtracting estimated costs.

The model finds that both location specific and game specific attributes influence economic viability. In particular, the locational factors of population, income, age of the team, and country significantly influence economic viability, as do game specific attributes of quality and time of play, and the importance of the game. Based on these results, the profitability of potential locations reveals that only three viable expansion cities exist for the National Hockey League: Ottawa, Tampa Bay, and Houston.

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CHAPTER ONE: SCOPE AND METHOD

1.1 Introduction and Overview

Since the Oakland Raiders decision in 1984 ushered in virtual "franchise free agency"[1], there have been repeated attempts to introduce legislation in the U.S. Congress to establish the criteria under which professional sports franchises could relocate and the conditions under which leagues should expand. The criteria under which professional sports franchises can relocate are largely location specific (population, income, local facilities, etc.). The assumption seems to be that economic viability is merely a matter of selecting the appropriate location.

1

Prior to Los Angeles Memorial Coliseum Commission v. National Football League (1984) (hereafter referred to as Raiders), the U.S. courts had held that all leagues represented a single entity of integrated parties not capable of the "combined" action necessary for a Section 1 Sherman Act offence. Thus, leagues, not teams could determine franchise relocation. See, for example, San Francisco Seals, Ltd. v. National Hockey League (1974). In Raiders, however, the courts held that a league consisted of "distinct and competing entities" so that the Sherman Act applied and teams, not leagues, could determine when and to where they moved. This was effectively underlined by a finding for damages against the NHL of over $49 million. Examples of post Raiders relocations by teams are Baltimore Colts to Indianapolis in 1984 (NFL) and Clippers to Los Angeles in 1987 (NBA). Under the Canadian antitrust laws - The Competition Act (formerly the Combines Act) - "franchises arrangements clearly are exempt from the restraint of competition offenses" (Barnes, 1988: p.115). This was underlined when the St. Louis Blues - Saskatoon affair (see Section 1.3) was handled under the monopoly section of the Combines Act not the specific sports sections.

However, existing evidence suggests that economic viability (at least on the revenue side) is a function not only of locational attributes but also of team-specific attributes (win-loss record, playing style, etc.)[2] and the appeal of the particular sport[3]. Therefore, to focus solely on locational attributes as predictors of franchise revenue could be seriously misleading. Hence, a policy geared only to locational attributes stands a good chance of being ineffectual at best and self defeating at worst.

Accordingly, the object of this thesis is to model team demand for one league sport, the National Hockey League, and use it to estimate the relative importance of location specific and team specific attributes for the generation of team revenue. These estimates, coupled with data on costs, will allow us to determine profitability and, thus, economic viability for teams in actual and potential franchise locations. This, in turn, should shed some light on franchise relocation and league expansion.

---

2 For a complete list of examples and the importance of locational and team specific attributes see Chapter 3.

3 For a list of examples of the appeal of various sports see Chapter 3, Section 3.1.1.

1.2 League and Team Viability: An Overview of the Issues

In North America over the last 40 years, the historical record - summarized in Table 1 - shows that the present structure (as of 1990) of professional major league team sport (baseball, basketball, football and hockey) is the result of three influences. One, existing leagues have absorbed teams (all, some, or none) from competing leagues when the latter became non-viable and left. Two, existing leagues have expanded by adding new franchises. Three, teams in existing leagues have left specific locations and have been resurrected in other locations[4]. The result is that each league has a monopoly of the sport, and each league team has a monopoly in a defined spatial area.

The common absorption, expansion, relocation pattern has given rise to a series of questions concerning the viability of leagues and their constituent teams, and the appropriateness of public policy initiatives supposedly designed to ensure viability and survival. Among the questions most frequently raised are: what makes some leagues viable and others not; what determines the number of

---

4 For more detail see Johnson (1983).

teams absorbed from a non-viable league; why do leagues expand to one city rather than another; do expansions exhaust the set of viable locations; and why do teams survive in particular locations but not in others?

1.2.1 Viability: The Influence of Team and Locational Attributes

The standard economic explanation for viability and survival revolves around the effects of the "uncertainty of game outcome" on revenue and profits. Briefly, the argument is that "competitive equality" among teams (supposedly ensured by league-wide labour market restrictions, drafts, reserve clauses, roster limits, etc.) produces maximum "uncertainty of game outcome" which is the prime determinant of attendance, revenue and, given costs, profits[9]. However, the gradual elimination of many league-wide rules, the lack of statistical support for the rules-uncertainty-revenue progression[10], and the fact that most professional teams and leagues seem to survive despite persistent

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9 For an introductory discussion of "team-owner motivation" and its influence on the "uncertainty of game outcome" see Appendix A.

10 See Chapter 3, Section 3.2.2, for a further discussion and examples of this topic.

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Table 1

The Structure of Professional Team Sport in North America, 1950-1990: Absorption, Expansion, Relocation and Spacial Monopoly				
	Baseball Major Leagues	Basket-ball N.B.A.	Football N.F.L.	Hockey N.H.L.
1950 # of Teams (Cities)	16 (10)	18 (18)	13 (11)	6 (6)
1990 # of Teams (Cities)	26 (24)	27 (26)	28 (26)	21 (20)
# of Teams Absorbed from Rival Leagues		4[5]	10[6]	4[7]
# of Teams Added by Expansion	10	15	6	12
# of Team Reloca-tions	11	16	14	5[8]

5

Absorbed from the American Basketball Association (1968-1977) in 1976/77.

6

Absorbed from the American Football League (1960-1969) in 1966. Two NFL teams joined the AFL after the merger in 1966. The NFL and AFL played separate schedules until 1970.

7

Absorbed from the World Hockey Association (1972-1979) in 1979/80.

8

This includes the merger of Cleveland and Minnesota in Minnesota.

competitive inequality[11], has shifted emphasis to other team specific attributes (such as league standing) and in particular to location specific attributes (including population and general economic conditions).

The former are important because maximum outcome uncertainty will rarely be achieved and, therefore, has to be supplemented by other team specific "compensatory demand increasing variables" (Jones, 1984). The basic reason for the failure to achieve maximum outcome uncertainty is that the labour market restrictions are designed to extract economic rents, they are not designed to produce competitive equality (Jones and Davies, 1978).

The latter are important because different locations have different attributes and thus different revenue and profit potential (Quirk and El Hodiri, 1974; Jones and Ferguson, 1988). However, whether team specific attributes are more important than location attributes or vice versa, or, indeed, whether they are interrelated, is a statistical matter and can only be resolved empirically for each given sport.

11
See Daymont (1975), Noll (1974: p.415; 1988; p.17-27), Jones and Davies (1978).

1.2.2 Viability: Attributes and Public Policy

As far as public policy towards team and league survival is concerned, historically, two directions have been taken. "Competitive equality" was assumed to be the key to league survival with the rationale running along the following lines: if the labour market was free, "rich" teams (presumably rich because of the greater revenue potential of their locations) would outbid "poor" teams for the best players so destroying competitive equality and the "poor" teams in the process (Jones and Davis, 1974). Viability - in this case defined as the largest possible number of teams - demanded anti-competitive constraints.

The second approach is more recent and has focused on locational attributes. Recent efforts have been made to legislate the criteria and conditions under which a league could expand, the location of the expansion franchises, and the terms under which existing franchises might relocate. The legislation was supposed to resolve the expansion and relocation problems, both of which stem largely from the monopoly control that leagues have over the number of franchises[12].

12

See York (1985) for a useful summary of the attempted legislation from 1982 to 1985 in the U.S. Congress to establish the criteria under which professional sports (continued...)

From an analytical point of view, if primarily "losing" teams relocate - that is, teams with a losing record - as is sometimes argued[13], then the significance of team attributes cannot be ignored in any consideration of the determination of franchise revenue. To focus solely on location specific attributes can create an incorrect impression of the revenue generating abilities of various locations. Given the sport, team specific and locational specific attributes are both necessary to calculate revenue, and revenue is crucial for calculating profits, the ultimate determinant of franchise viability.

To summarize, when considering the economic viability of professional sports leagues and teams, profitability is obviously decisive. This, in turn, means that revenue is important and in considering revenue both team specific and location specific attributes are significant.

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[12](...continued)
franchises can relocate and the conditions under which leagues should expand.

[13]
Quirk (1973) has argued that it is primarily "losing" teams that relocate with some obvious exceptions - the Dodgers shift to Los Angeles, the Giants shift to San Francisco in 1957 and the Raiders shift to Los Angeles - this is certainly true for virtually all relocations in the NBA and the NHL. Quirk and El Hodiri (1974) have argued that the better locations end up with the better teams so that performance (a team attribute) is positively related to the better locations; Jones and Ferguson (1988) find support for this hypothesis (see Chapter 2, Section 2.2; also Chapter 5, Section 5.3).

1.3 Viability and the National Hockey League: The Thesis Outline

Given the foregoing, the purpose of this thesis is two-fold: (i) to model team demand so as to derive revenue which, in conjunction with costs, determines profits and, ultimately, team viability in existing and potential locations; and (ii), to estimate the model for one sport, the National Hockey League ("NHL").

1.3.1 The Model

Following Jones and Ferguson (1988), the intent is to model short run and long run team demand in such a way as to determine the relative importance of location and team specific attributes for attendance revenue generated at existing and potential locations, with particular emphasis on Canadian and American differences. Teams are treated as local monopolists and demand is determined by a two equation model in which price and attendance are endogenous. Then, profit and viability in existing and potential locations is determined by adding estimated revenue from other sources (playoffs, media) to the estimated attendance revenue and subtracting estimated costs. This makes it possible to

address some of the issues in Section 1.2 above, namely: why do leagues expand to one city rather than another; do expansions and absorptions exhaust the set of viable locations; why do teams survive in particular locations but not in others; and what team qualities are necessary for survival at any given location?

Chapter 2 will outline the theoretical short run and long run models and introduce their quantitative content. Chapter 3 presents a detailed review of the rationale for the empirical content of the models.

1.3.2 The National Hockey League

The models are to be estimated for one league, the National Hockey League. The data are derived from multi-game and annual observations for three seasons, 1981 to 1984. The data consist of single observations of location specific attributes (population, income, etc.) for each season and multiple game observations (80 games per season for all 21 teams) proxying team specific attributes (team performance, outcome uncertainty etc.).

From the point of view of relevance and data availability the NHL is an appropriate vehicle in which to

analyze the importance of location and team specific attributes for team viability. As indicated in Table 2, the NHL is fairly representative of the absorption, expansion,

Table 2

The History of the National Hockey League, 1950-1990: Expansion, Relocation, and Absorption.				
Location 1950	Locations Added by Expansion	Reloca-tions	Teams Absorbed from Rival League	Location 1990
Boston Chicago Detroit Montreal New York (Rangers) Toronto	1967/68 California (Oakland) Los-Angeles Minnesota Philadel-phia Pittsburgh St.Louis 1970/71 Buffalo Vancouver 1972/73 Atlanta New York (Islders) 1974/75 Washington Kansas-City	to Cleveland (1976) merged with Minnesota (1978) to Calgary (1980) to Denver (1976) to New Jersey (1982)	1979/80 Edmonton Hartford Quebec	Boston Buffalo Calgary Chicago Detroit Edmonton Hartford Los-Angeles Minnesota Montreal New Jersey New York (Islders) New York (Rangers) Philadel-phia Pittsburgh Quebec St.Louis Toronto Vancouver Washington Winnipeg

relocation and monopoly pattern of major league North American team sport. Over the last 40 years NHL franchises have been relatively stable. Although the decade of the 1970s was a time of intense competition from the WHA, which ultimately resulted in the absorbtion of three teams, all NHL relocations have been due to three teams.

As far as the time period and data are concerned, 1981 to 1984 represented a Hobson's choice because the price data crucial to estimating the models were only available for these years. However, the three year time frame retains the advantages associated with the earlier study by Jones and Ferguson (1988) and allows some extensions.

First, the basic advantage of using the NHL is that, since the League does not have a national U.S. television contract and its teams do not share gate receipts, this simplifies matters and clarifies the effects of locational attributes on revenue. Second, the data covering three seasons is more extensive and complete than that used in the earlier study (Jones and Ferguson, 1988). The time span smooths out any aberrations which might crop up in data covering one season. In addition, all 21 teams are included in the present analysis (versus 16 of 18 in the original study) and the overall quality of the data, particularly the price variable, is higher.

Third, it allows us to compare the short run predictions for the survival of specific teams made in the first study (Jones and Ferguson, 1988) with what has actually transpired. An important conclusion of that study was that Canadian locations were, in economic terms, preferred to U.S. locations. This was based largely on the statistical importance of the variable representing Canadian locations which, in turn, was based on the three largest Canadian cities. Since the 1979 absorption encompassed smaller Canadian cities, is a Canadian location equally as effective as a revenue generating device? This is of some significance because, in the latest round of prospective expansion sites, Hamilton, Ottawa, and Saskatoon are aggressively promoting their suitability. The NHL, however, seems to favour American cities. Since the entrance of Edmonton, Hartford, Quebec City, and Winnipeg correspond with the predictions of the earlier models, have conditions changed? Is this, for example, because of the perceived importance of non-attendance revenue in particular "Pay T.V." or a national network contract?

The results of estimating the short-run and long-run models will be detailed in Chapter 4. The implications for existing and potential franchise sites will be evaluated in Chapter 5.

CHAPTER TWO - THE MODEL

2.1 Location, Price, and Attendance: Short Run

The model used here to analyze the relationship between price, attendance, and location was developed by Jones and Ferguson (1988). It forms a two-equation simultaneous system that uses the Zellner (1962) procedure in its estimation. The model allows the importance of the locational attributes and team attributes to be determined. This, in turn, allows the examination of the viability of the league in terms of its team locations and league expansion, as well as the appropriateness of public policy specification of criteria to guide relocations and expansions.

The basic assumption made by this model is that the demand for attendance is a linear function of the price charged by the home team. Additionally, the slope and intercept of the demand curve are assumed to be dependant on the locational attributes of the home franchise and the attributes of the teams as measured by the various game attributes. Formally, the demand function is stated as:

$$A_{gt} = C_{gt} \ (a_t - b_t p_t) \qquad (1)$$

where

g	denotes the game,
t	represents the home franchise,
A_{gt}	is the attendance[1] at the g^{th} game for team t,
p_t	is the attendance price[2] charged by team t,
C_{gt}	is a parameter that depends on the attributes of the teams playing in game g,
a_t, b_t	are parameters that depend on the locational attributes of the home franchise.

Jones and Ferguson claim that although the particular form chosen to represent the demand function was chosen for its "tractability", it also has some "intrinsic appeal" allowing consideration of how some team and locational attributes affect demand. The breakdown of equation (1) shows that ($a_t - b_t p_t$) may be interpreted as the underlying demand a particular city may have since it depends on locational factors of the home franchise. The term C_{gt} reflects such quality-of-play factors as team standings, proximity to the play-offs, the number of "superstars", etc.

It is assumed that all teams are profit maximizers[3],

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1 Actual game attendance (Source: *Victoria Daily Times*, 1981, 1982, 1983, 1984).

2 Average ticket prices per team are reported in 1983 American dollars (Source: 1983 prices from Strachen (1983); 1981 and 1982 prices from Jones). The annual CPI was used for each city to convert to 1983 dollars.

3 The discussion in Appendix A outlines the practicality of this

(continued...)

and that the marginal cost of selling one more seat is zero (i.e. all of the costs associated with attendance are fixed). Therefore, the profit maximizing price is simply the revenue maximizing price. Attendance revenue is obtained by summing the attendance at each game g for each team t and multiplying this by the average ticket price.

$$R_t = p_t \ (\Sigma_g A_{gt}) \tag{2}$$

Substituting equation (1) into equation (2) and maximizing revenue with respect to price gives us:

$$R_t = p_t \ \Sigma_g \ (C_{gt}a_t - C_{gt}b_t p_t)$$

$$\frac{dR_t}{dp_t} = \Sigma_g C_{gt}a_t - 2\Sigma_g C_{gt}b_t p_t^* = 0$$

$$p_t^* = 1/2 \ (a_t/b_t) \tag{3}$$

Substituting this profit-maximizing price from equation (3) into equation (1) yields the attendance equation:

$$A_{gt}^* = \Sigma_g C_{gt} \ (a_t/2). \tag{4}$$

Equations (3) and (4) together outline the model as it depends on team and locational attributes. Now,

---

[3](...continued)
assumption. See Ferguson et.al. (forthcoming, 1991) for further evidence to support this assumption.

substituting the profit-maximizing price from equation (3) into equation (2) we also obtain the revenue function for the teams given their existing location,

$$R_t^* = 1/4 \ (a_t^2/b_t) \ (\sum_g C_{gt}). \qquad (5)$$

This equation allows us to examine the revenue-generating potential that each North American city holds with consideration to supporting a hockey team. To illustrate, notice that equation (5) can be separated into two parts: (a_t^2/b_t) which reflects the effects of locational attributes' influences on revenue, and (ΣC_{gt}) which is dependent on the game attributes and fully independent of any locational considerations. Hence, the movement of any team from one city to another will have no effect on the second term in equation (5), only on the first term. With this in mind, the revenue generated by team t in an alternate city Ω is defined as,

$$R_{t\Omega}^* = 1/4 \ (a_\Omega^2/b_\Omega) \ (\sum_g C_{gt}) \qquad (6)$$

where $R_t^* = R_{tt}^*$ by construction.

For convenience Jones and Ferguson define:

$$H_\Omega = 1/4 \ (a_\Omega^2/b_\Omega)$$

$$Q_t = \sum_g C_{gt}$$

so equation (6) becomes

$$R_{t\Omega}^{*} = H_{\Omega}Q_{t}.$$

They refer to H_t as the "locational quality" of a franchise since it represents the combined revenue influence of a location on market power in equation (3) and on attendance in equation (4). The size of H_t for each location will reflect its revenue-generating potential relative to other North American locations. Q_t represents the "team quality" of team t since variations in Q_t depend on both the characteristics of the home and visiting teams, but the interlocking schedule will allow changes in Q_t to be primarily reflective of the home team's characteristics.

It is assumed that a_t, b_t, and C_{gt} are log linear functions of the location and game attributes[4]. Hence,

$$\log(a_t) = \alpha_0 + \alpha_1 CAN + \alpha_2 HNYMN + \alpha_3 LPOP + \alpha_4 LINC \qquad (7)$$

$$\log(b_t) = \beta_0 + \beta_1 CAN + \beta_2 HNYMN + \beta_3 LPOP + \beta_4 LINC \qquad (8)$$

$$\log(C_{gt}) = \gamma_0 + \gamma_1 LHTRL + \gamma_2 LVTRL + \gamma_3 UT3 + \gamma_4 UT3B3 + \gamma_5 PLD4Q + \gamma_6 STFF + \gamma_7 STFS + \gamma_8 STSS + \gamma_9 LSTAR + \gamma_{10} DAY \qquad (9)$$

where the prefix L denotes a logarithm and the variable

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4 For a discussion of the rationale for the inclusion of these particular variables see Chapter 3.

definitions are as outlined below.

(a) The Locational Attributes:

CAN — a dummy variable with a value of 1 if the game is played in Canada,

HNYMN — a dummy variable with a value of 1 if the home team franchise is less than six years old,

POP — the city's population[5],

INC — the city's *per capita* income[6];

(b) The Game Attributes:

HTRL — the home team's league ranking prior to the match (Source: *Victoria Daily Times*, 1981, 1982, 1983, 1984),

VTRL — the visiting team's league ranking prior to the match (Source: *Ibid.*),

UT3 — a dummy variable with a value of 1 if both teams playing are ranked in the top three teams (Source: *Ibid.*),

UT3B3 — a dummy variable with a value of 1 if one of the teams playing is ranked in the top three and the other in the bottom three (Source: *Ibid.*),

PLD4Q — a dummy variable based on the divisional point spread of teams in the fourth quarter (Source: *Ibid.*),

STFF — a dummy variable with a value of 1 if both

5

Population for U.S. Standard Metropolitan Area (Source: *Statistical Abstract of the United States*, 1981, 1982, 1983, 1984). Population for Canadian cities. (Source: *Census of Canada*, 1986).

6

Income for U.S. cities, *per capita* personal income for Standard Metropolitan Area (U.S. Department of Commerce, 1985: pp.43-44). Income for Canadian cities, *per capita* money income before tax (Source: *Statistics Canada, Income Estimates for Sub-Provincial Areas*, 1983).

teams have a fighting style of play based on the previous season's penalty minutes[7],

STSS — a dummy variable with a value of 1 if both teams have a skating style of play,

STSF — a dummy variable with a value of 1 if one team has a fighting style and one a skating style of play,

STAR — a measure of the number of "superstars" in any given game[8],

DAY — a dummy variable with a value of 1 if the game is played on a weekend (Source: *Victoria Daily Times*, 1981, 1982, 1983, 1984).

Substituting equations (7), (8), and (9) into equations (3) and (4) yields the following:

$$\begin{aligned} \log A_{gt} = {} & (\log(1/2) + \alpha_0 + \gamma_0) + \alpha_1 CAN + \alpha_2 HNYMN + \alpha_3 LPOP \\ & + \alpha_4 LINC + \gamma_1 LHTRL + \gamma_2 LVTRL + \gamma_3 UT3 + \gamma_4 UT3B3 \\ & + \gamma_5 PLD4Q + \gamma_6 STFF + \gamma_7 STSF + \gamma_8 STSS + \gamma_9 LSTAR \\ & + \gamma_{10} DAY \end{aligned} \qquad (10)$$

7

Style of play is defined as follows:
If the team's previous season's penalty minutes (Sources: *1981-1982 Official National Hockey League Record Book*, 1981; *1982-1983 Official National Hockey League Record Book*, 1982; *1983-84 Official Guide*, 1983) were greater than 1/2 standard deviation above the mean, the team is defined as a "fighting team"; if the team's previous season's penalty minutes were greater than 1/2 standard deviation below the mean, the team is defined as a "skating" team.

8

Total number of superstars in a game (Source: qualitative assessment).

$$\log p_t = (\log(1/2) + \alpha_0 - \beta_0) + (\alpha_1 - \beta_1)\text{CAN} + (\alpha_2 - \beta_2)\text{HNYMN} + (\alpha_3 - \beta_3)\text{LPOP} + (\alpha_4 - \beta_4)\text{LINC} \quad (11)$$

These equations form a simultaneous system that is estimated using the Zellner (1962) procedure.

The economics literature and an understanding of hockey allow us to predict the signs of specific variables. In terms of equation (10) these values can be interpreted as the variable's effect on demand, a positive (negative) value indicates that increases in that variable increase (decrease) demand. The variables with coefficients α_1 through α_4 represent locational attributes; α_1 and α_3 are expected to be positive (α_1, $\alpha_3 > 0$), the sign on α_2 is ambiguous (but may be hypothesised to be positive, reflecting the "honeymoon effect": the novelty has not worn off) as is the sign on α_4 because hockey may be either a normal or inferior good (α_2, $\alpha_4 \leq (\geq) 0$).

The following results are anticipated. Spectators are expected to prefer winning teams ($\gamma_1 < 0$, $\gamma_2 < 0$) and games with the largest number of "superstars" ($\gamma_9 > 0$). They are also expected to show preference for a high degree of uncertainty in the game's outcome ($\gamma_3 > 0$, $\gamma_4 < 0$), games that involve more violence ($\gamma_6 > 0$, $\gamma_7 > 0$, $\gamma_8 < 0$), games that are played closer to the playoffs ($\gamma_5 > 0$), and games

that are held on the weekend ($\gamma_{10} > 0$).

The estimating of the price equation (11) demonstrates the inverse effect the locational variables have on the elasticity of demand. From equation (1) the elasticity of demand is derived as,

$$E_t = p_t \; / \; (a_t/b_t - p_t) \tag{12}$$

so it follows that if ($\alpha_i - \beta_i > 0$) then the change in a_t > the change in b_t and an increase in the i^{th} locational variable will result in an increase in (a_t/b_t) and a decrease in the elasticity of demand. And if ($\alpha_i - \beta_i < 0$) then $a_t < b_t$ and an increase in the i^{th} locational variable will result in a decrease in (a_t/b_t) and an increase in the elasticity of demand. Here the expected signs are ($\alpha_1 - \beta_1$) > 0, ($\alpha_2 - \beta_2$) $\leq$ ($\geq$) 0, ($\alpha_3 - \beta_3$) > 0, and ($\alpha_4 - \beta_4$) $\leq$ ($\geq$) 0.

All of the structural coefficients in equations (7), (8), and (9) can be identified from the calculated coefficients of equations (10) and (11). However, there is one exception. One degree of freedom remains in the estimation of α_0, β_0, and γ_0. The choice of α_0, β_0, and γ_0 acts to scale both H_t and Q_t. This scaling does not affect any of the extracted results since revenue is obtained directly from the product of the antilogs of the dependent

variable in equations (10) and (11), and this scaling has no effect on the ranking of either H_t or Q_t.

2.2 Location, Price, and Attendance: Long Run

In 1974 Quirk and El Hodiri concluded that the greater the revenue-generating ability of a team's location, the greater will be its long-run stock of player skills. A proper test of this would require data spanning many seasons[9]. The approach taken in this study is to examine the relationship between locational quality and team quality making the assumption that deviations from long-run team quality are random in any one season, allowing the estimation of[10]

$$Q_t^L = \zeta_0 + \zeta_1 H_t. \qquad (13)$$

By substituting equation (13) into (6) the long-run revenue of a team in location t will be

$$R_t^L = \zeta_0 H_t + \zeta_1 H_t^2. \qquad (14)$$

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9 This task introduces new complications including limited resources and a league that has witnessed many franchise shifts and expansions.

10 The effects of a location on a team will require a few seasons to be completely established; therefore, the 3 years of this study allow for this break-in period with the exception of the New Jersey Devils who moved from Colorado following the 1982-83 season. New Jersey is therefore omitted from the estimation.

CHAPTER THREE - LEAGUE DEMAND

Studies on the direct consumption of sport are naturally classified into three categories according to the role of the demand estimates. First there are the studies that concern themselves with only one specific determinant of demand, second there are those which use the estimations primarily as an input, and finally there are studies which centre on estimating the demand function itself.

Examples of studies in the first group are comparisons of attendance without the use of discount pricing policy (Heilmann and Wendling, 1976) and a study by Canes (1974) relating attendance to league position. The obvious problem with studies of this kind is that implicit ceteris paribus assumptions exist without any attempt to explicitly account for them. This results in misleading relationships.

Studies of the second sort include work on monopsonistic exploitation and discrimination. Hunt and Lewis (1976) estimate equations for both home and away attendance in an attempt to find a relationship between revenue and dominance.

The number of studies estimating the demand function

for particular sporting events is the largest of the three. They include studies of all five major league sports, and cricket. Cairns et.al. (1985: p.16) supply an extensive list of such studies.

Three factors influence attendance. The first is the operational motives of the owner, and Jones (1985) conveniently breaks down the direct consumption attributes into the two remaining categories: game attributes and locational attributes. The owner determines the direct revenue structure as well as the indirect revenue structures, and has influence on league-wide rules that will impact overall league revenues[1]. Game attributes are factors that account for varying game attendance; these include the teams playing, the time of play, etc. Locational attributes vary seasonally and account for factors that influence demand specific to each city. The attributes in each category are many and vary across sports (Kenyon,1966). These features will now be discussed in detail.

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Discussion of this topic is restricted to Appendix A in order to maintain continuity.

3.1 Locational Attributes

3.1.1 Variables Relevant to this Study

City population and per capita income are the most frequently tested variables in empirical work of this nature. A number of others exist and have been used with varying degrees of success. The following is a discussion of the variables used in this study, their efficacy, and the reasons for such outcomes, as well as a list of variables omitted from this study and the reasons for this action.

(a) Region

Regions may be more supportive of a particular sport due to its ethnic and cultural composition (Redmond, 1978). Kelly (1970) found that attendance at winter sport events is positively related to social class background. Studies by Bloss (1970) and Buhrmann and Jarvis (1971) find a positive relationship between those who participate(d) in a sport and spectators of that sport; Redmond (1978) and DuWors (1972) feel this participation is fuelled by the need to be ethnically accepted. Facts for such hypotheses have come to light. Jones (1984, 1985), Jones and Ferguson (1988), and Noll (1974c) find that Canadian cities have substantially

higher attendance rates than similar American cities for professional hockey games. Redmond (1978) claims such results arise because hockey is a Canadian sport and that Canada is populated heavily with ethnic groups from other cultures trying to become "Canadian". Therefore, the model is expected to reflect this with a positive sign on the Canadian dummy.

(b) Population

There is general agreement that the attendance at sporting events is positively related to the population of the city. This statement is supported by every empirical study using a measure of market size, and only two exist that have not used a direct measure of market size (the studies by Bird (1982), and Drever and McDonald (1981)). Market size proxies are usually a record of the population of the city host to the team. Hart et. al. (1975) and Jennett (1984) extend the market to include people from the visiting team's city. They feel that supporters travel with their team; this is an element of importance only considerable in the U.K. because of the small travelling distances. The expected sign on the population variable is therefore positive.

(c) Income

Income measures are found in most studies, with varying results. Bird (1982) found soccer to be an inferior good, Noll (1974c) found that in football and ice-hockey the estimation of an income variable was insignificant, while baseball and basketball were significantly negative and positive, respectively. Jones (1985) and Jones and Ferguson (1988) found per capita income to be significantly negative in cross-sectional studies of ice-hockey, but insignificant in a time-series study of ice-hockey (Jones, 1984). Demmert (1973), Siegfried and Eisenberg (1980), and Scofield (1983) did not find per capita income to have a significant impact on the attendance variable. However, these inconsistencies across studies are expected. Cross- sectional studies do not explicitly account for differences in the cities' industry structure, region, average education, etc., rather, these factors are reflected in the cities' per capita income measure. Time-series studies eliminate this problem, but a gradually changing real income level cannot fully capture attendance changes because over the years the sport may gain or lose favour with the spectators, and this will partially be reflected in an income measure.

The negative relationship Jones (1984) found between

attendance and income is hypothesised to indicate that hockey is a "working class spectator sport" (p.60) or that the sign "merely reflects non-sport substitutes" (p.62). Voigt (1971) claims that lower-income people may attend sports events because "it helps to validate one's social worth in a society that demands ceaseless validation of one's status claims by means of elegant consumership [and] ... the game fosters surrogate kinship experiences" (p.27). Boyle (1963) states that direct consumption of sport provides mutual accessibility to anonymous members of the mass society. This leads to ambiguous expectations regarding the sign on the income variable.

(d) Price

The final locational attribute used in this study is price. Fundamental concepts in economics require the price elasticity to be negative. Problems with this expectation arise when one considers how the price elasticity is estimated. Cross-section studies measure varying prices across cities, and higher prices in one city may lead to higher attendance figures than that of a city with lower prices. The measure of price elasticity may be unreliable for the same reasons (noted above) as the measure of the income elasticity. Time series analysis eliminates this problem. However, the influences of price may be masked

with other unaccountable factors.

Another problem arises with the measurement of a price variable since there are different priced seats and differing rates based on age. Both Demmert (1973) and Noll (1974c) use an average price series based on the prices of available tickets rather than on tickets actually sold. This available price series is generated by forming a set of weights, each a percentage of the total capacity for the different parts of the stadium. Demmert favours average revenue per attender but claims unavailability of data is a factor that does not permit its use. Siegfried and Eisenberg (1980) regress actual average price on the average price of available capacity finding a relatively weak relationship for a sample of minor league baseball clubs. They feel that total gate receipts over total attendance should be used in cases where price discrimination is a factor. Studies by Jennett (1984) and Bird (1982) use a retail price index to deflate adult average prices to calculate a price series.

Further problems exist with non-payer attendance being included in total attendance measures. Ideally, studies should be run separating season-ticket holders from the rest of those attending a game. Schofield (1983) does make a rare attempt at differentiating between the two by including

prices of both single match seating and season-ticket prices. The cause for such a rarity is the lack of data availability.

Lastly, many authors feel that a ticket price misrepresents the price of seeing a sporting event. The travel and complement costs are often cited as ignored costs by researchers. Therefore, any price elasticity calculated is an underestimate of the true elasticity of demand. Bird (1982) is the only one to account for this by including a price series for the cost of travel.

For the record, only three of the studies find that price is negatively significant. This reflects the previously stated problems. In the model used here we include price defined only as a dependent variable, and therefore no conclusions can be drawn regarding its sign.

3.1.2 Omitted Locational Variables

Remaining locational attributes found in other studies have been found to be decidedly inappropriate for use here. Among these variables the following were felt to add little to the model's explanatory power: the number of professional teams per city (Jones, 1984; Hill et.al., 1982;

Noll, 1974(c)), the age of the stadium (Hill, 1982) and the stadium's location (Lowe and Harrold, 1972).

The capacity of the stadium (Jones, 1984, 1985; Noll, 1974(c); El Hodiri and Quirk, 1975) is omitted from this study because measures of capacity explain a substantial proportion of the variation in attendance due to the frequency of game "sell-outs"[2]. This only indicates that excess demand exists at the present price levels.

Additional variables omitted from this study include the average climate (Noll, 1974c) since it is highly correlated with the "Canadian" dummy variable used in the model. A measure of unemployment (Jennett, 1984) is expected to fluctuate little, and a measure of income would incorporate the level of employment. Demographic factors such as age and sex mix (Kenyon, 1966; Nielson, 1971), and marital status (McPherson, 1972) have anticipated insignificant results. The season of play (McPherson, 1972) is omitted because sports are seasonally rigid.

This concludes the list of locational attributes that have been used in empirical work of this type. The task of

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2

In the 1983/84 season about 40 percent of the regular season games "sold-out". See Ferguson et.al. (forthcoming March, 1991) for a discussion of the capacity problem.

statistically reproducing the real world has lead to this extensive list of variables impacting the attendance numbers at sporting competitions. In all cases, the often tedious efforts to gather the data, include it in a meaningful manner in the study, and tabulate the results has broadened the understanding of the economics of sports.

3.2 Game Attributes

For the purpose of exposition we can divide the game variables included in the model into three groups: "quality" of the game, the uncertainty of game outcome, and the time variables. These attributes fluctuate from game to game causing variations in the day-to-day demand for any sporting event in any location.

3.2.1 Quality of the Game

(a) Winning

Many different measures of current performance have been used, and all have found that winning teams draw more spectators than losing ones. The list of possible measures of a team's current performance is lengthy. A common measure is the team's ranking in the league (Siegfried and Hinshaw, 1979; Hart et. al., 1975; Jones, 1984, 1985; Jones and Ferguson, 1988) or division rank (Jones, 1984). Scully (1974), Noll (1974c), and Siegfried and Eisenberg (1980) use the percentage of games won over the season, while Drever and McDonald (1981) and Schofield (1982) use binary variables based on the league position of the teams. Other

measures include games won, goals for and against, and games-behind-the-leader (Hill et. al., 1982). All measure the same thing. Some may explain the variation in attendance better than others because they more accurately reflect the consumer's decision pattern based on the league's importance of winning, and the media's methods of presenting team performance. Here we also expect that winning teams, both home and visiting, will increase attendance.

(b) Violence

As early as 1929 Brill stated that attendance at sports events provided important outlets for the exercise of man's aggressive combative instincts; Zurcher and Meadow (1967) later shared this belief. Gerth and Mills (1954: p.63) claim that great amounts of aggression are "cathartically" released by crowds of spectators cheering. Other studies show that viewing violence only promotes it (Bandura and Walters (1963); Berkowitz (1969); Dollard et. al. (1939); Goldstein and Arms (1971)). Kaelin (1968) stated that while violence may initiate interest in a sport, its control is necessary to sustain continued interest in its expression. Jones (1984, 1985) and Jones and Ferguson (1988) make rare attempts to empirically resolve this debate. Hockey teams are classified as either "skating", "fighting", or "neutral"

based on the team's previous season's penalty record. Tests are made to determine whether "fighting" teams draw more fans than "skating" ones. It was found that when two "fighting" teams played attendance increased; however, this does not allow us to draw any conclusions regarding the expected outcome here.

3.2.2 Outcome Uncertainty

It is argued that restrictive practices (drafts, reserve clauses, waivers, etc.) put into place by league administrators attempt to equalize team strengths to ensure a high level of game uncertainty. However, we hesitate to accept the necessity of these practices since the relationship between attendance and game outcome uncertainty is unclear.

References to uncertainty found in the existing literature fit into four distinct classes. Its measure will depend on the usage and the particular hypothesis specified (Cairns et. al., 1986). First is the individual game's uncertainty of outcome. Game uncertainty of this type is a theoretical paradox in its relationship with attendance levels. Theory and empirical evidence (brought forward by Hill et. al. (1982), Jones (1984, 1985), and Jones and

Ferguson (1988)) proclaim that the certainty of winning has a positive influence on the level of attendance at a sports match. Theory also predicts that high game outcome uncertainty leads to increased attendance. Therefore, theory states that one cannot be increased without having a decreasing effect on the other and on the level of attendance. The solution rests in determining which has a greater effect on attendance. Quirk and El Hodiri (1974) discuss this trade-off using a profit maximizing owner and his decision to hire extra players. Revenue is assumed to fall as a team becomes too strong, but it rises to some point because the fans come to see their team win. The owner will increase his team's playing strength to the point where the last additional unit of playing skill adds as much to revenue as it does to costs.

Uncertainty of seasonal outcome can be factored into two cases. The uncertainty of which team is going to win the league race, and the uncertainty that a specific team will win the league championship (Jennet, 1984). Lastly, there is a multi-seasonal uncertainty. People will lose interest in a league if a club continually dominates it in terms of yearly winning.

Hart et.al. (1975) attempt to measure game uncertainty[3] using the logarithm of the difference between the clubs' league standing prior to each game; Siegfried and Hinshaw (1979) use a similar method. Neither study confirmed the hypothesis. Jones (1984,1985), Jones and Ferguson (1988), and Drever and McDonald (1981) use dummy variables in an attempt to measure uncertainty. Jones uses two dummies, one to test increased attendance if both teams are ranked in the top three teams and the other if one team is in the top three teams and the other in the bottom three (a low uncertainty situation). Little support for the game uncertainty hypothesis arises.

Noll (1974c), using a dummy variable to measure the average number of games between the top two teams, found weak support for a positive relationship between attendance and seasonal league uncertainty. Demmert (1973) found none using a variable representing the average number of clubs in

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3

Game uncertainty has been measured without any attempt to include such factors as home advantage, winning streaks, injured players, or officiating. Each of these is fairly obvious in its effect. If two teams are ranked as equal in the league, conventional uncertainty measures would rank the game's uncertainty high. However, if the home team is on a winning streak without any injuries, the visiting team is missing a key player due to an injury, the visiting team has lost all of its last fifteen away games, and the referee is expected to favour the home team, the actual uncertainty of the game's outcome is quite low. These factors are usually left unaccounted because the data is not easily attainable and is unreliable.

contention for the championship. Jennett (1984) tests the second type of seasonal uncertainty. Here spectator interest is hypothesised to be a function of the probability of success (instead of uncertainty as described above). He measures the reciprocal of the number of matches required to win the championship and finds strong support that people are attracted by successful sides. Schofield (1982) roughly tests the same thing by using a binary variable to indicate when a team is no longer in contention for the league title, and finds only slight support.

Thus, as the mixed results would indicate, the uncertainty of the outcome of a match does not appear to be overly important to those who attend sporting events. This leaves one questioning the practicality of the reserve system often imposed on professional sport leagues which assumes that (a) all owners seek only to maximize the number of games won (Jones and Davies, 1978), and as was shown[4], this is not the case, and (b) people choose to attend a sporting event the higher the uncertainty of its outcome, and this was shown to be questionable. Therefore, the reserve system may be erroneously implemented.

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[4] See Appendix A, for a detailed discussion of this topic.

In this study we use two measures of outcome uncertainty: a dummy indicating that the teams playing are ranked in the top 3 league positions (a high outcome uncertainty situation), and one indicating that one team is in the top 3, and one is in the bottom 3 league positions (a low outcome uncertainty condition). The expected outcomes reflect the hypothesis that increased outcome uncertainty increases spectator interest.

3.2.3 Accountability of Time

Almost every study includes a variable that reflects some aspect of time. These are usually binary variables that indicate the time of day, week, or season a particular game is played. All studies using a time variable have found it to be significant: weekend games, evening games, and games played late in the season (a "playoff drive" situation) all attract greater numbers of spectators. Here we use both a dummy to indicate a weekend game, and a "playoff drive" variable, and expect that both will be positive.

3.2.4 Game Attributes Omitted from this Study

Only two game attributes found in other studies have been omitted from this one. The first is a measure of the past and/or present performance of a specific player: Hill et. al. (1982) use a measure of the performance of the game's starting pitchers. This is inappropriate for the study of hockey because no such "key" positions exist.

Hill et. al. (1982) found promotional gimmicks increase attendance at sporting events and that the increase was greater than an average of 1,100 per game. Recognizing the large explanatory power of this variable makes its necessary omission (due to the complexities of accumulating valid data) regrettable.

This concludes a rather lengthy, yet incomplete, list (due to the immeasurability of human utility, and the unpredictability of environmental conditions) of factors that affect attendance at sporting events. This list is the product of the amalgamation of the data leading to an understanding of the economics of sports and the coordination of both the ability to recognize what is required and how to realize it.

CHAPTER FOUR - THE EMPIRICAL RESULTS:

ATTENDANCE AND MARKET POWER

To fully understand the factors required for economic viability, the model outlined in Chapter 2 has been estimated separately for Canadian and American populations, and the two combined. The distinctions between the markets will allow a more complete understanding of the policy implications, and relocation and expansion potentials.

The analysis uses the two-equation model outlined in Chapter 2, separating the variables into either locational or team specific attributes. The model is estimated using data from all games played during the 1981/82, 1982/83, and 1983/84 NHL seasons[1]. The model used in this study differs from the Jones-Ferguson (1988) model in two ways. The variable accounting for the number of "superstars" displays a high degree of collinearity with the attendance figures[2],

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1

This constitutes 759 Canadian, and 1674 American games. The games played in Calgary during the 1981/82 and 1982/83 seasons were omitted from the analysis because they were played in an arena with a seating capacity of less than 7,500; this artificially lowered the attendance figures during these games.

2

The positive correlation between the total number of "superstars" playing in a game and the league ranking of each team, and the negative correlation between it and the Canadian

(continued...)

and is therefore omitted from this analysis and a new "honeymoon" variable[3] is added. The NHL in 1977/78 (the data used by Jones and Ferguson in 1988) was relatively small (only 16 teams) and was fairly well established (only 4 cities received their franchise less than 5 years prior) and therefore, it was inappropriate to test the "honeymoon effect". However, the NHL in 1981/82, 1982/83, and 1983/84 was large (21 teams) and had recently undergone an expansion (7 franchises were placed within the previous 5 years), and there were many observations (840 observations) to test the "honeymoon effect".

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[2](...continued)
dummy variable, are each higher than the correlation between the "superstar" variable and the dependant variable (attendance).

Correlation Matrix of Coefficients

	LSTAR(ALL)	LSTAR(CAN)	LSTAR(USA)
LHTRL	0.35215	0.55892	0.22101
LVTRL	0.37398	0.36700	0.39030
CAN	(0.22446)		

Partial Correlation with Dependant Variable

	(ALL)	(CAN)	(USA)
LSTAR	0.0196	0.4879	(0.0142)

[3]
See Chapter 2 for thorough discussion of how this variable is used in the model; also, see Chapter 3 for a discussion of the rationale for the inclusion of this variable.

4.1 Test of Equality Between American and Canadian Samples

The test used to determine the statistical compatibility between the American and Canadian models was devised by Gregory C. Chow (1960) to determine whether a model applies to two different sample sets. To test this assumption a null hypothesis that the two regression models are identical is made.

Consider the two models[4]:

$$\begin{aligned}
\text{Log}(A_{gt}^{C}) &= (\log(1/2) + \alpha_0^{C} + \gamma_0^{C}) + \alpha_2^{C}\text{LPOP} \\
&\quad + \alpha_3^{C}\text{LINC} + \gamma_1^{C}\text{LHTRL} + \gamma_2^{C}\text{LVTRL} + .. \\
&\quad + \gamma_{10}^{C}\text{DAY} \\
\text{Log}(P_t^{C}) &= (\log(1/2) + \alpha_0^{C} + \beta_0^{C}) + (\alpha_2^{C} - \beta_2^{C})\text{LPOP} \\
&\quad + (\alpha_3^{C} - \beta_3^{C})\text{LINC}
\end{aligned}$$

and

$$\begin{aligned}
\text{Log}(A_{gt}^{U}) &= (\log(1/2) + \alpha_0^{U} + \gamma_0^{U}) + \alpha_2^{U}\text{LPOP} \\
&\quad + \alpha_3^{U}\text{LINC} + \gamma_1^{U}\text{LHTRL} + \gamma_2^{U}\text{LVTRL} + .. \\
&\quad + \gamma_{10}^{U}\text{DAY} \\
\text{Log}(P_t^{U}) &= (\log(1/2) + \alpha_0^{U} + \beta_0^{U}) + (\alpha_2^{U} - \beta_2^{U})\text{LPOP} \\
&\quad + (\alpha_3^{U} - \beta_3^{U})\text{LINC}
\end{aligned}$$

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4 The Canadian binary variable (CAN) was omitted from these tests since it would cause indeterminate results in the individual sample estimations.

where the variables are as defined in Section 3.1 and the superscript U indicates the U.S.A. model and the superscript C indicates the Canadian model. There are 759 observations in the Canadian model and 1,674 in the American model for the attendance equation, and 19 Canadian observations and 42 American observations for the price equation. The two models are run separately. Since no restrictions have been placed on the parameters of the model the equivalent to the unrestricted sum of squares can be estimated as the sum of the residual sum of squares of the individual models, that is

$$ESS_{UR} = ESS_C + ESS_U.$$

The number of degrees of freedom involved in each individual regression for the attendance equation is[5] (759 - 12) + (1,674 - 12) = 2,409, and for the price equation is (42 - 3) + (19 - 3) = 55. The residual sum of squares for the attendance equations are: $ESS_C = 7.051$, $ESS_U = 105.078$, and $ESS_{UR} = 112.129$. The residual sum of squares for the price equations are: $ESS_C = 0.0232$, $ESS_U = 0.275$, and $ESS_{UR} = 0.298$.

The null hypotheses is now assumed true. That is to

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[5] There are 12 coefficients estimated in the attendance equation, and 3 in the price equation.

say that $\alpha_0^C = \alpha_0^U$, $\alpha_1^C = \alpha_1^U$, ..., $\alpha_{10}^C = \alpha_{10}^U$, $\beta_0^C = \beta_0^U$, ..., $\beta_3^C = \beta_3^U$, $\gamma_0^C = \gamma_0^U$, ..., $\gamma_3^C = \gamma_3^U$. The model can then be estimated as

$$\begin{aligned} \text{Log}(A_{gt}) &= (\log(1/2) + \alpha_0 + \gamma_0) + \alpha_2\text{LPOP} + \alpha_3\text{LINC} + \\ &\quad \gamma_1\text{LHTRL} + \gamma_2\text{LVTRL} + .. + \gamma_{10}\text{DAY} \\ \text{Log}(P_t) &= (\log(1/2) + \alpha_0 + \beta_0) + (\alpha_2 - \beta_2)\text{LPOP} + \\ &\quad (\alpha_3 - \beta_3)\text{LINC} \end{aligned}$$

where there are 2,433 observations for the attendance equation, and 61 observations for the price equation. If the null hypothesis is true then the restriction placed on the model by the null hypothesis will not reduce the explanatory power of the model and ESS_R will not be significantly larger than ESS_{UR}. The number of degrees of freedom under the restricted model is (759 + 1,674 - 12) for the attendance equation and (42 + 19 - 3) for the price equation. The residual sum of squares for the attendance equation is ESS_R = 132.690, and ESS_{UR} = 0.362 for the price equation.

An F-test is used to determine whether the difference between the two residual sums of squares is significant[6].

6

Since each error sum of squares can be shown to follow a chi-square distribution the statistic follows an F-distribution. Since the two distributions are independent, their ratio

(continued...)

Therefore, the F-statistic for the attendance equation is

$$F_{(12,2409)} = 36.810$$

which does not allow the null hypothesis to be accepted with a 0.1% degree of significance. The F-statistic for the price equation is

$$F_{(3,55)} = 3.937$$

which does not allow the null hypothesis to be accepted at the 2.5% level of significance.

Therefore, statistically the American and the Canadian models are significantly different as determined by the F-statistic, and should be treated as two separate models.

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[6](...continued)
follows an F distribution (Pindyck and Rubinfeld (1980):p.124). The appropriate F statistic is:

$$F_{k,n+m-2k} = [(ESS_R - ESS_{UR}) / k] / [ESS_{UR} / (n+m-2k)]$$

where ESS_R = restricted residual sum of squares
ESS_{UR} = unrestricted residual sum of squares
k = restrictions (number of estimated coefficients)
n = observations in the American sample
m = observations in the Canadian sample

4.2 League-Wide Analysis

This section sets the ground work for the individual analysis of the Canadian and American populations. It demonstrates the significance of the locational and team attributes. The results are summarized in Table 3.

4.2.1 Attendance

The relationship between the locational variables and the attendance is as expected. The Canadian dummy variable reflects the strong support Canadians give hockey[7], while the positive relationship between population and attendance indicates that larger cities have greater hockey support. The negative sign on the income coefficient indicates that hockey has gained popularity in lower income cities[8], while the higher attendances at games played in cities with "young" teams validates the hypothesized "honeymoon effect".

7
Kidd and MacFarlane (1972: p.4) claims many Canadians consider hockey to be the national sport.

8
See the discussion in Chapter 3, Section 3.1., for one explanation of this result.

Table 3

The Determination of Attendance and Price: All Teams

ATTENDENCE EQUATION

R – Squared:	0.3270

Variable	Description	Coefficient	Asymptotic T Statistic
CONST	Constant	9.6118	20.9970
CAN	Canada	0.2513	18.1620
HNYMN	Honeymoon	0.0298	1.8842
LPOP	Ln (Population)	0.1071	12.4000
LINC	Ln (Income)	–0.0775	1.5859
LHTRL	Ln (Home Team Rank in League)	–0.0957	17.6570
LVTRL	Ln (Visiting Team Rank in League)	–0.0479	8.8310
UT3	Teams Ranked in Top 3	–0.0619	1.6828
UT3B3	Top 3 and Bottom 3 Ranking	–0.1309	0.6049
PLD4Q	4th Quarter Playoff Drive	0.0161	3.7805
STFF	Fighting Teams	0.0160	1.0770
STFS	Fighting and Skating Team	–0.0230	2.1878
STSS	Skating Teams	–0.0128	0.9010
DAY	Weekend Day	0.0705	7.9595

PRICE EQUATION

R – Squared:	0.3214

Variable	Description	Coefficient	Asymptotic T Statistic
CONST	Constant	–2.2237	0.5891
CAN	Canada	–0.0021	0.0188
HNYMN	Honeymoon	0.1773	1.3677
LPOP	Ln (Population)	0.0530	0.7460
LINC	Ln (Income)	0.4418	1.0927

The influences of the game attributes are not as conclusive as those of the locational attributes. The league-standing of both the home and visiting teams have positive bearings on attendance. As well, the day of the week the game is played, and the importance of the game to the teams' playoff potential both affect attendance positively. The draft and waiver clauses used to equalize team strength in support of the premise that high game uncertainty gains fan interest are found to be unjustified[9]: in fact, games of "high uncertainty" are found to reduce attendance. Lastly, the three variables used to test the popularity of the aggressive aspects of the game did not provide conclusive results. The draw of 2 "fighting" teams was insignificantly positive, while that of two "skating" teams was insignificantly negative. The significance of the negative relationship of a "skating" team playing a "fighting" team is inconclusive without additional significant support[10].

9

Games with high uncertainty are captured with the UT3 variable, and games with low uncertainty are captured with the UT3B3 variable.

10

These results may speak of a more highly passive fan attitude, or they may reflect the increased importance of other game aspects, or they may reflect a lack of fan knowledge of this particular aspect of the game.

4.2.2 Market Power

In all cases, the variables used to measure market power do not have significant relationships with the price variable, and therefore no conclusions can be drawn regarding the effect that differences in these variables have on the elasticity of demand, nor the market power associated with it.

The positive relationship between the income and the price variable indicates that cities with higher income will have lower elasticities of demand. This is expected since increases in income are expected to have reduced effects on attendance as price increases. The insignificant, near-zero coefficient on the Canadian dummy variable tells us that there is no difference between the market power of hockey franchises in Canadian and American cities. The positive relationship between price and population would suggest a low price elasticity, and therefore an increase in market power with a higher population. Lastly, the positive honeymoon variable reflects the expected higher market power in cities with "young" teams.

4.3 Analysis of Canadian Cities

The results differ slightly (Table 4) from the league-wide findings[11] when the model in Chapter 2 is estimated using only those hockey games played in Canada.

4.3.1 Attendance

The influences of the locational variables on attendance are as expected. Canadian cities with high population and high average income attract greater numbers to hockey games. And, as with the league-wide study, cities with "new" hockey franchises also attracted greater numbers.

Canadians are drawn to particular hockey games by the league standing of the two teams, the importance of the game in reaching the playoffs, and the day of the week on which it is played. Canadians are indifferent to the game's outcome uncertainty and have no desire to watch non-aggressive teams.

11
The only difference between this estimation and that of the previous section is the omission of the "Canadian" variable. The model dictates this difference since perfect collinearity would exist between this variable and the constant.

Table 4

The Determination of Attendance and Price: Canadian Teams

ATTENDENCE EQUATION

R – Squared:	0.4806

Variable	Description	Coefficient	Asymptotic T Statistic
CONST	Constant	5.5771	17.0330
HNYMN	Honeymoon	0.2863	15.1140
LPOP	Ln (Population)	0.2517	19.1050
LINC	Ln (Income)	0.2430	7.9188
LHTRL	Ln (Home Team Rank in League)	-0.0414	9.4894
LVTRL	Ln (Visiting Team Rank in League)	-0.0220	5.1966
UT3	Teams Ranked in Top 3	-0.0423	1.4124
UT3B3	Top 3 and Bottom 3 Ranking	-0.0005	0.0277
PLD4Q	4th Quarter Playoff Drive	0.0129	3.9688
STFF	Fighting Teams	-0.0033	0.3264
STFS	Fighting and Skating Team	-0.0144	1.7620
STSS	Skating Teams	-0.0727	4.7702
DAY	Weekend Day	0.0158	2.2644

PRICE EQUATION

R – Squared:	0.5598

Variable	Description	Coefficient	Asymptotic T Statistic
CONST	Constant	0.2274	0.3138
HNYMN	Honeymoon	-0.0460	1.1221
LPOP	Ln (Population)	-0.1300	4.4577
LINC	Ln (Income)	0.3286	4.7883

4.3.2 Market Power

The negative coefficient on the population variable signifies that smaller cities have lower elasticities of demand. This indicates that, as prices increase, attendance decreases by a smaller degree than in larger cities. Consequently, hockey is interpreted as more of a "necessity" in smaller Canadian cities than in larger ones. This may reflect a lack of entertainment substitutes in smaller cities, or possibly a higher degree of community support.

Canadian cities with higher average incomes find hockey more of a "necessity" than cities with a lower average income. This indicates that high-income cities have more freedom to alter prices. This may be due to the fact that the price of a hockey ticket in a high-income city constitutes a smaller proportion of total per capita income, and therefore, an increase in price has a diminished bearing on the decision to purchase the ticket.

Canadian cities recently acquiring a hockey team have less market power than cities with more established teams. This reflects more of a traditionalistic Canadian attitude.

4.4 Analysis of American Cities

The results of the American analysis closely parallel those of the overall study (the coefficients differ mainly in magnitude) (Table 5). This is anticipated since the number of American cities in the league is twice that of Canadian cities.

4.4.1 Attendance

The team-specific results deviate from those of the NHL-wide study in magnitude only[12]. As with both the league-wide study and the Canadian study, higher populations correspond to higher attendances. The income variable is negatively related to attendance, suggesting that cities with lower average incomes have higher average attendance figures. Jones and Ferguson (1988) suggest this may indicate that hockey is a "blue-collar" sport[13]. Once again, the honeymoon variable is positively related to

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12
Section 4.2.1 lists the league-wide results.

13
See the discussion in Section 3.1.

Table 5

The Determination of Attendance and Price: American Teams

ATTENDENCE EQUATION

R – Squared:	0.2779

Variable	Description	Coefficient	Asymptotic T Statistic
CONST	Constant	11.6340	14.4050
HNYMN	Honeymoon	0.0250	0.9585
LPOP	Ln (Population)	0.1090	10.1300
LINC	Ln (Income)	−0.2870	3.2789
LHTRL	Ln (Home Team Rank in League)	−0.1071	13.2710
LVTRL	Ln (Visiting Team Rank in League)	−0.0626	8.4461
UT3	Teams Ranked in Top 3	−0.0806	1.6390
UT3B3	Top 3 and Bottom 3 Ranking	−0.0203	0.7193
PLD4Q	4th Quarter Playoff Drive	0.0167	2.8588
STFF	Fighting Teams	0.0113	0.5045
STFS	Fighting and Skating Team	−0.0334	2.3079
STSS	Skating Teams	−0.0070	0.3928
DAY	Weekend Day	0.0947	7.8436

PRICE EQUATION

R – Squared:	0.2892

Variable	Description	Coefficient	Asymptotic T Statistic
CONST	Constant	−2.5539	0.6411
HNYMN	Honeymoon	0.1811	1.5035
LPOP	Ln (Population)	0.0689	1.3177
LINC	Ln (Income)	0.4620	1.0704

attendance; however, a conclusive relationship does not exist[14].

4.4.2 Market Power

Population is found to be positively related to price, indicating that large American cities have more autonomy in their choice of price. Also, American cities with high rates of average income have more freedom to vary the price of a hockey ticket. In lower income cities a rise in the price of hockey tickets will make hockey less affordable than the same increase in a more affluent city. And, American franchises have greater market power in cities recently granted a hockey franchise.

14
Inconclusive results may exist in this analysis because only 2 franchises qualified as "new" teams in this sample.

CHAPTER FIVE - THE EMPIRICAL RESULTS: LOCATION, TEAM QUALITY, AND PROFITABILITY

The observed success of franchises in Calgary, Edmonton and New Jersey during the early eighties reflects the "hockey fever" endogenous to cities recently acquiring hockey franchises. The "honeymoon effect"[1] captures this added appeal that hockey has in cities with new teams.

The viability of any team is dependent on its profitability over time. Therefore, the discussion of both the short run viability after the "honeymoon effect", and the long run viability is included in this chapter. The discussion of the short run analysis including this "honeymoon effect" is found in Appendix B.

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1 For the purpose of this study, the "honeymoon effect" is a condition associated with cities whose NHL franchise is at most 5 years old.

5.1 The Short Run

The estimation used in this section assumes that every team has undergone the 5-year "honeymoon" period. Therefore, all franchises are treated equally by disregarding the economic advantages connected with the "honeymoon effect". This allows an analysis of the actual economic viability of a franchise in a given location.

Based on the NHL's history (the years in existence, and the league's freedom to expand and relocate[2]) and an assumption of profit maximization (or utility maximization including profit maximization) on behalf of the team owners[3], the league is expected to incorporate franchises in cities where the returns are the greatest. This expectation will be analyzed with the estimation of the model in the short run. The relocation of existing teams and the expansion of the league will be reviewed based on the economic profitability of various possible locations throughout North America.

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2 The 5-year old WHA professional hockey league merged with the NHL in the early eighties (see Chapter 1, Section 1.2) after allowing its members great flexibility to relocate and expand due to the league's infancy.

3 This assumption is sound given the evidence in Appendix A.

The locational quality (H_t) and the team quality (Q_t) for the existing NHL cities, as well as the locational quality and the anticipated team quality[4] for 14 additional North American cities are all listed in the corresponding table for each section. The attendance revenue and the season revenue[5] are listed as well.

5.1.1 League-Wide Analysis

The ranking of the North American cities by the locational quality shows that 18 of the NHL franchises are currently located in the top 21 cities most suited to support a team. Two of the cities currently home to NHL franchises, but not rated in the top 21 cities, are recent

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4

The anticipated team quality is the average of all existing teams unique to each study. A team of slightly poorer quality than the New York Rangers is used in the league-wide analysis, a team of the same quality as Quebec is used in the Canadian analysis, and a team of slightly lower quality than the New York Islanders is used in the American analysis.

5

Regular attendance revenue = H_t * Q_t, and season revenue = regular attendance revenue + playoff revenue + broadcast revenue. The costs include net operating cost and player salaries (for a detailed account of revenue and cost calculations see Appendix D).

Table 6

Locational and Team Quality for All Cities: Short Run

Location	Locational Quality			Team Quality		Three-Year Revenue		
	Ht	Rank All	Rank NHL	Qt	Rank NHL	Attendance Revenue	Season Revenue	
Toronto	3,377	1	1	5,335	19	$18,015,584	$20,513,745	*
New York (I)	3,297	2	2	5,930	3	$19,553,803 *	$26,707,236	*
New York (R)	3,297	3	3	5,673	11	$18,706,362 *	$22,871,645	*
Los Angeles	3,161	4	4	5,422	16	$17,139,173	$19,127,317	*
Chicago	3,139	5	5	5,686	10	$17,845,522	$22,411,001	*
Montreal	3,122	6	6	5,865	4	$18,309,797	$22,557,670	*
Vancouver	2,983	7	7	5,526	13	$16,483,582	$20,247,333	*
Washington	2,933	8	8	5,441	15	$15,957,551	$17,808,627	
Philadelphia	2,878	9	9	5,818	6	$16,744,703	$19,186,638	*
Detroit	2,828	10	10	5,385	17	$15,228,674	$17,030,734	
Calgary	2,783	11	11	5,826	5	$16,212,406	$19,973,685	*
Boston	2,758	12	12	5,998	2	$16,544,933	$20,777,679	*
Edmonton	2,708	13	13	6,194	1	$16,773,620	$22,387,191	*
New Jersey	2,648	14	14	5,261	20	$13,932,810	$15,298,226	
Minnesota	2,608	15	15	5,701	9	$14,865,483	$18,123,501	
St. Louis	2,576	16	16	5,548	12	$14,292,210	$17,293,574	
Ottawa	2,548	17		5,628	11	$14,340,486	$17,121,943	
Denver	2,546	18		5,628	11	$14,329,680	$17,109,041	
Pittsburgh	2,501	19	17	5,353	18	$13,385,588	$14,697,375	
Houston	2,500	20		5,628	11	$14,068,955	$16,797,746	
Winnipeg	2,496	21	18	5,465	14	$13,638,834	$15,502,808	
Hamilton	2,431	22		5,628	11	$13,683,110	$16,337,064	
San Francisco	2,394	23		5,628	11	$13,471,426	$16,084,321	
Quebec	2,368	24	19	5,719	8	$13,540,043	$16,207,432	
Tampa Bay	2,328	25		5,628	11	$13,101,034	$15,642,089	
Dallas	2,310	26		5,628	11	$12,998,695	$15,519,900	
Hartford	2,240	27	20	5,238	21	$11,731,997	$12,670,557	
Buffalo	2,235	28	21	5,811	7	$12,987,270	$15,238,397	
Halifax	2,152	29		5,628	11	$12,113,907	$14,463,500	
Regina	2,083	30		5,628	11	$11,722,525	$13,996,207	
Cleveland	2,074	31		5,628	11	$11,674,913	$13,939,360	
Seattle	2,074	32		5,628	11	$11,674,392	$13,938,738	
Saskatoon	2,059	33		5,628	11	$11,591,079	$13,839,265	
Portland	1,888	34		5,628	11	$10,628,430	$12,689,903	
Fredericton	1,740	35		5,628	11	$9,795,340	$11,695,227	

(*) Indicates Revenues greater than Costs

expansion cites, and still appreciate short term gains due to the "honeymoon effect". The third team, Buffalo, has had strong economic support due to its playing strength[6]. In addition, Houston, Ottawa, and Hamilton (the 3 cities listed in the top 21 but not home to an NHL team) have all been considered for future league expansion.

5.1.2 Canadian Analysis

The original 3 Canadian NHL cities, and the two cities in Alberta are best suited to support NHL hockey teams[7]. Of the existing 7 Canadian cities home to an NHL franchise, 6 of these rated in the top 7 most suited to support hockey of this calibre. Quebec was ranked 9th, with Ottawa in the 6th position.

6

The leverage that the team attributes have on attendance, Chapter 4, Section 4.1.1, is strong, and accordingly, the team in Buffalo has been able to maintain economic viability with a strong performance.

7

This result is anticipated since virtually every home game for these five teams "sold out", within this study's time frame.

Table 7

Locational and Team Quality for Canadian Cities: Short Run

Location	Locational Quality			Team Quality		Three-Year Revenue		
	Ht	Rank All	Rank NHL	Qt	Rank NHL	Attendance Revenue	Season Revenue	
Toronto	2,780	1	1	6,984	6	$19,416,207	$22,108,587	*
Vancouver	2,557	2	2	7,083	5	$18,111,604	$22,247,087	*
Calgary	2,508	3	3	7,495	2	$18,796,281	$22,981,587	*
Montreal	2,481	4	4	7,356	3	$18,249,931	$22,483,915	*
Edmonton	2,380	5	5	7,510	1	$17,871,876	$23,852,997	*
Ottawa	2,178	6		7,223	4	$15,734,133	$18,935,280	
Winnipeg	2,149	7	6	6,955	7	$14,950,347	$16,993,562	
Hamilton	2,074	8		7,223	4	$14,977,391	$18,024,577	
Quebec	1,973	9	7	7,177	4	$14,162,624	$16,952,661	
Regina	1,897	10		7,223	4	$13,702,074	$16,489,794	
Saskatoon	1,886	11		7,223	4	$13,618,901	$16,389,699	
Halifax	1,873	12		7,223	4	$13,526,444	$16,278,431	
Fredericton	1,516	13		7,223	4	$10,952,321	$13,180,597	

(*) Indicates Revenues greater than Costs.

During the 3 years of this study Edmonton profited by more than $3M[8], while Vancouver, Toronto, Montreal and Calgary earned approximate profits of $3M each. Over the same period of time Winnipeg and Quebec each lost an estimated $3M. Winnipeg's poor returns are due to the poor quality of the team - a team of Edmonton's calibre[9] would have resulted in profits of over $2M for the same period. However, even if the best Canadian team played in Quebec City, the location would not be profitable.

In considering the cities in Canada not currently home to NHL franchises, Ottawa is the most suitable. In the first five years of operation a team could expect profits in the neighbourhood of $0.5M annually[10], and following this the team could be expected to break even. An Ottawa-based team of the Oilers' calibre could profit the owners in

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8
All profit and revenue references report game and broadcast revenue, unless otherwise indicated (see Appendix D for a detailed discussion).

9
The Edmonton Oilers were the best Canadian team during the period of this study (see Table 7).

10
Using the short term calculations from Appendix B, Section B.2.

excess of an estimated $0.75M annually over the short run[11].

The other Canadian locations could not expect to do as well in the short run. Even though Hamilton is ranked as the 8th most suitable location in Canada for a hockey franchise, the best that it could expect is a profit of $0.3M a year with a team of the same calibre as the Edmonton Oilers.

5.1.3 Analysis of American Cities

High populations in New York, Los Angeles, and Chicago result in these cities being rated as the most economically appropriate locations for a team. Overall, of the 13 cities currently supporting franchises, 11 are ranked among the top 13 cities best suited to support a team. Denver and Houston are ranked 13th and 14th, while Buffalo is ranked 16th and Hartford is ranked 19th. With the exception of these two locations, the league has located franchises in the locations that will provide the greatest returns.

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11 These calculations do not include any external costs associated with the move, such as the physical cost of the move, the building of a new stadium, the renovations of an existing stadium, or any reimbursements.

Table 8

Locational and Team Quality for American Cities: Short Run

Location	Locational Quality			Team Quality		Three-Year Revenue	
	Ht	Rank All	Rank NHL	Qt	Rank NHL	Attendance Revenue	Season Revenue
New York (R)	3,462	1	1	6,495	2	$22,482,656 *	$27,488,794 *
New York (I)	3,462	2	2	6,013	7	$20,815,199 *	$28,430,093 *
Los Angeles	3,325	3	3	5,667	10	$18,842,100	$21,027,784 *
Chicago	3,296	4	4	6,031	5	$19,879,633 *	$24,965,505 *
Philadelphia	3,034	5	5	6,315	3	$19,159,690 *	$21,953,812 *
Detroit	2,984	6	6	5,575	11	$16,637,043	$18,605,760
Washington	2,931	7	7	5,688	9	$16,670,389	$18,604,154
Boston	2,816	8	8	6,590	1	$18,560,069	$23,308,353 *
St. Louis	2,682	9	9	5,810	8	$15,582,463	$18,854,780
New Jersey	2,669	10	10	5,360	14	$14,303,121	$15,704,827
Minnesota	2,668	11	11	6,018	6	$16,058,271	$19,577,708 *
Pittsburgh	2,633	12	12	5,531	12	$14,565,143	$15,992,527
Denver	2,568	13		5,917	7	$15,194,550	$17,967,555
Houston	2,551	14		5,917	7	$15,095,503	$17,850,433
Tampa Bay	2,459	15		5,917	7	$14,547,959	$17,202,961
Buffalo	2,349	16	13	6,248	4	$14,672,981	$17,216,297
Dallas	2,315	17		5,917	7	$13,696,751	$16,196,409
San Francisco	2,285	18		5,917	7	$13,521,999	$15,989,764
Hartford	2,227	19	14	5,493	13	$12,231,284	$13,209,787
Cleveland	2,094	20		5,917	7	$12,387,332	$14,648,021
Seattle	2,063	21		5,917	7	$12,208,737	$14,436,832
Portland	1,915	22		5,917	7	$11,330,334	$13,398,120

(*) Indicates Revenues greater than Costs.

Hartford lost an estimated $2.5M during the 3 seasons of this study[12]; this is partially due to the poor quality of the team during these years (Hartford was the 2nd worst American team during the study). A team of average quality located in Hartford could expect to lose only $2M, and a top ranked[13] team could expect to profit by over $1M for the same period.

An expansion team in Houston would profit by over $1.5M over the first 5 years and then just break even in the short run. A team in Houston could increase profits to a level between $0.5M and $0.75M annually.

12

This is considering Hartford's recent acquisition of the franchise and therefore the "honeymoon effect" is still in place (this result comes from Appendix B, Section B.3).

13

The team in Boston was calculated to be the team of the highest quality during this study (Table 8).

5.2 Long Run

Quirk and El Hodiri (1974) conclude that a long run relationship exists between the quality of a location and the quality of the team that will exist there[14]. Jones and Ferguson[15] found supportive evidence for this in 1988.

In an effort to test this conclusion the relationship between H_t and Q_t was estimated using the 3 years of data from 1981/82 to 1983/84 with the following results using 58 observations[16]:

14

See Chapter 2, Section 2.2 for a detailed review of this procedure.

15

Jones and Ferguson (1988:p.17) found the following relationship between locational quality (H_t) and team quality (Q_t):

$$Q_t = 1{,}407.3 + 0.25532\ H_t$$
$$\quad\quad (5.2339)\quad (2.1317)$$
$$R^2\text{(adjusted)} = 0.2246 \quad\quad F = 5.344$$

(t statistics in parenthesis) for 16 NHL teams during the 1977/78 seasons.

16

Calgary was only included for the 1983/84 season (see footnote 1 in Chapter 4, for a detailed discussion of this matter). The team in New Jersey was omitted from this estimation because the team was located in Denver, Colorado for the 1981/82 and 1982/83 seasons and only had one season in New Jersey in 1983/84.

$$Q_t^L = \underset{(19.094)}{1,826.5} + \underset{(0.5211)}{0.1907}\ H_t \qquad (15)$$

R^2 (adjusted) = 0.0048

The results support the Quirk and El Hodiri hypothesis that locational and team are positively related in the long run.

The long run locational[17] and team[18] quality, as well as the three-year attendance and season revenue[19] are listed in Table 9. In the long run, New York is the most profitable location for a hockey franchise, followed by Toronto, Los Angeles, and Chicago. Montreal is next with an expected three-year profit of $2.7M.

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17 The locational quality is calculated in the league-wide short run analysis (Section 5.1.1).

18 The team quality is estimated using the long run relationship in equation (15).

19 Regular attendance revenue = H_t * Q_t^L, and season revenue = regular attendance revenue + playoff revenue + broadcast revenue. The costs include net operating cost and player salaries (for a detailed account of revenue and cost calculations see Appendix D).

Table 9

Locational and Team Quality for All Cities: Long Run

Location	Locational Quality			Tm Qlty	Three-Year Revenue	
	Ht	Rank All	Rank NHL	QtL	Attendance Revenue	Season Revenue
Toronto	3,377	1	1	5,673	$19,157,474	$24,496,023 *
New York (I)	3,297	2	2	5,667	$18,685,054 *	$23,891,955 *
New York (R)	3,297	3	3	5,667	$18,685,054 *	$23,891,955 *
Los Angeles	3,161	4	4	5,659	$17,889,437	$22,874,627 *
Chicago	3,139	5	5	5,659	$17,762,184	$22,711,912 *
Montreal	3,122	6	6	5,659	$17,666,914	$21,053,073 *
Vancouver	2,983	7	7	5,651	$16,856,705	$20,087,573 *
Washington	2,933	8	8	5,646	$16,558,271	$19,731,939 *
Philadelphia	2,878	9	9	5,642	$16,239,557	$19,352,139 *
Detroit	2,828	10	10	5,640	$15,950,489	$19,007,666
Calgary	2,783	11	11	5,639	$15,691,447	$18,698,975
Boston	2,758	12	12	5,635	$15,543,648	$18,522,847
Edmonton	2,708	13	13	5,635	$15,258,902	$18,183,524
New Jersey	2,648	14	14	5,629	$14,907,139	$17,764,341
Minnesota	2,608	15	15	5,628	$14,675,022	$17,487,735
St. Louis	2,576	16	16	5,626	$14,493,901	$17,271,899
Ottawa	2,548	17		5,626	$14,335,525	$17,083,167
Denver	2,546	18		5,625	$14,321,194	$17,066,089
Pittsberg	2,501	19	17	5,624	$14,064,037	$16,759,644
Houston	2,500	20		5,623	$14,054,601	$15,558,443
Winnipeg	2,496	21	18	5,622	$14,031,648	$15,533,035
Hamilton	2,431	22		5,620	$13,662,013	$15,123,848
San Francisco	2,394	23		5,617	$13,443,140	$14,881,557
Quebec	2,368	24	19	5,617	$13,297,620	$14,720,465
Tampa Bay	2,328	25		5,612	$13,062,765	$14,460,480
Dallas	2,310	26		5,612	$12,960,302	$14,347,054
Hartford	2,240	27	20	5,606	$12,556,968	$13,900,564
Buffalo	2,235	28	21	5,608	$12,533,821	$13,874,940
Halifax	2,152	29		5,604	$12,060,647	$13,351,136
Regina	2,083	30		5,600	$11,662,639	$12,910,541
Cleveland	2,074	31		5,598	$11,612,512	$12,855,051
Seattle	2,074	32		5,598	$11,611,983	$12,854,465
Saskatoon	2,059	33		5,598	$11,529,093	$12,762,705
Portland	1,888	34		5,588	$10,551,531	$11,680,545
Fredericton	1,740	35		5,580	$9,710,956	$10,750,029

(*) Indicate Revenue greater than Costs

CHAPTER SIX: REVIEW AND RECOMMENDATIONS

6.1 Viability: An Overview of the Issues

For more than 60 years the NHL was comprised of only 6 teams - since 1967 it has increased to 21. The expansions[1] since 1967 reflect the improved economic conditions conducive to team viability, and the relocations reflect the unsure nature of the association of these conditions with viability. In addition to these successful expansions and relocations, many negotiations have failed to unite team with city. Two well-documented cases of attempted relocation include the Oakland Seals in the late sixties[2], and the St. Louis Blues in 1983[3]. These actual and ventured changes to the locational framework of the NHL demonstrate the necessity of the league to ascertain the

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1 See Chapter 1, Section 1.3.2, Table 2 for a detailed history of the NHL.

2 The Oakland Seals attempted to move to Vancouver, but the league, exercising its control over franchise shifts (an unanimous vote of members was necessary to approve a relocation), vetoed the move.

3 The team was sold by its owners Ralston Purina to Canadian interests who intended to move the team to Saskatoon. The league again vetoed the move, seized the franchise, and sold it to U.S. interests who kept it in St. Louis.

conditions for the economic viability of its members.

This recent history of expansion and relocation leaves many questions unanswered. First, is the league operating at a saturation level, or is it able to support additional franchises? Second, could the existing teams increase returns by relocating (i.e. is the current structure economically optimal), and if not, how could these conditions be improved? And third, what are the locational and team conditions that lead to optimizing the league's economic position?

These questions directly apply to the recent announcement by the NHL of the expansion of the league into Ottawa and Tampa Bay, as well as the sale of the Minnesota North Stars to a group headed by Howard Baldwin for $38M. As part of the settlement, the North Stars are to remain in Minnesota, but surrender up to 30 players to an expansion franchise in the greater San Francisco area. This franchise was awarded to George and Gordon Gund, the previous owners of the North Stars. However, has the Bay area overcome its inability to support an NHL hockey team as George Gund believes? "The conditions are improved in the Bay area (since the days of the Seals) because the market is much larger," George Gund said. "It's grown in those 15 years. There is more of an interest in hockey than there was at

that time." (*Victoria Times-Colonist*; May 11, 1990: p.B5). Additionally, will the failing Minnesota North Stars be able to continue in Minnesota, especially considering the damage done to the team's strength by losing the 30 players?

6.1.1 Viability: The Influence of Locational Attributes

The criteria under which professional sports franchises can relocate at present is virtually exclusively location specific. The locational factors must be considered if team economic viability is critical, and in terms of the NHL, four determining factors exist: a geographical condition, population, the age of the team, and income.

The geographical distinction between Canada and the United States must be recognised. The league-wide study illustrates that attendance at hockey games is higher in Canada, *ceteris paribus*, and the two samples are statistically different as determined using an F-test[4]. These findings facilitated the estimation of the model for each sample independently.

Higher population result in higher attendances.

4
See Chapter 4, Section 4.1 for a detailed account of this test.

However, smaller Canadian cities consider hockey more of a "necessity" than larger ones, and therefore, have more market power. The reverse is true in the United States, indicating that economic viability is unquestionably stronger in larger American cities.

New teams will attract more spectators than established ones. However, in Canada cities with "new" franchises consider them more of a "luxury" than established franchises. This does not give "new" Canadian teams as much market power as existing ones. Americans are the opposite: higher market power exists in cities with newly acquired teams.

Americans may consider hockey a "blue-collar" sport, as is demonstrated by the negative income elasticity (Jones and Ferguson, 1988). In Canada, however, high attendance is strongly related to high average income. In both cases, high average income signifies increased market power.

Why is one location preferred over another when considering league expansion, and is this choice appropriate? In terms of the NHL, this question must be answered in two parts: one for each of the American and Canadian samples. In Canada the most profitable locations

have the following characteristics: high population[5], newly established franchises[6], and high average income. The most favourable locational conditions for an economically viable hockey franchise in the United States are high population, newly established hockey teams, and lower income[7].

The importance of the locational factors regarding expansion and relocation can be reviewed simply by estimating[8] the profitability of an average "quality" team[9] located in the top and bottom ranked cities in both

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5

Since Canadian cities with high populations have higher attendance rates, but reduced market power, an incongruency arises. Empirical evaluation can be used to find a solution: increasing population, *ceteris paribus*, reveals that higher population is a favoured locational trait for improved economic viability.

6

Empirical testing reveals that "new" teams are associated with increased profits, even though market power is reduced in these locations.

7

Attendance rates increase with reduced levels of average income, but market power increases with average income. Various levels of income, *ceteris paribus*, found lower average income levels are associated with improved profitability.

8

All estimations performed in this chapter use the short run finding from Table 7 and Table 8, unless otherwise indicated.

9

The team located in Quebec City is considered an "average" quality team for the Canadian study, and for the American study, it is the team in St.Louis. See Tables 7 and Table 8.

Canada[10] and the United States[11]. The range of profits[12] an average team in Canada can expect is from -$3.0M to $4.4M, and an average American team can expect from -$3.4M to $6.0M. As is immediately evident, the location is a dominant determinant of economic viability.

6.1.2 Viability: The Influence of Team Attributes

The criteria under which professional sports franchises can relocate are largely location specific. However, as the existing evidence will attest[13], economic viability is a function of game-specific attributes as well as locational-specific attributes. Thus, to evaluate the economic viability solely on locational qualities could be

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10 Based on the "hockeyness" (H_t) rating, the top ranked Canadian city is Toronto, and the bottom city is Quebec.

11 Based on the "hockeyness" (H_t) rating, the top ranked American city is New York, and the bottom city is Hartford.

12 Attendance revenue is calculated as $H_t * Q_t$, playoff revenue is based on the number of playoff games teams actually had over the period, broadcast revenue is 10% of total revenue (attendance plus playoff), season revenue is the sum of these three, and profits are calculated as the difference between season revenue and the location-specific cost. See Appendix D for a detailed account of this procedure.

13 Chapter 3, Section 3.2 gives a detailed outline of the evidence presented in other studies.

misleading.

The chance of viability improves if the following game-specific conditions are present: (1) both teams rank highly in the league standings, (2) neither team is a "skating" team[14], (3) the game is played on a weekend, and (4) the game has escalated play-off importance. In terms of the magnitude of the impact each of these has on attendance, the teams' league standings have the greatest impact, followed by the play-off relevance of the game.

Attention must be given to the fact that the game-specific factors do not have the same revenue leverage as do the locational factors, but their influence is very significant in terms of team viability. The effect that team-specific[15] attributes have on the profitability of a team is very consequential. Extremes in these team-specific

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14

This means that the variables STSS and STSF have a negative relationship with the rate of attendance; see Chapter 3, Section 3.2.1, for definitions of these variables.

15

As a notational distinction, "team"-specific attributes refer to the win-loss record, style of play, etc., while the "game"-specific attributes refer to the time of play, etc., and include the team-specific attributes.

The measure of the "game"-specific factors (Q_t) is used to estimate the impact that the "team"-specific factors have on profits. This is an acceptable substitution since the game schedule for each team will be relatively constant across all teams, thereby eliminating any advantages due to this factor, and isolating the "team"-specific factors.

attributes cause fluctuations in profits that an average location[16] in Canada can endure ranging from -$0.6M to $5M[17], and an average location[18] in the United States can bear profits ranging from -$1.4M to $6.1M[19]. As it is immediately apparent, the team-specific attributes do have significant bearings on the economic viability of a team in a specific location.

Additionally, in terms of these team-specific attributes, differences between Canadian and American markets must be calculated. These variations will reveal methods by which policy makers can best improve the conditions to regionally support economic viability for existing and new teams. The differences will also assist in

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16

For illustrative purposes, Montreal is chosen since its "hockeyness" rating is the median of those Canadian locations currently supporting an NHL team.

17

Profits are based on the "hockeyness" rating of the location, "H_t" (Montreal) multiplied by the "quality" rating, "Q_t" (Winnipeg is the poorest "quality" team, and Edmonton the highest) plus the playoff and broadcast revenue for the teams. See Chapter 2, Section 2.1 for a description of the "Q_t" and "H_t" measures, and see Appendix D for a breakdown of the revenue calculations.

18

For the purpose of illustration, Washington is chosen since its "hockeyness" rating is the median of those American locations currently supporting an NHL team.

19

The worst team for this calculation is located in New Jersey, while the best team is located in Boston.

identifying, and avoiding, conditions that lead to the necessity of relocation.

In general, Canadians seem less concerned with the "quality" and convenience of a hockey game than Americans (i.e. Canadians will attend **any** hockey game). The following supportive evidence refers to Table 4 and Table 5. First, league standings influence attendance 2.5 times more in America than in Canada. Second, in Canada the uncertainty of a game's outcome does not sway attendance; and third, Canadians do not consider a play off race as significant as Americans. Fourth, Canadians favour passive teams less than Americans (attendance drops at any game involving a "skating" team). And finally, the weekday of the game is 6 times more important to Americans than Canadians. These examples indicate that Canadians are likely to attend a hockey game, regardless of its "quality" or convenience. Therefore, American support can be increased to a greater degree if more attention is paid to improving the "quality" (actual and perceived) of the game and its scheduling, and thus, regional economic viability may be enhanced.

6.2 Viability and the National Hockey League

The preceding findings leave one question unanswered: have the expansion options for the NHL been depleted in North America, and if not, which locations will support a viable expansion franchise, and which present locations are unable to support economically viable teams? Moreover, was the decision to locate expansion franchises in Ottawa, San Francisco and Tampa Bay wise, or would the overlooked city of Saskatoon have been a better choice?

The review of the short run economic viability of cities makes it possible to address these issues. Because the outcome of the Canadian analysis and the American analysis cannot be compared directly[20], team profitability will be used to make league-wide recommendations regarding economic viability, expansion, and relocation. Based on the profitability of each North American location, only 3 viable expansion cities exist: Ottawa, Tampa Bay and Houston[21].

20

The Canadian and American results were tested to determine if a means of comparing the samples existed. The results did not have strong statistical relationships; therefore, no means was found which allowed direct comparison of the two samples. For a detailed discussion of these procedures see Appendix C.

21

The city of Denver is not as suitable for an expansion team since the associated costs of operation are high (see Appendix D).

In all cases expansion teams could expect to break even after 5 years. The longevity of the team in Hartford would suggest that NHL expansion teams could survive in Denver, Dallas, Tampa Bay and San Francisco. Also, the durability of the team in Quebec leads to the conclusion that Hamilton could support a team with financial stability[22].

If either team in Quebec City or Hartford is not financially viable, including broadcast and playoff revenues, then consideration should be given to the relocation of these teams into Ottawa, Tampa Bay, or Houston. If this is the case, then expansion is not recommended at this time because the league is approaching its saturation level, as is demonstrated by the fact that the list of profitable locations is exhausted.

However, the expansion of the NHL into San Francisco in the 1990/91 season remains a slight mystery. The findings would indicate that Ottawa, Hamilton, Tampa Bay, Houston, Denver, or Dallas would be more profitable, other things equal, and that a team in San Francisco could be expected to operate at a loss. This decision may be explained if the "honeymoon effect" were expected to last because profits of

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22
Basing expansion into Hamilton solely on the financial success of the team in Quebec may be risky because this team is young and has repeatedly completed the season with a high league placement.

approximately $0.5M could be expected annually with an average team, and over $1.5M if the team were of top quality. Given this assumption, the other eligible cities would be more profitable. The fact that Hamilton was not chosen may reflect a belief that American cities have more opportunity to establish an expansion team because they have more market power in the short run than do Canadian teams[23]. These findings display explicitly the ease at which expansion into new locations can be construed as economically viable. This possible misconception may lead to inappropriate expansion or relocation decisions.

23

Table 4 reveals that market power is reduced for Canadian expansion teams, while Table 5 discloses that market power is increased for American expansion teams.

6.3 Concluding Remarks

The past fifteen years have seen the league expand, relocate, restructure, and rework its rules in an effort to appreciate its greatest returns. These changes have moved the league closer to its optimal profit-maximizing position. Although it is near this target, the foregoing recommended changes will help attain this goal.

The results of this study reflect the economic conditions exhibited in the early eighties, and consequently decisions regarding the economic viability of particular locations may deviate slightly. However, the ranking of the locational economic viability, and the relevance and consequence of the team and location specific factors included in this study will remain accurate for years to come.

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APPENDIX A - OWNERSHIP MOTIVATION

Ownership of a professional sports team incorporates many alluring aspects including firsthand financial gain, prestige, direct economic benefits, and direct non-pecuniary benefits. Regardless of the owner's goal - whether it be one of profit maximization, victory maximization, or a combination of the two (Noll, 1982) - the owner must generate revenue if he is to cover the associated costs; it is therefore vital that an understanding of the product's demand be reached, as well as the nature of the market in which the product is competing.

The examination of team sports involves the consideration of the industry's structure (Neale, 1964). Each team in a league is an individual entity with its own set of economic goals and strategies; however, no team can survive without the existence of at least one other team. This causes each team to form a coalition with other clubs to produce revenue-generating outputs (Jones, 1969).

The motivational consideration guiding team owners with the economic decisions must also be examined. A long-standing debate among economists exists over the appropriateness of the conventional assumption that team

owners seek to maximize their profits, rather than utility or team victories. This issue of owner motivation is of escalated importance in this industry since regulatory policies in the form of drafts, reserve clauses, and waivers are often imposed on leagues on the apparent basis of an assumed motivational factor shared by all team owners.

The labour market restrictions are enforced under the assumption that they are required to ensure league survival: "if the affiliation of players to a team were to be determined only by the pocket books of the teams, the wealthier teams would wind up with all the best players and the league would not be viable" (Dept. of Consumer and Corporate Affairs, 1973: p.2). The model of thinking under which this reasoning apparently falls is that of the unconstrained maximization of games won (Jones and Davies, 1978). Under this model team owners are only concerned with winning games; and therefore the poorer teams will eventually loose all their games, money and talent, forcing them from the league if left unregulated. This degenerating process will continue until there is only one team in the league, thereby causing it to collapse.

If, however, the owners seek to maximize profits then the reserve system has no effect on the distribution of playing strength. Contracted players can be either used or

sold by a team based on the relative returns on a player in each situation. A player would be sold to another team if he is more valuable to the buying than the selling team. It then follows that players would be distributed so that each is maximizing his productivity (i.e. each would play for the team that is able to receive the highest returns from his services). This is the exact result a free market operation would produce. The only difference under a reserve clause is that part of the selling price is paid to the selling team and part of the player's value goes to the buying team. In a free market the player gets his full value.

> "The analytical position in the economics literature is clear on this subject: as long as property rights are well defined and recontracting through sales of players' contracts is permissible and costless, a labour market with monopsonistic restrictions leads to the same allocation of players and relative team strengths as does a competitive labour market, only the distribution of wealth between players and owners is affected" (Hunt et.al., 1976: p.936).

El Hodiri and Quirk (1971) and Noll and Okner (1971) both agree that in a free market players will end up on teams for which they have the highest value. They feel the free agent draft would not be missed because the poorer clubs would act as a "conveyer belt", obtaining players at a low price and selling them at a higher price to teams willing to pay. Canes (1971) presents a similar argument but adds that the agent draft may produce a small equalizing effect but that determining player talent may hinder this equalizing effect.

Canes (1970) compared sport situations with restrictive

procedures to sport situations without them and concluded that equality of competition is independent of each of the restrictive procedures. Daymont (1975) agrees with these claims saying that the player distribution through the reserve system is "determined by the forces as in a competitive market" (1975: p.95).

A third possible motivation of sports owners is that of maximizing victories subject to a minimum-profit constraint (perhaps a negative value) (Noll, 1982). Theoretical outcomes of this motivational assumption are intermediate between those of the two previous possibilities. Stronger teams would be more desirable than under the profit maximization assumptions, and no highly profitable team would ever sell a player unless it was for the purpose of hiring a better one; however, no more than minimum profits would be earned so long as strength improving opportunities exist.

A fourth hypothesis exists. Sloane (1971, 1980) and Dabscheck (1975a, 1975b) suggest that owners try to maximize their utility. This may include playing success, average attendance, health of the league, and discretionary profits (Sloane, 1971). Quirk and El-Hodiri (1974) agree and add to this list prestige, publicity, and winning.

It is difficult to determine which of these four hypotheses to accept as applicable to each sport and team. Empirically a problem exists in distinguishing between utility and profit maximizing behaviour. To date, studies addressing this question tend only to approach the problem with a single hypothesis, and do not spend equal time testing the appropriateness of the competing hypothesis (Cairns et. al., 1985).

Jones (1969) shows that the actual conduct of the National Hockey League is in accordance with the profit maximizing hypothesis. However, Cairns et. al. (1986: p.12) are critical of Jones' failure to "consider alternative hypothesis", arguing that his results may be due to the "unique features" of a professional league (the interdependence of the members) and not the profit maximizing goal of the owners claiming that "utility maximizing clubs will also be bound by the 'unique features' and thus may behave accordingly".

Schofield (1982) lists many profit seeking activities that are found to exist in first class cricket in England. He also recognizes that "group objectives comprise joint profit as a requirement of survival" (p.339); again, a utility function may account for such behaviour.

Quirk and El Hodiri say that the profit maximizing hypothesis does "not appear to be widely at variance with the empirical results" (1974: p.76) stating that if the profit maximizing assumption is abandoned, "almost any conclusion may be rationalized by imputing sufficient strength to nonprofit motivation factors" (Ibid).

Demmert (1973) and Noll (1974c) attempt to directly answer the question of owner motivation. Both studies use price elasticity estimates to conclude that profit maximizing assumptions cannot be rejected: "the pricing policies of teams do not appear to be motivated by any goal other than profits" (Noll, 1974c: p.154). Hunt and Lewis (1976) draw similar conclusions by estimating the level of dominance in the baseball market. They find that it corresponds to that which would maximize profits and is substantially below that level which would maximize revenue. Noll (1974b) and Davenport (1969) also present evidence to support profit maximization based on the profitability of U.S. team sports.

Given the above findings and rationales no definitive statement about the motivational factors influencing team owners' behaviours can be made. It appears that teams are not owned solely to win games as the reserve system suggests, but rather that profits are the main motivational

factor and that a utility function including games won and league survival may best explain owner motivation. Theory shows that a utility function with profits implicit will carry the same empirical results as profit maximization; however, the problems of defining utility to enable testing still exist, leaving utility maximization as a motivating factor often less empirically desirable than profit maximization.

APPENDIX B: THE EMPIRICAL RESULTS DURING THE HONEYMOON[1]: LOCATION, TEAM QUALITY, AND PROFITABILITY

The analysis used in this section includes the influence of the "honeymoon effect". The estimation calculates revenues for all cities, and includes the estimated consequences the "honeymoon effect" has on increasing revenue for cities recently acquiring their NHL franchise[2]. Those cities home to hockey teams for a period longer than 5 years do not realize this condition, and therefore the revenues calculated for these teams do not reflect this additional increase. The locational quality (H_t) and the team quality (Q_t)[3] for the existing 21 NHL cities, as well as the locational quality for 14 additional North American cities, and the anticipated new-franchise

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1 It is speculated that cities recently acquiring hockey teams will support the team with diminishing vigour over time, thus displaying the consequences of the "honeymoon effect". For the purpose of this study, the "honeymoon effect" is a condition associated with cities whose NHL franchise is at most 5 years old.

2 During the period of this study, six franchises experience the "honeymoon effect". Colorado received its NHL franchise in 1976 and was transferred to New Jersey in 1983. Edmonton, Hartford, Quebec and Winnipeg received their franchises in 1979, while the Atlanta franchise was transferred to Calgary in 1980.

3 See Chapter 2, Section 2.1 for detailed definitions of these concepts.

team qualities[4] are listed in the table accompanying each section. Attendance and season revenue is also listed[5].

4

A new franchise is expected to have a poor quality team so it is rated as the lowest quality for each of the three studies. In the league-wide study the Hartford Wailers were the lowest quality team; in the Canadian study this distinction went to the Winnipeg Jets; and in the American study the New Jersey Devils rated as the lowest quality team.

5

See Appendix D for a detailed breakdown of the revenue calculations.

B.1 League-Wide Analysis

The "honeymoon effect" is clearly evident with this estimation. The locational quality based on population, income, age of the team, and country, present results that are unrealistic. In the short run Calgary, Edmonton, and New Jersey are rated as cites more suited for hockey than Chicago, Montreal and Vancouver; and they are rated as dramatically superior to Detroit and Boston. Buffalo is ranked below all but one of the rated cities. These finding clearly reflect the bias introduced in the short run by the "honeymoon effect".

Table 10

Locational and Team Quality for All Cities: Short Run
(Including the 'Honeymoon Effect')

Location	Locational Quality			Team Quality		Three-Year Revenue	
	Ht	Rank All	Rank NHL	Qt	Rank NHL	Attendance Revenue	Season Revenue
Calgary	3,423	1	1	5,826	5	$19,944,208 *	$24,571,264 *
Toronto	3,377	2	2	5,335	19	$18,015,584	$20,513,745 *
Edmonton	3,331	3	3	6,194	1	$20,634,602 *	$27,540,316 *
New York (I)	3,297	4	4	5,930	3	$19,553,803 *	$26,707,236 *
New York (R)	3,297	5	5	5,673	11	$18,706,362 *	$22,871,645 *
New Jersey	3,258	6	6	5,261	20	$17,139,890	$18,819,600
Los Angeles	3,161	7	7	5,422	16	$17,139,173	$19,127,317 *
Chicago	3,139	8	8	5,686	10	$17,845,522	$22,411,001 *
Ottawa	3,134	9		5,238	21	$16,417,948	$17,731,383
Denver	3,132	10		5,238	21	$16,405,577	$17,718,023
Montreal	3,122	11	9	5,865	4	$18,309,797	$22,557,670 *
Houston	3,075	12		5,238	21	$16,107,081	$17,395,647
Winnipeg	3,070	13	10	5,465	14	$16,778,246	$19,071,273
Hamilton	2,991	14		5,238	21	$15,665,340	$16,918,567
Vancouver	2,983	15	11	5,526	13	$16,483,582	$20,247,333 *
San Francisco	2,944	16		5,238	21	$15,422,989	$16,656,828
Washington	2,933	17	12	5,441	15	$15,957,551	$17,808,627
Quebec	2,913	18	13	5,719	8	$16,656,716	$19,938,089
Philadelphia	2,878	19	14	5,818	6	$16,744,703	$19,186,638 *
Tampa Bay	2,863	20		5,238	21	$14,998,940	$16,198,855
Dallas	2,841	21		5,238	21	$14,881,776	$16,072,318
Detroit	2,828	22	15	5,385	17	$15,228,674	$17,030,734
Boston	2,758	23	16	5,998	2	$16,544,933	$20,777,679 *
Hartford	2,755	24	17	5,238	21	$14,432,490	$15,587,089
Halifax	2,648	25		5,238	21	$13,868,811	$14,978,316
Minnesota	2,608	26	18	5,701	9	$14,865,483	$18,123,501
St. Louis	2,576	27	19	5,548	12	$14,292,210	$17,293,574
Regina	2,562	28		5,238	21	$13,420,731	$14,494,389
Cleveland	2,552	29		5,238	21	$13,366,221	$14,435,519
Seattle	2,552	30		5,238	21	$13,365,625	$14,434,875
Saskatoon	2,533	31		5,238	21	$13,270,242	$14,331,862
Pittsburgh	2,501	32	20	5,353	18	$13,385,588	$14,697,375
Portland	2,323	33		5,238	21	$12,168,138	$13,141,589
Buffalo	2,235	34	21	5,811	7	$12,987,270	$15,238,397
Fredericton	2,141	35		5,238	21	$11,214,360	$12,111,509

(*) Indicates Revenues greater than Costs

B.2 Analysis of Canadian Cities

As with the league-wide analysis, both Calgary and Edmonton are ranked higher than Toronto, Vancouver, and Montreal in the short run. In fact, both Ottawa and Hamilton are rated higher than Montreal. Findings such as these emphasise the bias present in the short run due to the "honeymoon effect".

Table 11

Locational and Team Quality for Canadian Cities: Short Run (Including the 'Honeymoon Effect')

Location	Locational Quality			Team Quality		Three-Year Revenue	
	Ht	Rank All	Rank NHL	Qt	Rank NHL	Attendance Revenue	Season Revenue
Calgary	3,189	1	1	7,495	2	$23,902,524 *	$29,224,819 *
Edmonton	3,026	2	2	7,510	1	$22,726,992 *	$30,332,958 *
Toronto	2,780	3	3	6,984	6	$19,416,207	$22,108,587 *
Ottawa	2,770	4		6,955	7	$19,267,344	$20,808,732 *
Winnipeg	2,733	5	4	6,955	7	$19,011,794	$21,610,073 *
Hamilton	2,637	6		6,955	7	$18,340,670	$19,807,924 *
Vancouver	2,557	7	5	7,083	5	$18,111,604	$22,247,087 *
Quebec	2,510	8	6	7,177	4	$18,010,076	$21,558,061 *
Montreal	2,481	9	7	7,356	3	$18,249,931	$22,483,915 *
Regina	2,412	10		6,955	7	$16,778,972	$18,121,290
Saskatoon	2,398	11		6,955	7	$16,677,122	$18,011,292
Halifax	2,381	12		6,955	7	$16,563,902	$17,889,015
Fredericton	1,928	13		6,955	7	$13,411,742	$14,484,681

(*) Indicates Revenues greater than Costs.

B.3 Analysis of American Cities

In the short run, both New Jersey and Houston are rated higher than two of the original six NHL franchises based on the locational qualities of population, average income, and the age of the franchise. The outcome that Houston is a preferred site over Boston and Detroit is logically unacceptable since these two cities have supported hockey for over 50 years. This is further evidence that the economic viability of a location in the short run reflects the "honeymoon effect", and should not be regarded when considering the possible use of the location through league expansion or team relocation.

Table 12

Locational and Team Quality for American Cities: Short Run (Including the 'Honeymoon Effect')

Location	Locational Quality			Team Quality		Three-Year Revenue	
	Ht	Rank All	Rank NHL	Qt	Rank NHL	Attendance Revenue	Season Revenue
New York (R)	3,462	1	1	6,495	2	$22,482,656 *	$27,488,794 *
New York (I)	3,462	2	2	6,013	7	$20,815,199 *	$28,430,093 *
Los Angeles	3,325	3	3	5,667	10	$18,842,100	$21,027,784 *
Chicago	3,296	4	4	6,031	5	$19,879,633 *	$24,965,505 *
New Jersey	3,279	5	5	5,360	14	$17,576,324	$19,298,804 *
Denver	3,156	6		5,360	14	$16,914,126	$18,267,256
Houston	3,135	7		5,360	14	$16,803,870	$18,148,180
Philadelphia	3,034	8	6	6,315	3	$19,159,690 *	$21,953,812 *
Tampa Bay	3,022	9		5,360	14	$16,194,360	$17,489,908
Detroit	2,984	10	7	5,575	11	$16,637,043	$18,605,760
Washington	2,931	11	8	5,688	9	$16,670,389	$18,604,154
Dallas	2,845	12		5,360	14	$15,246,821	$16,466,566
Boston	2,816	13	9	6,590	1	$18,560,069	$23,308,353 *
San Francisco	2,808	14		5,360	14	$15,052,292	$16,256,475
Hartford	2,736	15	10	5,493	13	$15,030,357	$16,232,785
St. Louis	2,682	16	11	5,810	8	$15,582,463	$18,854,780
Minnesota	2,668	17	12	6,018	6	$16,058,271	$19,577,708 *
Pittsburgh	2,633	18	13	5,531	12	$14,565,143	$15,992,527
Cleveland	2,573	19		5,360	14	$13,789,214	$14,892,351
Seattle	2,536	20		5,360	14	$13,590,407	$14,677,640
Portland	2,353	21		5,360	14	$12,612,594	$13,621,602
Buffalo	2,349	22	14	6,248	4	$14,672,981	$17,216,297

(*) Indicates Revenues greater than Costs.

APPENDIX C: COMPARABILITY OF AMERICAN AND CANADIAN MODELS

The direct inability to compare the Canadian and American locational quality (H_t) and team quality (Q_t) arises with the single degree of freedom that remains when determining the three intercept terms α_0, β_0, and γ_0 in the model. This one degree of freedom in choosing α_0, β_0, and γ_0 means that H_t and Q_t are related by a scaling factor (call it λ) which does not influence the calculation of revenue. In other words

$$R_{tt}^{*} = (\lambda H_t)\ (Q_t/\lambda)$$

This one degree of freedom does not allow one to assume that the choice of γ_0 will be the same for both the Canadian and American models, and therefore λ cannot be assumed to be equivalent between the two models either.

C.1 Determination of Comparability

If separate Canadian and U.S. models are estimated, then the models can not be assumed to have the same scaling factor.

$R_{tt}^{C} = (\lambda^{C} H_t^{C})\ (Q_t^{C} / \lambda^{C})$ for the Canadian model, and

$R_{tt}^{U} = (\lambda^{U} H_t^{U})\ (Q_t^{U} / \lambda^{U})$ for the American model.

Recall from the long run model[1] the relationship between H_t and Q_t:

$$Q_t^{J} = \zeta_0 + \zeta_1 H_t^{J}, \text{ or}$$

$$Q_t^{J}/\lambda^{J} = \zeta_0 + \zeta_1 \lambda^{J} H_t^{J}, \text{ or}$$

$$Q_t^{J} = \lambda^{J}\zeta_0 + \zeta_1 (\lambda^{J})^2 H_t \qquad \text{(C1)}$$

where J = U or C.

If we let $\lambda^{U} = 1$ then equation (C1) becomes

$$Q_t^{U} = \zeta_0 + \zeta_1 H_t^{U}$$

for the American model, and

$$Q_t^{C} = \lambda^{C}\zeta_0 + \zeta_1 (\lambda^{C})^2 H_t^{C}$$

for the Canadian model[2].

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[1] See Chapter 2, Section 2.2 for a discussion of the long run model.

[2] For estimation purposes, equation C1 is written as

$$Q_t^{J} = (cd^{J}+1)\zeta_0 + \zeta (cd^{J}+1)^2 H_t \qquad \text{(C2)}$$

(continued...)

When we estimate equation C1[3] the following results emerge[4]:

$$Q_t = \underset{(1.042)}{(0.0147*CAN+1)}*\underset{(17.625)}{1808.208} + \underset{(1.042)}{(0.0147*CAN+1)^2}*\underset{(0.578)}{0.0211}*H_t$$

Therefore

$\lambda^C = 1 + 0.0147 = 1.0147,$

$\lambda^U = 1,$

$\zeta_0 = 1808.208,$ and

$\zeta_1 = 0.0211.$

However, the variables H_t and CAN are not significant and the null hypothesis that the coefficients are equal to zero

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[2](...continued)

where J = U or C.

If J = U we cause $\lambda^U = (cd^U+1) = 1$ by letting $d^U = 0$, and if J = C we cause $(cd^C+1) = \lambda^C$ by letting $d^C = 1$ (therefore d^J = Canadian dummy variable: CAN).

The estimation of equation C2 is done using nonlinear estimation (Pindyck and Rubinfeld, 1980; pp.262-269). This is an iterative linearization method in which a nonlinear equation is linearized around an initial set of coefficient values using a Taylor series expansion (Taylor, 1969). A new set of coefficients is estimated using OLS and then the nonlinear equation is relinearized around this new set of coefficients. This process is repeated until convergence within a margin is met, or until recognized series divergence occurs, causing the procedure to be re-initialized.

[3]

There are 21 observations. This number of observations can not be increased to include 21 observations from each of the 3 seasons because this would require estimating a scaling factor between each season to allow comparability.

[4]

The figures in parentheses are asymptotic t-statistics.

cannot be rejected. However, if we assume that $\lambda^U = 1$ and $\lambda^C = 1.0147$ then the Canadian cities have locational qualities that are 1.0147 times higher than their American counterparts. This is tabled in Table 13. This scaling factor helps equate the two models; however, the results are still not acceptable. The scaling factor is expected to be about 1.1 in order to rank the team quality in an acceptable order: the scaling factor calculated (1.0147) causes all of the Canadian teams to have higher qualities than the American teams[5]. Therefore, the results of this analysis cannot be accepted.

5
For example, the Winnipeg Jets were not a better team than the Boston Bruins during the years covered by this study.

Table 13

Locational and Team Quality for All Cities: Short Run
(Comparison using a Scaling Factor)

Location	Locational Quality			Team Quality		Three-Year Revenue	
	Ht	Rank All	Rank NHL	Qt	Rank NHL	Attendance Revenue	Season Revenue
New York (I)	3,462	1	1	6,013	14	$20,815,199 *	$28,430,093 *
New York (R)	3,462	2	2	6,495	9	$22,482,656 *	$27,488,794 *
Los Angeles	3,325	3	3	5,667	17	$18,842,100	$21,027,784 *
Chicago	3,296	4	4	6,031	12	$19,879,633 *	$24,965,505 *
Philadelphia	3,034	5	5	6,317	10	$19,165,758 *	$21,960,765 *
Detroit	2,984	6	6	5,575	18	$16,637,043	$18,605,760
Washington	2,931	7	7	5,688	16	$16,670,389	$18,604,154
Toronto	2,821	8	8	6,882	6	$19,416,207	$22,108,587 *
Boston	2,816	9	9	6,590	8	$18,560,069	$23,308,353 *
St. Louis	2,682	10	10	5,810	15	$15,582,463	$18,854,780
New Jersey	2,669	11	11	5,360	21	$14,303,121	$15,704,827
Minnesota	2,668	12	12	6,018	13	$16,058,271	$19,577,708 *
Pittsburgh	2,633	13	13	5,531	19	$14,565,143	$15,992,527
Vancouver	2,595	14	14	6,980	5	$18,111,604	$22,247,087 *
Denver	2,568	15		6,317	10	$16,223,198	$19,183,932
Houston	2,551	16		6,317	10	$16,117,447	$19,058,881
Calgary	2,545	17	15	7,386	2	$18,796,281	$22,981,587 *
Montreal	2,518	18	16	7,249	3	$18,249,931	$22,483,915 *
Tampa Bay	2,459	19		6,317	10	$15,532,834	$18,367,576
Edmonton	2,415	20	17	7,400	1	$17,871,876	$23,852,997 *
Buffalo	2,349	21	18	6,248	11	$14,672,981	$17,216,297
Dallas	2,315	22		6,317	10	$14,624,002	$17,292,882
San Francisco	2,285	23		6,317	10	$14,437,419	$17,072,248
Hartford	2,227	24	19	5,493	20	$12,231,284	$13,209,787
Ottawa	2,210	25		6,317	10	$13,963,405	$16,511,726
Winnipeg	2,181	26	20	6,854	7	$14,950,347	$16,993,562
Hamilton	2,104	27		6,317	10	$13,291,827	$15,717,585
Cleveland	2,094	28		6,317	10	$13,225,937	$15,639,670
Seattle	2,063	29		6,317	10	$13,035,251	$15,414,184
Quebec	2,003	30	21	7,072	4	$14,162,624	$16,952,661
Regina	1,925	31		6,317	10	$12,160,035	$14,379,241
Portland	1,915	32		6,317	10	$12,097,381	$14,305,153
Saskatoon	1,913	33		6,317	10	$12,086,222	$14,291,958
Halifax	1,900	34		6,317	10	$12,004,170	$14,194,931
Fredericton	1,539	35		6,317	10	$9,719,740	$11,493,593

(*) Indicates Revenues greater than Costs.

APPENDIX D: CALCULATION OF REVENUE AND OPERATING COSTS

The methodology used to calculate revenues and costs was originated by Jones and Ferguson (1988). Some slight deviations have been made in an effort to complement the original work, and to accommodate the new avenues of analysis.

D.1 Revenue

D.1.1 Short Run Revenue Calculations

Season Revenue = Game Revenue + Broadcast Revenue

Game Revenue = Regular Season Attendance Revenue + Playoff Revenue

Season Attendance Revenue = $H_\Omega \times Q_t$

where

H_Ω, Q_t are as defined in Chapter 3;
Ω represents the home city;
t represents the quality of the home team for existing franchises, and for new franchises it represents a team of minimum quality during the first 5 years, and a team of average quality following 5 years;

Playoff Revenue = (Revenue per regular season game) x (the number of home playoff games for existing franchises), and
(Revenue per regular season game) x (the minimum number of playoff games during the first 5 years and the average number of playoff games following that for all teams in each study for new franchises) (Source: *Times Colonist*)

Broadcast Revenue = 12, 10 , or 8 percent of Game Revenue for existing teams based on the average attendance over the 3 years. If the average attendance is greater than 1 standard deviation above the average league attendance, or if the average attendance is 100% of capacity, 12% is used. 8% is used if the average attendance figure is greater than 1 standard deviation below the league average. 10% is used for the remainder. For new franchises 8% is used during the first 5 years and 10% for the remaining years.

D.1.2 Long Run Revenue Calculations

Season Revenue = Game Revenue + Broadcast Revenue

Game Revenue = Regular Season Attendance Revenue + Playoff Revenue

Season Attendance Revenue = $H_\Omega \times Q_t^L$

where

H_Ω, Q_t^L are as defined in Chapter 2, Section 2.2;
Ω represents the home city;
t represents the quality of the home team for both existing and new franchises;

Playoff Revenue = (Revenue per regular season game[6]) x (the number of home playoff games[7]);

Broadcast Revenue = 12, 10 , or 8 percent of Game Revenue for all teams based on the average long run locational quality (Q_t^L). If the average locational quality is greater than 1 standard deviation above the average, 12% is used. 8% is used if the average locational quality is greater than 1 standard deviation below the league average. 10% is used for the remainder.

6

This is calculated as ($H_t * Q_t^L$) / 120.

7

The number of playoff games is 3, 10, or 17 (10 is the average number of playoff games during the 81/82, 82/83, and 83/84 seasons, while 3 and 17 are one standard deviation either side). If the long run locational quality (Q_t^L) is greater than 1 standard deviation above the average then 17 playoff games are used. 3 playoff games are used if the long run locational quality is less than 1 standard deviation below the average. 10 playoff games are used otherwise.

D.2 Operating Costs

D.2.1 Definitions

Total Operating Cost =	Net Operating Cost + Player Salary Cost
Net Operating Cost =	Total Operating Cost 1972/73 (weighted by the number of teams in Noll's 3 attendance groups (1974: p.25)) of $3,462,000 less player depreciation of $1,000,000 less player salary cost 1972/73 (average roster size of 21; players per team at average salary of $42,500 (Jones and Davis, 1978: p.733) of $892,500 = $1,569,500. This figure was extrapolated to 1977/78 dollars using the rate of inflation as measured by the CPI.
Player Salary Cost =	Average roster of 21 players per team at average salary of $87,900 (*Toronto Globe and Mail*, March 14, 1978: p.37) = $1,845,900.

D.2.2 Operating Costs per City

Costs used in this study are taken directly from the study by Jones and Ferguson (1988). The total operating cost they calculated was extrapolated to 1983 U.S. dollars at the rate of inflation measured by the CPI in each city involved in this study.

The following is a list of the actual 3-year costs calculated:

Existing NHL cities.

Boston	$18,713,712
Buffalo	$18,364,854
Calgary	$19,822,578
Chicago	$19,523,559
Detroit	$19,037,649
Edmonton	$19,710,447
Hartford	$19,025,190
Los Angeles	$18,913,059
Minnesota	$19,025,190
Montreal	$19,859,958
New Jersey	$19,025,190
New York	$18,339,936
Philadelphia	$18,414,690
Pittsburgh	$19,648,152
Quebec City	$19,997,007
St.Louis	$19,336,671
Toronto	$19,897,335
Vancouver	$19,548,477
Washington	$18,638,955
Winnipeg	$19,286,835

Additional Canadian cities.

Fredericton	$19,759,373
Halifax	$19,612,318
Hamilton	$19,759,373
Ottawa	$19,512,197
Regina	$19,270,222
Saskatoon	$19,408,880

Additional American cities.

Cleveland	$20,838,148
Dallas	$20,076,002
Denver	$20,658,467
Houston	$19,185,485
Portland	$18,217,805
San Francisco	$19,054,128
Seattle	$19,366,757
Tampa Bay	$19,025,190

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(Glen Seredynski)

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