WHEN IS THE HONEYMOON OVER?
NATIONAL HOCKEY LEAGUE ATTENDANCE 1970 – 2003

John C. Leadley
and
Zenon X. Zygmont

Western Oregon University

Paper prepared for the Sports Economics session (#80) at the Western Economic Association Meetings in Vancouver, BC, July 1, 2004.

John C. Leadley
Division of Business & Economics
Western Oregon University
Monmouth, Oregon 97361
503-838-8719
503-838-8723 (fax)
leadlej@wou.edu

Zenon X. Zygmont
Division of Business & Economics
Western Oregon University
Monmouth, Oregon 97361
503-838-8244
503-838-8723 (fax)
zygmonz@wou.edu

ABSTRACT

This paper uses a Tobit analysis to test for the presence of a honeymoon effect for National Hockey League (NHL) arenas using pooled cross-section time series samples from 1970-2003. No previous NHL attendance demand or attendance-related study has tested for such an effect. We estimate that the opening of a new arena increases attendance demand 15–20 percent in the first years of operation, and that the honeymoon is over by the eighth year. This is similar in magnitude and duration to the previously estimated effects for new facilities for Major League Baseball and National Basketball Association teams. Because many NHL arenas are subsidized, the honeymoon effect has public policy implications if revenue projections for a new arena over-estimate the initial effect or ignore the decline over time.

I. INTRODUCTION

In February 2004, the National Hockey League published the *Independent Review of the Combined Financial Results of the National Hockey League 2002-2003 Season*. This publication, commonly referred to as the Levitt Report (it was co-authored by Arthur Levitt, the former chairman of the Securities and Exchange Commission), reports losses of $273 for the 2002-2003 season (roughly $9 million per team) and supports warnings by team owners that contraction is inevitable without significant concessions by the Players Association (NHLPA) in the next Collective Bargaining Agreement (CBA). The Players Association views the report with suspicion, given the proximity of the publication of the report to the expiration of the CBA this September, and common knowledge of the accounting chicanery used by teams to inflate their losses (see, e.g., Quirk & Fort, 1999, 101-106). However, the NHLPA did not reject the report in its entirety, and it reportedly offered to reduce player salaries 5% across the board. Whether a restructured CBA will solve all the alleged financial misery of the NHL remains to be seen as there are issues other than labor costs that may explain why the average NHL franchise is at a financial disadvantage relative to other professional sports.[1]

When teams in other professional sports plead poverty, they usually do so in the hope that a new stadium or arena—paid for by taxpayers—will generate increased revenue streams and improved profit margins. To justify their rent-seeking, team owners stress the positive impact a team and its facility has on the local economy.[2] Since attendance is one of the primary sources of team revenue, higher projected attendance will increase franchise revenue, which in turn contributes to a larger potential economic impact. Opening a new stadium or arena may result in an initial surge in attendance, but over time the novelty of the new facility fades and attendance begins to decline. This relationship between spectator attendance and the age of the facility is called the honeymoon effect (hereafter, HE).[3] If the decline in attendance over time is not taken into account, or is stronger than anticipated, then the projected economic impact of the sports facility, and the justification for subsidization, will be biased upwards (Baade and Sanderson, 1997a, p. 96).

Currently, out of 30 NHL teams, 24 (80%) are skating in arenas built since 1991. The presence of so many new arenas in a league that claims to be experiencing severe losses raises questions about the relationship between a new arena and team operating income and whether the HE was correctly estimated or understood to begin with. Our empirical analysis indicates that the honeymoon effect is an important factor in determining attendance, with an initial increase of fifteen to twenty percent. Depending on the sample period used for estimation, the honeymoon ends after five or eight years. The shorter length is for the period 1970–2003, while it is longer for 1994–2003, suggesting that the honeymoon is getting longer. Overall, the HE we find for hockey is similar in magnitude and duration to the effect we have estimated for baseball and basketball (Leadley & Zygmont, in press).

II. LITERATURE SUMMARY

The recent financial difficulties of the Ottawa Senators, a team which advanced to the 2003 Eastern Conference finals before losing, illustrates the importance of factors other than winning percentage.[4] Seredynski, Jones and Ferguson (1994) tested an attendance demand model in which team revenues and profits are a function of both the quality of the team and the attributes of the location. They estimated attendance revenues and operating costs to determine the short and long run profitability of existing franchises and other potential locations. One factor influencing their revenue estimates is the HE. They estimated a dummy variable for the first six years of a new team’s existence and found it to be significant for Canadian cities but not those in the United States. However, the variable they used does not distinguish *between the honeymoon for a new team and the honeymoon for a new arena*. Of the six new teams added to the league during the time period they studied, 1979-1984, only two had a new arena.[5] Thus, their variable is capturing a new team effect rather than a new arena effect. Nevertheless, their attempt to develop a model of franchise location viability remains important. At the time of their study, Canadian cities, even those without a franchise, appeared to be better locations than most U.S. cities. Their result supports the NHL's decision to allow former WHA franchises in Edmonton, Quebec City, and Winnipeg to join the NHL in 1979, and it also explains the relocation of the Atlanta Flames to Calgary in 1980.

III. THE MODEL

Attendance studies for professional sports have typically used ticket price, arena capacity, team performance and city characteristics as regressors. While this approach results in a high R^2, it lacks a theoretical basis and may not estimate the demand function as intended. The role of arena capacity, a supply variable, in determining demand is questionable, and price and attendance are at least partially determined simultaneously. Ticket prices are set prior to the beginning of the season, so that the error in the attendance equation will be independent of the price variable, but the team will still choose those prices based on expected market conditions that also affect the level of attendance.

Our model is a variation of one used by Jones and Ferguson (1988) to estimate attendance per game in the National Hockey League. The model relies on several simple assumptions. First, attendance demand is a linear function of ticket price, or $Q = a - bP$. The resulting formula for price elasticity of demand is $\varepsilon = (a - Q)/Q$. Second, marginal costs are zero, so that expected ticket revenue and thus profit are maximized at the point where ε is equal to one. Setting $(a - Q)/Q$ equal to one yields $Q^* = a/2$ and $P^* = a/2b$ as the optimal quantity and price.

Taking the natural log of both Q^* and P^* results in

(1) $\ln Q^* = \ln 1/2 + \ln a$

(2) $\ln P^* = \ln 1/2 + \ln a - \ln b$

The third assumption is that the natural logs of the intercept and slope of the demand curve are linear functions of a vector of the natural log of team and city characteristics (**x**), so that

(3) $\ln a = \alpha_0 + \boldsymbol{\alpha}_1 \ln \mathbf{x}$

(4) $\ln b = \beta_0 + \boldsymbol{\beta}_1 \ln \mathbf{x}$

Combining these assumptions gives

(5) $\ln P^* = \ln 1/2 + \alpha_0 + \boldsymbol{\alpha}_1 \ln \mathbf{x} - \beta_0 - \boldsymbol{\beta}_1 \ln \mathbf{x}$

$= \ln 1/2 + (\alpha_0 - \beta_0) + (\boldsymbol{\alpha}_1 - \boldsymbol{\beta}_1) \ln \mathbf{x}$

(6) $\ln Q^* = \ln 1/2 + \alpha_0 + \boldsymbol{\alpha}_1 \ln \mathbf{x}$

There is considerable empirical evidence that teams set ticket prices in the inelastic region of the demand curve (see Fort, 2004), with estimated values ranging from close to one to as low as 0.25. A common explanation is that reducing ticket prices increases the revenue from concessions and parking by more than the decrease in ticket revenue. The effect of such behavior on our model is relatively benign. If teams select ticket prices where elasticity equals e, then $Q^* = a/1+e$ and $P^* = ea/(1+e)b$. This will change only the constant terms in equations (5) and (6). This is because a shift in demand, represented by a change in the intercept a, will still change actual attendance by a fraction of that shift, whether it is 1/2 if elasticity equals one or 2/3 if elasticity is 0.5. While the coefficients in equation (6) will measure the effect on <u>actual</u> attendance irrespective of the value of e, the implied shift in demand will vary with e. If teams price where elasticity is equal to one, then the shift in demand is twice as large as the change in Q*. If elasticity is set equal to 0.5, then the shift in demand is 1.5 times larger than change in Q*. Lacking any consistent alternative value in the literature, we will continue the exposition assuming that price elasticity is equal to one, but also recognize that shifts in demand derived from changes in Q* will probably be smaller than those implied by our estimated coefficients.

Ticket prices, which are set prior to the start of the season, will be based on expected demand conditions. Some demand–side variables are known, such as age of the arena and the length of time the team has played in that city, while others must be forecasted. The known variables are denoted by **z** and the forecasted variables by **w**. We will assume that for the latter teams use the naïve forecast that next season will be like this one, so the price equation should be estimated using the values from the previous season ($\mathbf{w}_{-1}$). The use of lagged **w** also make sense if season tickets sales depend on the outcome of the previous season.

(7) $\ln P^* = \ln 1/2 + (\alpha_0 - \beta_0) + (\boldsymbol{\alpha}_1 - \boldsymbol{\beta}_1) \ln \mathbf{z} + (\boldsymbol{\alpha}_2 - \boldsymbol{\beta}_2) \ln \mathbf{w}_{-1}$

The impact of uncertain demand and the inability to adjust price is more complicated for the attendance equation. Demand may be higher or lower than expected, based on the actual values of the **w** variables, but ticket prices are fixed in advance and cannot be adjusted to move attendance to the new revenue maximizing point. If the intercept increases from a to a', attendance does not increase from a'/2, but rather to a/2 + (a' – a). We assume that the intercept of the demand curve changes by a multiplicative factor based on the ratio of the actual value of **w** to the expected value ($\mathbf{w}_{-1}$).

(8) $\ln a = \alpha_0 + \boldsymbol{\alpha}_1 \ln \mathbf{z} + \boldsymbol{\alpha}_2 \ln \mathbf{w}_{-1} + \boldsymbol{\gamma}_1 \ln \mathbf{w}/\mathbf{w}_{-1}$

The resulting attendance equation is

(9) $\ln Q = \ln 1/2 + \alpha_0 + \boldsymbol{\alpha}_1 \ln \mathbf{z} + \boldsymbol{\alpha}_2 \ln \mathbf{w}_{-1} + \boldsymbol{\gamma}_1 \ln \mathbf{w}/\mathbf{w}_{-1}$

$= \ln 1/2 + \alpha_0 + \boldsymbol{\alpha}_1 \ln \mathbf{z} + \boldsymbol{\alpha}_2 \ln \mathbf{w}_{-1} + \boldsymbol{\gamma}_1 (\ln \mathbf{w} - \ln \mathbf{w}_{-1})$

In the NHL, arena capacity is likely to be a significant constraint, so that teams may not be able to reach the point on the demand curve where revenue and profits are maximized. If Q* is expected to exceed arena capacity then the team should raise ticket prices until the quantity demanded equals capacity. A team can also experience an unexpected increase in demand, resulting in sellouts but no increase in price. For the periods 1970–2003 and 1994–2003, teams experienced sellouts during 17% and 16% of the seasons, respectively. If censoring is not accounted for the estimated coefficients will be biased downwards. The attendance equation (9) can be estimated by using a maximum–likelihood Tobit procedure with arena capacity as the right censoring value (this approach was also used by Burdekin and Idson, 1991, for NBA attendance). Ticket prices will be left censored at the price corresponding to arena capacity as quantity demanded. This censoring value of the dependent variable is not known, so the condition that attendance is equal to arena capacity is used as an indicator of left censoring in the Tobit procedure for equation (7).

An even larger number of seasons had attendance equal to 95% or more of arena capacity, with the likely result that attendance for a significant number of games during those seasons was constrained. A dummy variable equal to one if attendance was greater than or equal to 95% of capacity was used as an alternative indicator of censoring, with very similar results.

IV. THE VARIABLES

The dependent variables are attendance per home game and the average ticket price (in 1984 dollars). Attendance per game, rather the season total typical in most attendance studies, is used because of variations in the number of scheduled games played per seasons (from 78 to 84) and the labor dispute in 1994 (only 48 games were played).

Previous attendance studies have measured ticket prices using a constructed price index (the weighted average price for all seats offered for sale), a realized price index (the weighted average price for tickets sold), the median or unweighted average price, or a representative price (for example, a courtside or general admission ticket). The strengths and weaknesses of each method are discussed at length in the literature.[6]

We collected data on both representative ticket prices and a constructed price index. In general, teams in the NHL have not been forthcoming about ticket prices. None of the teams we contacted directly were willing to provide any historical price data. By using a combination of media guides, pocket schedules and fan web sites, we were able to accumulate data on general admission prices and the highest priced tickets available on game days (i.e., not seats reserved for season tickets) for slightly more than half of the sample. We also collected price data from *Team Marketing Report*, which has calculated the price of an average ticket for NHL teams since 1994. The disadvantage of using this source is that we are not able to use attendance data collected for 1970 to 1993.

The rationale for using a general admission ticket is that it is roughly comparable across teams and over time. Unfortunately, the nature of a general admission seat has changed over time as teams have introduced more sophisticated price discrimination. In the past, most teams offered a small number of tickets categories. In recent years, the number of categories has increased and some of the previous general admission seats have been offered at higher prices. In addition, the nature of a general admission ticket may be different in large and small arenas. The number of seats close to the ice is approximately equal, while the larger arena has more seats further from the action. Combined with the increased price discrimination, general admission seats in newer larger arenas may be less desirable than in the past. Because of the sporadic nature of our data collection and concerns about consistency over time, we chose to estimate the system of equations using the average ticket price data for 1994–2003 and the attendance equation alone for 1970–2003. For 1994–2003, the results for attendance equation as part of a system of equations were virtually identical to those for the attendance equation estimated alone.

The standard analysis of panel data accounts for differences in the intercept or slope coefficients across individuals using fixed or random effects. With a large number of independent variables and no a priori reason that a given coefficient will vary across teams, we chose to model the team differences in terms of the intercept only. We used a fixed-effects approach because our sample includes all NHL teams. The random-effects approach would be appropriate when using a limited sample to draw inferences for a larger population.

It is also common with panel data to allow the intercept to vary over time. This will account for a change in attendance that affects all teams equally. Indeed, it is apparent from yearly attendance averages that the NHL has not experienced a uniform pattern of growth, with the most significant increase occurring during the 1980s. The alternative to using dummies for each year is to impose a functional form to the time trend. The advantage of this approach is that the number of estimated coefficients is reduced (for our sample, from 33 to 1). However, we believe that the loss in degrees of freedom is offset by the lack of restrictions. Why should the trends in the 1970s, 1980s and 1990s be assumed to be the same?

Prior attendance studies have included a selection of city–level variables assumed to influence demand, such as unemployment, per capita income and population. We excluded the latter two variables after noting a high degree of collinearity with the team dummies. The host cities that had a high per capita income relative to other cities at the beginning of the sample period also had a high income at the end. The same was generally true for population. While the unemployment rate in each city exhibited much more variation over time than income and thus avoids the collinearity problem, a consistent time series was not available for Canadian cities. In addition, it was not significant in our previous studies of professional baseball and basketball. We eventually abandoned this as explanatory variable.

A new arena can affect demand by its novelty or by improving the fan experience. For baseball attendance, Noll (1974), Baade and Tiehen (1990), and Coffin (1996) assumed a linear decline after the first year. Coffin determined that the best fit occurred with a four–year decline, while the other authors assumed a decrease over ten years. Other studies included a dummy for newer facilities, usually equal to one if the stadium age is five years or less. Rather than impose a structure to the decline over time, we chose to include separate dummy variables for each of the first ten years after a new arena was built. We initially used fifteen years, but the effects in the last five years were never significant, and for our restricted sample of 1994 to 2003, only one arena was between ten and fifteen years old, and we generally avoid estimated coefficients based on one observation. A total of 31 arenas were built during the sample period. In addition, seven arenas were built within ten years of the start of the sample period.

Fans may be more likely to attend games for a team that has recently located in their city. To capture this honeymoon effect we defined dummy variables for each of the first ten years of a team's operation in a city. If the decline is non-linear, this approach is preferred to the ad hoc assumption used in previous studies that the decline is linear over time[7] If the decline is linear, then our use of separate dummies reduces efficiency. For the period 1967 to 2003 there were 27 expansion teams and four teams moved to the NHL from the former World Hockey Association.[8] Seven teams relocated at least once during this period.[9] If most of the new teams had been formed late in our sample period, so that the new teams dummies were equal to one for all of those observations, those variables would be highly collinear with the teams' fixed effect dummies. Fortunately, most teams were new for only a fraction of their included years.

Team performance has been found to be a significant determinant of attendance in nearly all previous studies. A team's performance can be measured absolutely or relative to other teams in its division. Two alternative measures of absolute performance are the team's winning percentage and total points earned. Teams are awarded two points for a win, one point for a tie or an overtime loss and zero points otherwise. While points are used to determine relative standing, fans may not view two ties as equivalent to one win. We used both measures, with no significant differences in regression results. Relative performance is measured by a dummy indicating whether the team made the playoffs that year.

Fans may also respond to a team's style of play. Previous studies of the NHL have characterized teams as fighting or skating.[10] Total penalty minutes are one indication of a team's style of play, although this combines fighting majors and minor penalties. To account for different reactions to violence by fans in the U.S. and Canada, an interaction term with a dummy equal to one for teams in Canada can be included.

The price equation includes lagged team performance, while the attendance equation includes both lagged and current performance. Lagged performance is not available for the first year of expansion teams. To avoid losing these observations, we calculated the means of these variables for all expansion teams in their first year and entered these values for lagged performance. For a new team, it is reasonable for management and fans to expect their team to be similar to other expansion teams in their first year. For teams that were in the World Hockey Association prior to their entry into the NHL, we used performance in their last year in the WHA.

Table 1 summarizes these variables and the data sources. The descriptive statistics for the sample periods 1970–2003 and 1994–2003 are reported in Table 2. The number of observations for which a complete set of data was available is 709 and 279, respectively.

IV. RESULTS

For the period 1970 to 2003, the adjusted R^2 for the attendance reduced–form equation is 0.749, with a log likelihood of 293. For the period 1994 to 2003, both the attendance and price equations could be estimated. The adjusted adjusted R^2 for attendance is 0.678, with a log likelihood of 217. Because a dummy was used to indicate censoring of the price variable, rather than a value of the dependent variable itself, the EViews program did not report an R^2 statistic. The log likelihood for this regression is 190. The estimated coefficients and robust (Huber/White) t-statistics are given in Table 3.

As noted by McDonald and Moffit (1980), the estimated coefficients from a Tobit regression must be interpreted with care. While this method estimates the coefficients in equations (7) and (9), those coefficients measure the effect of changes in the independent variables on attendance demand, not on actual attendance. If a team's winning percentage increases, more fans will wish to attend and the demand for tickets will increase, but the probability of selling out the arena also increases. The change in expected actual attendance can be measured by multiplying the estimated coefficient from the Tobit regression by 0.85, which is the percentage of observations that were not censored.[11]

Caution must also be exercised when interpreting the estimated coefficients for winning percentage, penalty minutes and playoff status. The lagged values of these variables are included in both equations because we assume that teams use them to forecast demand for the upcoming season. Because ticket prices are set prior to the start of the season, they will not be affected by the actual conditions in the following season. However, attendance will depend on whether those expectations were fulfilled. Thus, the variables for the current season appear in the attendance equation, but not the price equation.

The interpretation of the coefficients for the lagged variables in the price equation is relatively straightforward. The winning percentage in the previous season will affect the expected intercept and slope for the demand curve. The coefficient in the reduced-form price equation equals the difference between the effects on the intercept and the slope ($\alpha - \beta$). Note that it is possible for an increase in winning percentage to have no effect on ticket price if the expected increase in demand is offset by a decrease in elasticity of demand (flatter demand curve).

To interpret the coefficients for the attendance equation, one must distinguish between an expected change in demand and the actual change. If team performance improves, we assume that management will expect the same for the following year and forecast high demand for tickets. If that expectation is fulfilled, so that w/w_{-1} equals one, then attendance will change with a coefficient of α from Equation (9). If performance in the following season does not meet expectations, then the effect on attendance of the change in w_{-1} is reduced to $\alpha - \gamma$. Given the specification of the model, there is a different impact on attendance for an expected change in performance that does not occur and a change in performance that is not expected. The effect of an unexpected change in current season performance (w), that is, holding prior performance (w_{-1}) constant, is measured by γ.

For both sample periods (1970–2003 and 1994–2003), winning percentage from the previous season has a positive and significant effect on attendance. This suggests that an increase in winning percentage in one season that occurs again the next season, as expected by management and fans, will increase attendance by a significant amount. The coefficient on the ratio of current to lagged winning percentage, which measures the effect of an unexpected increase in winning percentage, is also positive and significant. Note that the estimated for the latter is smaller than for an expected change in winning percentage. The difference between these coefficients, which measures the effect of a change in expected winning percentage that does not actually occur, is also positive and statistically significant. Apparently the increase in season ticket and early season sales in anticipation of another good season is enough to increase attendance for a poor performing season. In the price equation (1994–2003), the effect of lagged winning percentage is positive, as expected, but not significant.

The estimated effect of penalty minutes from the previous season on attendance is positive but statistically significant for both sample periods. The effect of the difference in penalty minutes from the previous season is positive and significant only for the longer sample. Penalty minutes have a positive and significant effect in the price equation. The estimated coefficient for an interaction term between penalty minutes and team location in Canada was negative, suggesting that Canadian fans place less value on violence, but it was not statistically significant, and we did not include this term in the final results.

The coefficients on the playoff dummies for the current and previous season for attendance are not significant. However, the effect on ticket price of making the playoffs during the prior season is positive and significant in the price equation.

The coefficients for the new arena dummies are presented in Figure 1. For the attendance equation, they are positive and significant during the first eight years for the 1994–2003 sample and for the first five years for the entire 1970–2003 period. In both cases, the initial increase in attendance is also economically significant, with coefficients of 0.16 and 0.20 for the two samples, respectively. The subsequent decline does not appear to be linear, with a plateau after the first year and a drop-off at the end. For the price equation, the coefficients are positive and statistically significant only for the first two years. The good news for team owners, particularly those arguing for public subsidies based on an increase in attendance and related jobs, is the initial size of the honeymoon effect. The bad news for owners, and local taxpayers, is that estimates assuming lasting increases may not hold true, although the honeymoon appears to be getting longer over time.

The estimated coefficients for the new team dummy variables are not significant in any year for the attendance equation, except for year two in the regression for the 1994–2003 period. For the price equation, the effect is positive and significant only in the ninth year. The overall lack of significance is surprising, but not entirely unexpected. There may be good reasons why those cities did not already have NHL franchises that counteract the newness effect.

The estimated coefficients for the year effects for the two equations are shown in Figure 3 and Figure 4. For attendance, the effects are compared to the year 1970, which is assumed to have a value of zero. While not restricted to any particular functional relationship, there is a clear downward trend during the 1970s, followed by an upward trend that continues to the present. The years 1994 and 1995 appear as outliers to the upward trend, which is not surprising given the strike–shortenend season in 1994. However, they are actually above the trend, not below! Perhaps fans attended more games during 1994 expecting the season to end early, and then again in 1995 after not getting enough games in 1994. There is a decline after 1995 back to the previous trend line.

The coefficients in the price equation, which could only be estimated for 1994–2003, show an upward trend from 1994 to 2000. In 2001 the trend line shifts down, but appears to resume its upward growth.

The centered leverage values indicate whether there are any observations that have undue influence on the estimated coefficients. Four values were greater than 0.5, which indicates that omission of one observation will have a significant effect. The Cleveland Barons and Kansas City Scouts each had just two observations in our sample. The small number of observations for estimating those cities dummies is not a serious problem, however, as we do not attempt to interpret the city dummy coefficients

To test for possible multicollinearity, we examined the variance inflation factor (VIF) for each independent variable. The highest value was 4.3 for the penalty minutes variable, and this is less than the commonly used critical value of 10.

For both equations, the Durbin-Watson statistic indicates the probable existence of serial correlation of the error terms. Unfortunately, the EViews software program does not permit an autoregressive specification for the error term in censored regression models. To determine how this might affect our results, we estimated uncensored OLS models with and without correction for serial correlation. Simple OLS gave similar results for the team performance variables but a shorter honeymoon than in the Tobit model. This effect is not surprising given that OLS estimates are biased downward when censoring occurs. The addition of a first–order autoregressive error term resulted in estimated OLS coefficients closer to those from Tobit, with the new arena effect of similar length, magnitude and statistical significance.

V. CONCLUSION/SUMMARY

Our analysis makes several contributions to the existing literature on attendance demand for professional sports. Our paper is the first to use a large cross section–time series data set to confirm the presence of a honeymoon effect in the NHL. Second, we find the initial increase in attendance demand for a new hockey arena is approximately 15–20% percent. This is comparable to the estimated effect for other professional sports. The effect on actual attendance will be smaller than the increase in the demand for tickets due to the capacity constraint. Multiplying the change in demand by the percentage of observations that are at capacity approximates the effect on actual attendance. For the first year of a new hockey arena the expected percentage increase is roughly equal to that for a new basketball arena and approximately half as large as for a new baseball stadium, particularly a baseball–only park. Third, the effect diminishes, falling to near zero after the eighth year; unlike similar studies for

MLB, we do not assume a particular functional form for that decline. This downward, albeit non-linear, trend in demand suggests that Hamilton and Kahn's (1997, p. 253) claim that the honeymoon effect for a typical MLB stadium lasts about eight years is roughly equivalent for the NHL. Fourth, we believe we have made a methodological contribution by using a theoretical model of profit maximization and incorporating arena size as a capacity constraint in the regression analysis. Finally, our findings have public policy implications. Given the routine demands for public subsidies by city officials and allied interest groups, claims that a new arena will generate a large initial and prolonged increase in attendance, and attendance-related spending, may be far too optimistic.

REFERENCES

Austrian, Z. & Rosentraub, M.S. (1974). Cleveland's gateway to the future. In R.G. Noll and A. Zimbalist (Eds.), *Sports, jobs, and taxes: the economic impact of sports teams and stadiums* (pp. 355-384). Washington, D.C.: The Brookings Institution.

Baade, R.A. & Sanderson, A.R. (1997a). The employment effect of sports teams and facilities. In R.G. Noll and A. Zimbalist (Eds.), *Sports, jobs, and taxes: the economic impact of sports teams and stadiums* (pp. 55-91). Washington, D.C.: The Brookings Institution.

Baade, R.A. & Sanderson, A.R. (1997b). Minor league teams and communities. In R.G. Noll and A. Zimbalist (Eds.), *Sports, jobs, and taxes: the economic impact of sports teams and stadiums* (pp. 452-493). Washington, D.C.: The Brookings Institution.

Baade, R.A., & Tiehen, L.J. (1990). An analysis of major league attendance, 1969-1987. *Journal of Sport and Social Issues*, **14**(1), 14-32.

Burdekin, R.C.K., & Idson, T. (1991). Customer preferences, attendance and the racial structure of professional basketball teams. *Applied Economics*, **23**(1B), 179-186.

Cairns, J., Jennett, N. & Sloane, P.J. (1986). The Economics of Professional Team Sports: A Survey of Theory and Evidence. *Journal of Economic Studies*, **13**(1), 3–80.

Coates, D. & Humphreys, B.R. (1999). The growth effects of sport franchises, stadia and arenas. *Journal of Policy Analysis and Management* **18**(4), 601-624.

Coffin, D.A. (1996). If you build it, will they come? Attendance and new stadium construction. In J. Fizel, E. Gustafson, and L. Hadley (Eds.), *Baseball economics: Current research* (pp. 33-46). Westport, CN: Praeger Publishers.

Demmert, H.G. (1973). *The economics of professional team sports*. Lexington, MA: Lexington Books.

Fort, R. (2004). Inelastic sports pricing, *Managerial and Decision Economics*.

Hamilton, B.W. & Kahn, P. (1997) Baltimore's Camden Yards ballparks. In R.G. Noll and A. Zimbalist (Eds.), *Sports, jobs, and taxes: the economic impact of sports teams and stadiums* (pp. 245-281). Washington, D.C.: The Brookings Institution.

Hudson, I. (2001). The use and misuse of economic impact analysis. *Journal of Sport and Social Issues*, **25**(1), 20-39.

Jones, J.C.H. & Ferguson, D.G. (1988). Location and survival in the National Hockey League. *Journal of Industrial Economics* **36**(4), 443-457.

Leadley, J.C. & Zygmont, Z.X. (2003). The National Hockey League: A survey of the sports economics literature. Presented at the Western Economic Association annual meeting in Denver, CO.

Leadley, J.C. & Zygmont, Z.X. (in press). When is the honeymoon over? Attendance trends in the National Basketball Association, 1970-1999." *Journal of Sports Economics.*

Leadley, J.C. & Zygmont, Z.X. (in press). When is the honeymoon over? Attendance trends in Major League Baseball, 1970-1999." *Journal of Sport Management.*

Levitt, A.L. Jr. (2004). Independent review of the combined financial results of the National Hockey League 2002-2003 season.

McDonald, J.F. & Moffitt, R.A. (1980). The uses of Tobit analysis. *Review of Economics and Statistics* **62**(2), 318-321.

Noll, R.G. & Zimbalist, A. (Eds.). (1997). *Sports, jobs, and taxes: the economic impact of sports teams and stadiums*. Washington, D.C.: The Brookings Institution.

Noll, R.G. Attendance and price-setting. (1974). In R.G. Noll (Ed.), *Government and the sports business* (pp. 115-157). Washington, D.C.: The Brookings Institution.

Quirk, J. & Fort, R. (199p). *Hard ball: The abuse of power in pro team sports*. Princeton, NJ: Princeton University Press.

Rascher, D. (1999). A test of the optimal positive production network externality in Major League Baseball. In J. Fizel, E. Gustafson, and L. Hadley (Eds.), *Baseball economics: Current research* (27-45). Westport, CN: Praeger Publishers.

Seredynski, G., Jones, J.C.H. & Ferguson, D.G. (1994). On team relocation, league expansion, and public policy: Or, where do we put this hockey franchise and why would you care. *Seton Hall Journal of Sport Law* **4**(2), 663-700.

U.S. Census Bureau. *County and city data book*. Washington, D.C. Various years.

U.S. Census Bureau. *State and metropolitan area data book*. Washington, D.C. Various years.

U.S. Census Bureau. *Statistical abstract of the United States*. Washington, D.C. Various years.

Walker, D. (2002). Not suited for the average fan: Corporate America squeezes cheap seats. *Milwaukee Journal Sentinel* (accessed on–line on 07/30/2003 at www.jsonline.com/sports/etc/mar02/30680.asp).

Table 1. Data Sources

Variable: Attendance per home game
Sources: Various team media guides (accessed at the Amateur Athletic Foundation of Los Angeles Library and the Hockey Hall of Fame, Toronto)
Hockey Research Association (www.hockeyresearch.com/mfoster/business/attendance.htm)
Hockey Zone Plus (www.hockeyzoneplus.com/cgi-bin/att.pl)
Individuals: Don Fraser (Toronto), Steve Knowles (Edmonton), Rod Fort (http://users.pullman.com/rodfort/SportsBusiness/BizFrame.htm)

Variable: Ticket prices
Sources: Team Marketing Report (www.teammarketing.com)
Various team media guides
Various team pocket schedules
Individuals: Richie Kremer, Ron Roth, Chris Haynes, Mike Harling, Morey Holzman, Nicolas Gagné, Scott Bennyhoff, Claude Jacques, Kelly L., Reorgman.

Variable: Arena seating capacity
Sources: Munsey & Suppes (www.ballparks.com)
Various team media guides
Individuals: Don Fraser (Toronto)

Variable: Arena age (dummies for the first ten years after construction)
Sources: Munsey & Suppes (www.ballparks.com)

Variable: Team age (dummies for the first ten years for an expansion or relocated team)
Sources: Munsey & Suppes (www.ballparks.com)

Variable: Penalty minutes
Sources: Hockeydb.com

Variable: Team win percentage and points
Sources: Hockeydb.com

Table 2. Descriptive Statistics

	Mean	Std. dev.	Min	Max	Total
1970–2003					
Attendance	15,119	2,917	4.850	21,002	—
Winning percent	0.419	0.116	0.098	0.756	—
Points per game	1.01	0.23	0.26	1.65	—
Penalty minutes	18.07	4.95	8.35	33.91	—
Arena capacity	17,137	1,866	7,424	26,000	—
New arena	—	—	—	—	31
New team	—	—	—	—	26
1994–2003					
Attendance	16,379	2,333	8,188	21,002	—
Avg ticket price	$24.77	$5.05	$13.39	$41.97	—
Winning percent	0.417	0.109	0.110	0.756	—
Points per game	1.03	0.20	0.48	1.60	—
Penalty minutes	16.61	3.37	9.74	26.77	—
Arena capacity	18,200	1,679	10,755	26,000	—
New arena	—	—	—	—	22
New team	—	—	—	—	7

Table 3. Regression Results

	1994–2003		1970–2003
	Attendance	Price	Attendance
Lagged winning percentage	0.204*** (4.24)	0.053 (1.04)	0.247*** (6.78)
Lagged penalty minutes	0.076* (1.70)	0.120** (2.39)	0.105*** (2.72)
Lagged playoffs	-0.022 (-1.14)	0.042** (2.02)	-0.020 (-1.19)
Current – lagged win %	0.390*** (6.30)		0.446*** (11.28)
Current – lagged penalties	0.513 (0.96)		0.128*** (2.85)
Current – lagged playoffs	0.008 (0.28)		-0.014 (-0.58)
New arena year 1	0.201*** (7.77)	0.076** (2.24)	0.158*** (5.60)
New arena year 2	0.176*** (6.23)	0.071** (2.18)	0.112*** (3.82)

New arena year 3	0.166*** (6.05)	-0.019 (-0.59)	0.070** (2.32)
New arena year 4	0.175*** (6.05)	-0.016 (-0.42)	0.077*** (2.95)
New arena year 5	0.193*** (6.78)	-.053 (-1.51)	0.074*** (2.85)
New arena year 6	0.150*** (5.06)	-0.019 (-0.44)	0.026 (1.10)
New arena year 7	0.108*** (3.43)	0.003 (0.08)	0.008 (0.285)
New arena year 8	0.080** (2.36)	0.057 (1.34)	-0.035 (-1.13)
New arena year 9	0.028 (0.63)	0.032 (0.57)	-0.052 (-1.30)
New arena year 10	0.037 (0.87)	-0.022 (-0.35)	-0.052 (-1.13)
New team year 1	0.074 (1.20)	0.088 (1.14)	0.016 (0.79)
New team year 2	0.074 (1.29)	0.066 (1.03)	0.120* (1.88)
New team year 3	0.054 (1.01)	0.101 (1.46)	0.080 (1.58)
New team year 4	0.044 (0.95)	0.031 (0.54)	0.083*** (2.83)
New team year 5	0.001 (0.01)	0.017 (0.29)	0.030 (0.98)
New team year 6	0.023 (0.51)	0.086 (1.37)	0.024 (0.72)
New team year 7	-0.041 (-1.12)	0.038 (0.64)	0.022 (0.72)
New team year 8	-0.045 (-1.27)	0.055 (1.04)	0.053 (1.57)
New team year 9	-0.025 (-0.79)	0.092* (1.74)	0.045 (1.22)
New team year 10	-0.012 (-0.48)	0.040 (0.71)	0.020 (0.61)

Statistical significance using a two-tailed test indicated by * for the 0.10 level, ** for the 0.05 level and *** for the 0.01 level. T-statistics are based on Huber/White standard errors.

Figure 1. New Arena Effects
Sample: 1994–2003

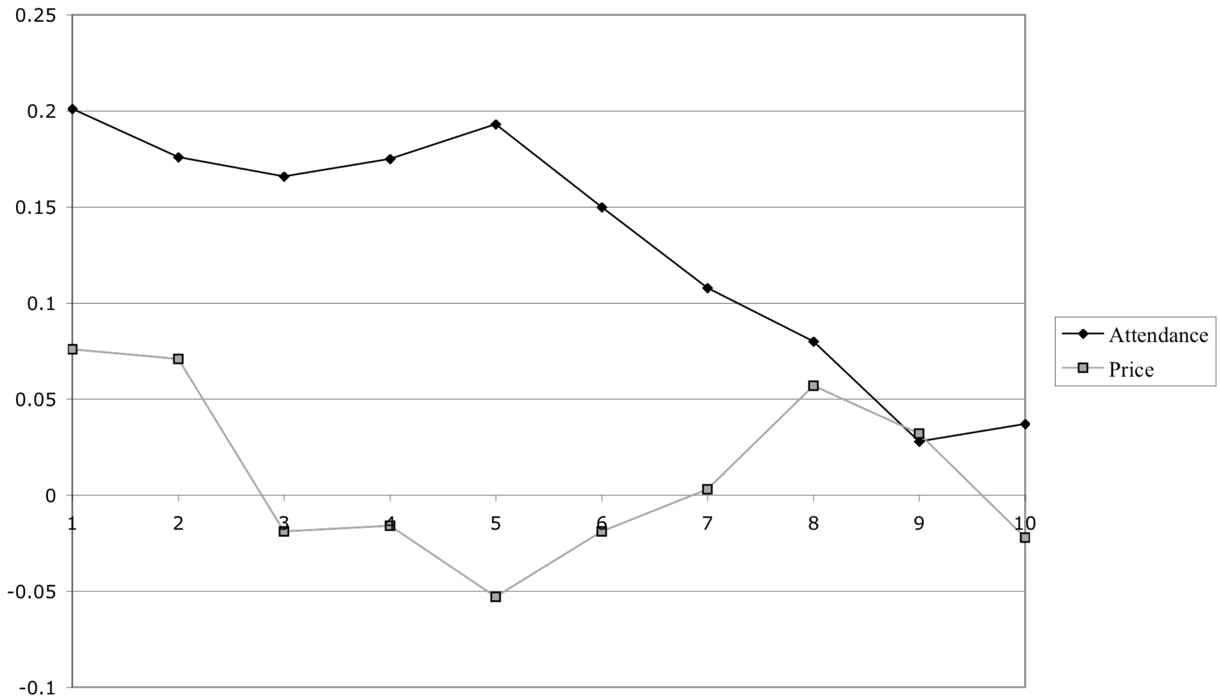

Figure 2. New Arena Effects
Sample: 1970–2003

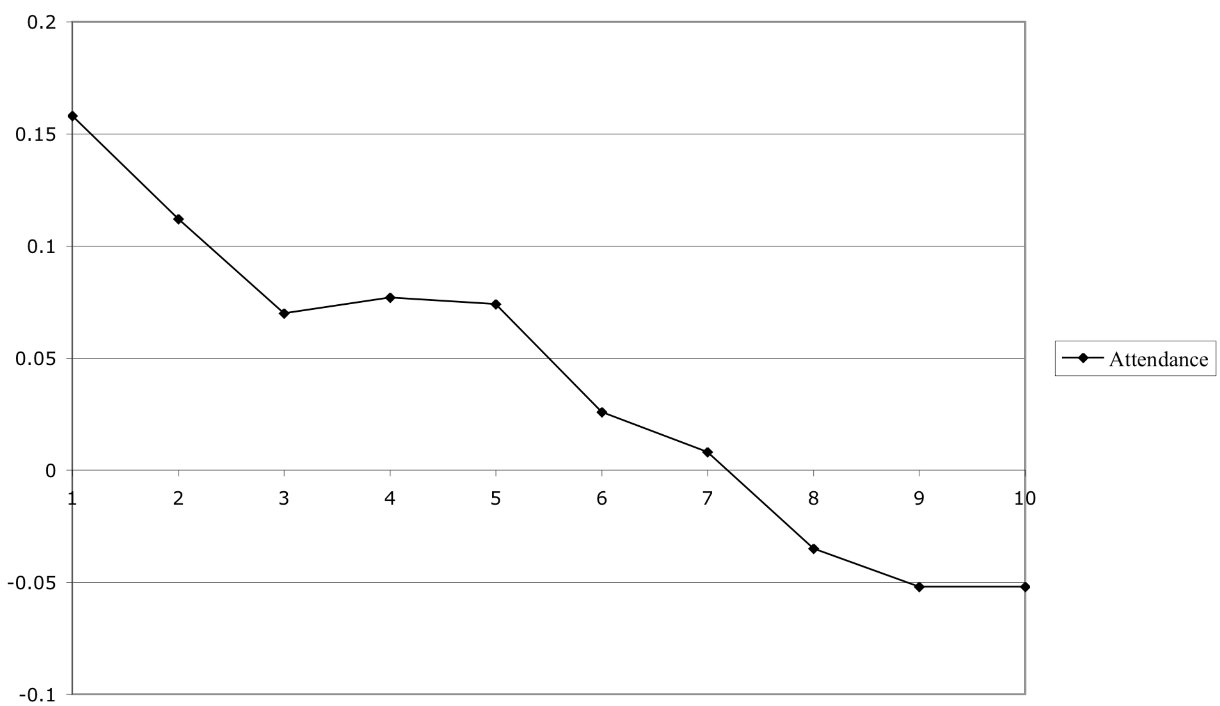

Figure 3. Year Effects: Attendance

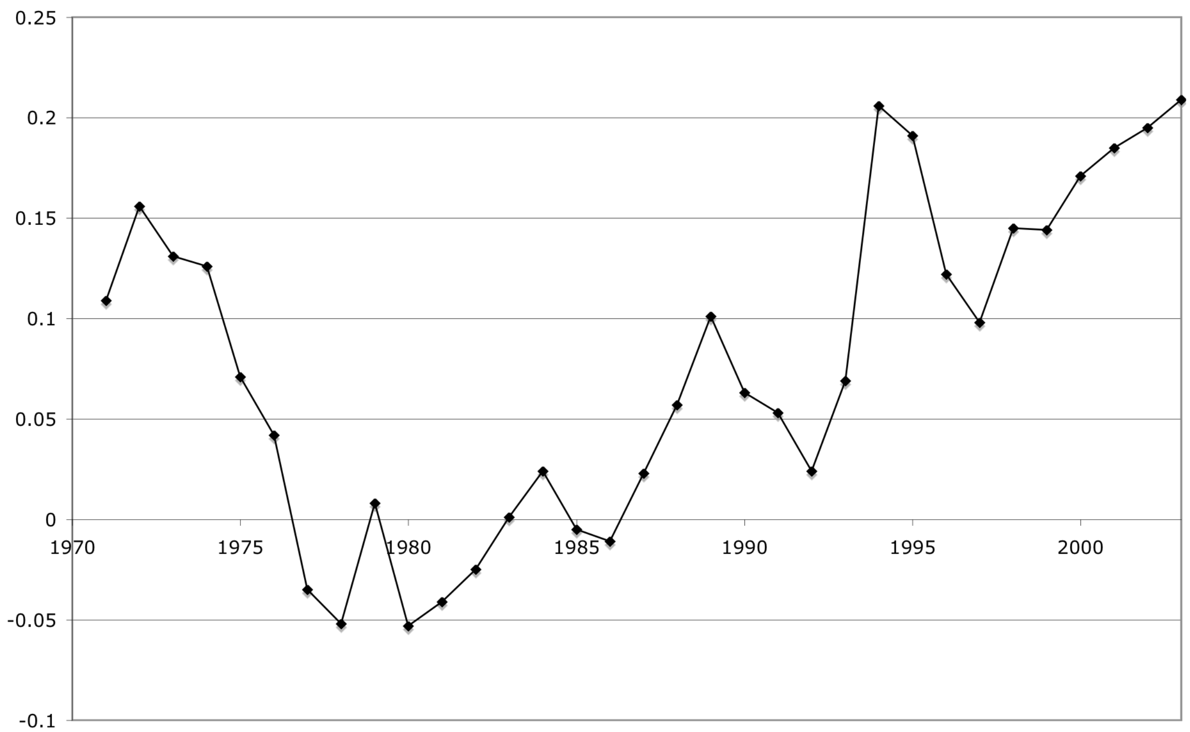

Figure 4. Year Effects: Price

[1] For example, an unfavorable exchange rate, a trivial television contract in the United States, higher taxes in Canada, and possible over-expansion. Quirk & Fort (1999, pp. 192 & 209) provide NHL media income and estimated franchise operating income for the period 1990-1996.

[2] They make these claims despite substantial evidence to the contrary. See, e.g., Noll & Zimbalist (1997), Coates & Humphries (1999), and Hudson (2001).

[3] Noll (1974, p. 118) indicated "a newer facility may attract fans because of its greater comfort or because it affords a better view of the game" and Seredynski, Jones, and Ferguson (1994, p. 667, fn 13) suggested a new facility will "attract crowds irrespective of team quality." For other discussions of the honeymoon effect see Austrian and Rosentraub (1997, p. 380), Baade & Sanderson (1997a, p. 96; 1997b, p. 461), and Noll & Zimbalist (1997, pp. 16-17).

[4] A similar argument applies to the financially beleaguered Buffalo Sabres. Since entering the league in 1970 the Sabres failed to make the playoffs only seven times.

[5] Edmonton, Hartford, Quebec, and Winnipeg entered the league from the WHA in 1979. Atlanta relocated to Calgary in 1980 and Colorado shifted to New Jersey in 1982. New arenas were built for New Jersey's first season and in 1983 for Calgary.

[6] See Cairns, Jennett and Sloane (1986) for a survey of past studies and Coffin (1996) for a more recent discussion.

[7] Demmert uses the number of years the team has been located in that city, up to a maximum of five. Coffin uses four minus the number of years, with zero after the fourth year.

[8] Expansion teams were formed in Anaheim, Atlanta (Flames), Buffalo, Florida, Columbus, Kansas City, Los Angeles, Minnesota (Northstars), Minnesota (Wild), Nashville, New York (Islanders), Oakland, Ottawa, Philadelphia, Pittsburgh, St. Louis, San Jose, Tampa Bay, Vancouver and Washington. The Cleveland Barons, which began as the Oakland Seals in 1967, folded operations in 1978. In total, the NHL expanded from six teams in 1966 to thirty teams in 2000.

[9] Teams relocated to Calgary, Carolina, Colorado, Cleveland, Dallas, New Jersey and Phoenix.

[10] For a summary of these studies see Leadley & Zygmont (2003).

[11] For dependent variables that are left censored at zero, the Tobit coefficients are multiplied by the normal distribution function at the value of the estimated equation, evaluated at the sample means of the dependent variables, divided by the estimated standard deviation of the error term. This simple method cannot be used in our model because the censoring value (arena capacity) varies from team to team and over time. An approximation used by McDonald and Moffit (1980) is the fraction of the observations that are not censored.