Using Revealed and Stated Preference Data to Estimate the Demand and Consumption Benefits of Sporting Events: An Application to National Hockey League Game Trips[1]

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Abstract: This paper examines the demand for hockey game trips among metropolitan and non-metropolitan residents of Alberta, Canada. Using data on both revealed and stated preference game trip behaviour from a telephone survey conducted throughout Alberta, we estimate the effect of ticket prices, team quality, arena amenities, and capacity on the latent demand for NHL hockey. We find that lower ticket prices, higher team quality and additional capacity encourage attendance. The base case consumer surplus per game is $50 for those who had attended hockey games and about 50% less for those who had not attended games. Exploiting the stated preference data, we develop a number of other consumer surplus estimates. We also include travel costs in the estimation of the demand function and estimate the full value of the game trip considering both ticket prices and travel costs. Sold out arenas in Calgary and Edmonton generate annual consumption benefits of $40 and $35 million. Considering the full price consumer surplus for the Calgary Flames of $103 per game trip, the annual consumption benefits may be as high as $82 million.

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1. Introduction

When the Baltimore Orioles moved from their 1950s-vintage home in Memorial Stadium to Oriole Park at Camden Yards in 1992, a new era in stadium and arena construction dawned in North American professional sports. The greatly enhanced premium seating, luxury suites, concessions, sight lines, and other amenities made possible by advances in architectural design and construction technology led to large increases in revenues for the Orioles. Teams in Major League Baseball (MLB), the National Football League (NFL), the National Basketball Association (NBA) and the National Hockey League (NHL) joined the rush to replace their now economically obsolete arenas and stadiums with their own version of Camden Yards. Of the 30 NHL teams, 24 have moved into new arenas since 1993, with another arena under construction and several under consideration.

Two teams that have not gotten new arenas are the Edmonton Oilers and the Calgary Flames, Alberta's two teams in the NHL. The Oilers continue to play in Rexall Place in suburban Edmonton, which opened in 1974. The Flames play in the Pengrowth Saddledome, dating from 1983. Both teams complain of a lack of space for luxury suites and other premium seating, as well as cramped facilities for concessions, placing them at a competitive disadvantage with other teams in the league (Kom, 2008; Mah, 2007).

Both the Oilers and the Flames have expressed a desire for new arenas, and conversations in Edmonton and Calgary are ongoing concerning where the new arenas would be sited and to what extent they would be publicly financed. This paper takes the opportunity presented by the possibility of new NHL arenas in Alberta to examine the demand for hockey game trips among residents of Edmonton, Calgary, and the rest of Alberta province. Using data on both revealed and stated preferences from a telephone survey conducted throughout Alberta, we estimate the

effect of ticket prices, team quality, arena amenities, and capacity on the latent demand for NHL hockey. Unlike most attendance studies, we measure private consumption benefits of new arenas, in the form of consumer surplus, to current and future game attendees. Furthermore, unlike the one previous study that econometrically estimated consumer surplus for game attendance (Irani, 1997), this paper includes data on travel costs in the estimation of the demand function, allowing an estimate of the full consumer surplus.

2. Literature Review

Economists have conducted many empirical analyses of the demand for attendance at sporting contests. Two studies in particular are relevant to this paper because they address the impact of new stadiums and arenas on season attendance. They confirm that the Orioles' experience with increased attendance and revenues was not a fluke. Zygmont and Leadley (2005) use a panel data set of season attendance spanning 1970-2000 in MLB to estimate the "honeymoon effects" of a new stadium on attendance and ticket prices, finding substantial positive effects on both that persist, with only modest declines, for 8 to 10 years. They conclude that a baseball-only stadium that replaces an older multipurpose stadium will generate an additional $228 million in ticket revenue over 15 years.

Leadley and Zygmont (2006) test for honeymoon effects in the NHL from 1970-2003 using Tobit analysis since the capacity constraint is usually binding in the NHL, unlike in MLB. For instance, during the 2007-08 season, eleven NHL teams achieved season attendance greater than or equal to 100 percent of seating capacity while the league as a whole filled 94 percent of its seats for the season. In MLB in 2007, only eight teams exceeded 90 percent, with one team at 100 percent capacity. The honeymoon effect in the NHL from 1994-2003, a period in which 21

new arenas opened, increased an NHL team's attendance by 15 to 20 percent and the honeymoon lasted eight years.

There have been many other attendance studies, most of them focusing on game-by-game attendance rather than season attendance. Baseball attendance has been studied more often than attendance in other sports, in part perhaps because capacity constraints are not usually binding in baseball. Among the many baseball articles are Bruggink and Eaton (1996), Kahane and Shmanske (1997), Butler (2002), Coates and Harrison (2005), and Donihue, Findlay, and Newberry (2007). Welki and Zlatopper (1994, 1999) estimate game-day attendance in the National Football League, while Price and Sen (2003) did so for Division I-A (now called the Football Bowl Subdivision) college football. Soccer attendance in European leagues has been the subject of studies by Garcia and Rodriguez (2002) and Czarnitzki and Stadtmann (2002), among others. Attendance at National Basketball Association (NBA) games has been estimated by Burdekin and Idson (1991), and attendance at NHL games by Paul (2003).

Despite the differences in locations, time periods and sports, the attendance studies have found broadly similar results. Most studies have found that ticket prices have a negative impact on attendance, though not always, and that except for Bruggink and Eaton (1996), demand tends to be inelastic with respect to price. The inelasticity of demand is surprising considering that the local monopolies usually enjoyed by professional sports teams should result in prices in the elastic portion of the demand. Many studies have also found that income affects demand, with sports more often than not being a normal good. However, in some cases, as in baseball (Bruggink and Eaton, 1996), a sport appears to be an inferior good, even as the same sport appears to be a normal good in other studies. Quality of competition consistently proves significant: the better the home team and its opponent, the higher the attendance.

Irani (1997) estimates a demand function for MLB using actual 1985 season attendance, as opposed to the usual game-by-game attendance, and ticket price data. Using his estimates to calculate the choke price for MLB tickets and integrating the estimated attendance function over the range of ticket prices, he calculates average annual consumer surplus of about $35 million (2007 dollars) per team (Irani, 1997). Alexander, Kern, and Neill (1999) calculate consumer surplus by assuming a constant elasticity demand function, and combining evidence of team revenues with assumptions about different demand elasticities. Not surprisingly, the amount of consumer surplus depends strongly on the value of the assumed elasticity. Alexander, Kern and Neill do not estimate any demand functions or price elasticities with attendance data.

Methods developed by environmental economists to measure the value of public and private benefits of consumption provide the means to improve upon the estimates of sports consumer surplus developed by Irani and Alexander, Kern and Neill. In this paper we use the travel cost method, which is a revealed preference method most often used to estimate recreation benefits (Smith and Phaneuf 2005), but it has also been used to estimate the benefits of other goods such as health care (Clarke 2002). The travel and time costs incurred to get to an activity site can constitute a major cost of participating in the recreation activity. Since individuals reside at varying distances from stadiums, the variation in distance and the number of trips taken can be used to estimate a demand function and derive the benefits of attendance and stadium characteristics. Revealed preference approaches are limited to the variation in historical experience. Forecasts beyond are often inaccurate or impossible.

Stated preference methods provide additional tools to estimate the benefits of sporting events and amenities. Stated preference approaches include the contingent valuation method (CVM) and the contingent behavior method (CBM). The CVM uses willingness to pay responses

to hypothetical situations to estimate benefits. Over the past decade or so, economists have extended the use of CVM to sports in order to estimate the use and nonuse values of sports public goods. In the seminal CVM sports article, Johnson and Whitehead (2000) surveyed respondents in Lexington, Kentucky who were asked whether and how much they would be willing to pay for a new basketball arena for the University of Kentucky and for a baseball stadium to attract a minor league team. For both projects, the nonmarket benefits fell short of the costs of constructing the new buildings.

Since Johnson and Whitehead (2000) there have been a number of CVM studies of sports public goods. Civic unity, community pride, improved racial relations, and topics of conversation are some of the public goods addressed by sports CVM studies covering the NFL, NBA, MLB, amateur participatory sports and the Olympics (Johnson 2008). Although the later CVM studies tend to find substantially larger values of sports public goods than did Johnson and Whitehead, peer reviewed sports CVM articles find in every case that the value of sports public goods fall short of the cost of constructing arenas, stadiums, and other venues.[3]

In contrast to the CVM, the CBM is a stated preference approach that directly elicits hypothetical behavior information from survey respondents. Respondents are asked about their behavioral responses to a hypothetical change. One strength of the CBM is its flexibility. Hypothetical choices may be the only way to gain policy-relevant behavior information about situations where revealed preference data are not available. Yet, the major weakness of the CBM

[3] Other methods that have been or could be used to value sports amenities include the hedonic price method (Carlino and Coulson 2004; Coates, Humphreys and Zimbalist 2006, Carlino and Coulson 2006), public referenda (Coates and Humphreys 2006) or a combination of the two (Dehring, Depken and Ward 2008).

approach is its hypothetical nature. Respondents face unfamiliar situations with incomplete information. To date, the CBM has not been applied to sports attendance behavior.

The combination and joint estimation of revealed and stated preference data exploits the contrasting strengths of the alternative approaches while minimizing their weaknesses (Whitehead et al. 2008). Stated preference data allow analysis of behavior beyond the range of historical experience. In many cases, hypothetical choices may not reflect budget, and other, constraints on behavior. For example, in a contingent behavior survey respondents may answer a hypothetical game trip question with their good intentions of buying season tickets and going to every game. Yet, when they must make real choices, they confront unexpected constraints on time and income and make fewer game trips. Combining revealed preference and stated preference data allows mitigation of the bias associated with hypothetical choices present in stated preference data. Grijalva et al. (2002) and Whitehead (2005) find evidence that jointly estimated revealed and stated preference models generate valid predictions of future behavior.

In contrast to previous research valuing sports-related goods and services that rely solely on revealed preference data or the CVM, we jointly estimate a demand model using revealed and stated preference data. In the rest of the paper we summarize the survey data, describe the empirical methods and present the empirical results. Conclusions follow.

3. Survey Data

A telephone survey conducted during late 2007 and early 2008 collected revealed preference and stated preference data. A random sample frame of telephone numbers for the Edmonton and Calgary metropolitan areas and for the rest of Alberta was generated. The initial screening questions selected either a male or female potential respondent age 18 years or older. Based on pre-established quotas data were collected from 937 people (Edmonton, n = 339;

Calgary, n = 331; nonmetropolitan Alberta, n = 267). In order to meet the quota requirements, 6764 telephone numbers were called, with 1610 of these numbers being excluded for technical reasons (e.g., not in service, busy/no answer), and another 2346 numbers being excluded for non-eligibility and other reasons (e.g., business fax, less than 18 years of age, unable to speak English). Another 1871 people refused to participate, resulting in an overall response rate of 33 percent (i.e., 937 / [937 + 1871]).

The study instrument consisted of a Computer-Assisted Telephone Interviewing questionnaire that included a description of a new downtown hockey arena with various features:

> *Suppose the Flames/Oilers decide to build a new, state-of-the-art hockey arena [in a complex that would also include affordable housing, arts and cultural space including galleries, theatres and museum space, and a casino] in downtown Calgary/Edmonton to replace the Pengrowth Saddledome/Rexall Place. [Suppose environmentally friendly materials and design will be used]. Some people say that building the arena, [housing, cultural complex, and casino] downtown would improve the quality of life in Calgary/Edmonton more than building it in the suburbs.*

Respondents in the Edmonton and Calgary surveys received various combinations of arena characteristics ranging from a new arena with no additional characteristics and an arena with four additional characteristics (green design, affordable housing, cultural complex and a casino).

The revealed preference data are based on hockey game trips that actually occurred during the 2006-07 season. The stated preference data are based on future hockey game trips under various hypothetical conditions. The stated preference data are used to simulate a change in demand resulting from changes in the quality of the hockey game experience, increased seating availability and changes in ticket prices (see Appendix). Stated preference questions

asked about future trips to the current arena: (1) with an expected first place finish, (2) with an expected last place finish and (3) with an expected third place finish. Questions were then asked about future trips to a new downtown arena with additional upper level seating and a third place finish: (1) with a $15 ticket price decrease from the lowest walk up ticket price, (2) with a $25 ticket price decrease from the lowest walk up ticket price, and (3) with a $5 ticket price decrease from the lowest walk up ticket price. The combined revealed and stated preference pseudo-panel data has seven observations for each respondent.

Respondents in the Edmonton and Calgary surveys were asked questions about Oilers and Flames games, respectively. Respondents in the nonmetropolitan Alberta survey were asked about how often they visit Calgary and Edmonton. Respondents who visit Calgary more often are considered in the Flames market and asked questions about trips to Flames games. Respondents who visit Edmonton more often are considered in the Oilers market and asked questions about trips to Oilers games. Respondents were also asked how long it usually takes to get to Calgary and Edmonton. The average number of hours traveled is 4 to Calgary and 3 to Edmonton. Seventy-two percent of nonmetropolitan Alberta respondents visit the city with the lowest travel time more often. Hours traveled is converted to distance traveled assuming an average speed of 75 kilometres per hour.

Of the 937 completed interviews, we discard those cases with no response to the stated preference attendance and other key questions. We employ a sample of 828 respondents. Table 1 presents a summary of the game trip dependent variable. Based on preliminary analyses that showed the hockey game trip demand functions differed by team market and by whether the respondent had attended a game during the past season, we present the data in terms of four subsamples: (1) Flames market respondents who attended a game during the 2006-07 season

(n=133); (2) Flames market respondents who had not attended a game (n=246); (3) Oilers market respondents who had attended a game (n=148); and (4) Oilers market respondents who had not attended a game (n=301). Those in the Flames market who had attended at least one game attended an average of 5 games during the past season (5.19 in Table 1; we report rounded values in the text). Those in the Oilers market who had attended at least one game attended an average of 4 games during the past season.[4]

In each subsample a similar pattern appears in each hypothetical scenario. Under the current arena and price scenario, respondents state they would attend about the same number games regardless of the team's expected finish. Those in the Flames market who had attended at least one game said they would attend an average of 7, 6 and 6 games during the future season with an expected team finish of first, fifth and third. Those in the Oilers market who had attended at least one game said they would attend an average of 6, 5 and 5 games during the future season with an expected team finish of first, fifth and third. Those in the Flames and Oilers markets who had not attended at least one game said they would attend between zero and one games during the future season with an expected team finish of first, fifth and third.

With a new arena and lower ticket prices, respondents who had attended a game during the past season said that their future attendance would roughly double. Those in the Flames market would attend an average of 10, 13 and 9 games during the future season with upper level ticket prices of $20, $10 and $30. [5] Those in the Oilers market said they would attend an average

[4] National Hockey League teams host 41 regular season games each season.

[5] This issue is complicated when you consider that many of the seats in the upper deck at the Saddledome have obstructed views. This helps to explain why the cheapest ticket price in Calgary is so much lower than in Edmonton. It also might influence buying preferences, as some

of 8, 9 and 6 games during the future season with upper level ticket prices of $30, $20 and $40. With a new arena and lower ticket prices, respondents who had not attended a game during the past season said that their future attendance would also increase significantly. Those in the Flames market would attend an average of 2, 3 and 1 games during the future season with upper level ticket prices of $20, $10 and $30. Those in the Oilers market said they would attend an average of 1, 2 and 1 games during the future season with upper level ticket prices of $30, $20 and $40.

Table 2 presents descriptive statistics for the independent variables. The actual ticket price paid by Flames and Oilers game attendees is $82 and $78, respectively. Average ticket prices paid for Flames and Oilers games range from $11 to $300 and $20 to $179 suggesting that the reported price paid includes secondary market purchases. Several differences across subsamples emerge. The average travel cost is $26 and $40 for Flames and Oilers attendees and $44 and $66 for non-attendees suggesting that travel distance is a factor in the game trip decision.[6] The average household income is $110 thousand and $77 thousand for Flames

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fans might not even consider going to games at the current Saddledome because of poor sightlines, but would with a new arena (with clear viewing). Thus even though there might not be any more seats in a new arena, it might be seen as an increase in capacity for some fans who want seats with a good view of the game.

[6] Travel cost is computed as $c = \alpha d + (\theta y / h)(d / mph)$, where α is the average cost per mile (including gas, oil and depreciation), d is round-trip distance, θ is the opportunity cost of time, $0 < \theta < 1$, y is household income, h is annual work hours, and mph is average miles per hour. We use the following standard values: $\alpha = 0.32$, $\theta = 0.33$, $h = 2000$ and $mph = 75$ k/h.

attendees and non-attendees.[7] Average household income is $94 thousand and $71 thousand for Oilers attendees and non-attendees. This comparison suggests that respondent ability to pay may be a factor in the game trip decision. In both markets male respondents are more likely to attend games. Sixty-three percent of respondent attendees are male in the Calgary market and 59 percent are male in the Edmonton market. Non-attendees are 43 percent male and 39 percent male in the Calgary and Edmonton markets. Game attendees average 43 years of age in both markets, while non-attendees are 50 and 52 in the Calgary and Edmonton markets.

Perhaps because the Pengrowth Saddledome is near downtown Calgary while Rexall Place is in the suburbs, a higher proportion of Flames attendees live and work downtown than Oilers attendees. This is further evidence that travel costs may affect attendance decisions. Among Flames and Oilers attendees, 8 percent and 2 percent live downtown, 25 percent and 13 percent work downtown, and 69 percent and 56 percent own property in the metro area. Among Flames and Oilers non-attendees, 6 percent and 5 percent live downtown, 11 percent and 11 percent work downtown, and 50 percent and 48 percent own property in the metro area. Fourteen percent of Flames attendees and 25 percent of Oilers attendees are from the rest of Alberta. Thirty percent and 35 percent of Flames and Oiler respondent non-attendees are from the nonmetropolitan survey.

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[7] Sixteen percent of the income variables are imputed using an income regression that has an R^2 value of .27. In this model income increases with education and age (at a diminishing rate). Income is higher for males, married respondents, and metro respondents (relative to rural Albertans).

Other variables show little difference across subsamples. Between 65 percent and 73 percent of each subsample are married. The average number of years of schooling is 14. The average number of years lived in the city is between 17 and 21.

4. Empirical Model

The Poisson regression model is often used to study count data such as numbers of recreation trips (Haab and McConnell, 2003). Assume that x_{it} is the number of hockey game trips taken by individual *i* in scenario *t*, which is drawn from a Poisson distribution with mean λ_{it}:

$$\Pr(x_{it}) = \frac{e^{-\lambda_{it}} \lambda_{it}^{x_{it}}}{x_{it}!}, x_{it} = 0,1,2,... \tag{1}$$

The natural log of the mean number of game trips is assumed to be a linear function of prices, income and scenario dummy variables. To allow for variation across hockey fans that cannot be explained by the independent variables, we assume that the mean number of trips also depends on individual specific and random error. The Poisson demand model is:

$$\ln \lambda_{it} = \beta_0 + \beta_{p^R} p_{it}^R + \beta_p p_{it}^S + \beta_c c_i + \beta_y y_i + \beta_{RP} RP + \delta' Z + \gamma' D + \mu_i + e_{it} \tag{2}$$

where p^R is the revealed preference ticket price (p^R=0 if x = 0), p^S is the stated preference ticket price, c is the round trip travel cost to the hockey arena, y is income, *RP* is a revealed preference dummy variable; $\beta, \delta,$ and γ are coefficients (vectors) to be estimated; μ_i is the random effect for group (person) *i* and e_{it} is a mean zero error term. Individuals are indexed *i* = 1, …, *n*, and *t* = 1, …, 7 denotes seasonal hockey game trip demand in the pseudo-panel data. *Z* is a vector of scenario design variables (i.e., new arena, arena characteristics) and *D* is a vector of demographic characteristics. The *RP* dummy variable is included to test for bias in hypothetical responses: *RP* = 1 for revealed preference trip data (t = 1) and 0 for stated preference trip data (t > 1). Pooling

the data suggests that panel data methods be used to account for differences in variance across sample individuals, *i*, and scenarios, *t*. The distribution of trips is Poisson with conditional mean and variance, λ_{it}. If $\exp(\lambda_{it})$ is assumed to follow a gamma distribution, then the unconditional trips, x_{it}, follow a negative binomial distribution (Hausman, Hall, and Griliches 1984).

With the semi-log functional form price, travel cost and income elasticities are $e_p = \beta_p \overline{p}^S, e_c = \beta_c \overline{c}, e_y = \beta_y \overline{y}$. The full price elasticity is the weighted average of the price and travel cost elasticity

$$e_{pc} = e_p \theta_p + e_c \theta_c \tag{3}$$

where $\theta_k = \dfrac{k}{p+c}$, $k = p, c,$ is the ticket price and travel cost share of the full price.

With the semi-log functional form the economic benefit per hockey game for the representative hockey fan as measured by average consumer surplus (*CS*) per game in the ticket market is (Bockstael and Strand 1987):

$$\frac{CS_p}{x} = -\frac{1}{\beta_p}, \tag{4}$$

The economic benefit per hockey game trip is a weighted average of the ticket price and travel cost consumer surplus

$$\frac{CS_{pc}}{x} = -\left(\frac{1}{\beta_p}\theta_p + \frac{1}{\beta_c}\theta_c\right) \tag{5}$$

The economic benefit of a change in the hockey experience per game measured by the jth scenario design variable ΔZ_j and evaluated in the ticket market is:

$$\frac{\Delta CS_p(\Delta Z)}{x} = -\frac{\delta_Z \Delta Z}{\beta_p}. \tag{6}$$

where δ_{Z_j} is the regression coefficient on the jth scenario design variable. The economic benefit of a change in the hockey experience per hockey game trip is a weighted average of the change in ticket price and travel cost consumer surplus

$$\frac{\Delta CS_{pc}(\Delta Z)}{x} = -\left(\frac{\delta_Z \Delta Z}{\beta_p} \theta_p + \frac{\delta_Z \Delta Z}{\beta_c} \theta_c \right) \tag{7}$$

Equations (5) and (7) diverge from equations (4) and (6) with statistically significant coefficients on the travel cost coefficients. If the travel cost coefficient is statistically insignificant then that term drops out of the consumer surplus equation.

5. Empirical Results

Table 3 presents the random effects Poisson coefficient estimates for the Calgary Flames and Edmonton Oilers markets. The models include the revealed preference ticket price as an independent variable. Each model contains a dummy variable for the new arena scenario and the new arena dummy interacted with the nonmetropolitan sample (this is the only variable that indicates different behavior across metropolitan and nonmetropolitan samples). Team finish and dummy variables for arena features, green design and construction, affordable housing, a casino and a cultural complex are included. Each of the arena features dummy variables are coded as zero for the nonmetropolitan sample since those respondents were not asked the arena scenario questions. In addition, dummy variables for the revealed preference scenario, gender and marital status are included. Other variables included in the model are continuous: household income, age and years of schooling. Other variables in Table 1 are omitted from the demand models due to multicollinearity or statistical irrelevance.

We split each market into those who had revealed a preference for hockey games during the 2006-07 season (attendees) and those who had not (non-attendees).[8] The random effects Poisson coefficient estimates for each market and attendees and non-attendees subsamples are presented in Table 3. In each of the attendee models, the revealed preference coefficient is negative and significant. There are two interpretations of this result. First, it might indicate hypothetical bias. In the hypothetical scenarios respondents said that they would like to attend more games than they are actually able to attend. The second interpretation is that this result measures latent demand at the current seating capacity and ticket prices. Respondents would like to attend more games but game sell-outs constrain their behavior.

5.1 Prices and Income

The effect of revealed preference ticket price on the number of games attended is ambiguous since current game trips are quantity constrained, ticket price reflects quality and ticket price is partially endogenous as an increasing function of income. In each model the actual ticket price coefficient is not significantly different from zero. The coefficient on the stated preference price variable is negative and statistically significant, as expected. Demand is inelastic across markets: $e_p = -0.57$ for Calgary and $e_p = -0.77$ for Edmonton.[9] The coefficient on the

[8] See the Appendix for an analysis of demand models with attendees and non-attendees combined.

[9] Economic theory indicates that each dollar of cost should be considered equivalently by consumers, suggesting that ticket price and travel cost should be added together to form a single cost variable. However, model performance is superior with these variables entered separately. This suggests that consumers respond differently to the two types of cost. Perhaps, the travel cost variable is capturing the cost of multi-purpose trips. In addition to a hockey game, respondents

travel cost variable is negative and statistically significant in the Calgary attendee model. The travel cost elasticity is $e_c = -0.10$ for Calgary and the full price elasticity is $e_{pc} = -0.45$ in the Calgary attendee model.[10] The coefficient on the income variable is positive and statistically significant in the Edmonton attendee model. The income elasticity is $e_y = 0.78$. Other price and income coefficients are not statistically significant. In each non-attendee model the coefficient on the stated preference price variable is negative and statistically significant. Demand is elastic: $e_p = -1.25$ for Calgary and $e_p = -1.78$ for Edmonton. The coefficient on the travel cost and income variables are statistically insignificant in each non-attendee model.

5.2 Capacity

In each model, a new downtown arena with plenty of upper level seats would increase attendance in three of the four models, especially for the nonmetropolitan Alberta in three of the four models. According to the marginal effects[11], Flames attendees and non-attendees would go to two more games each year. Fifty-six percent of Oilers non-attendees would attend one more game each year. Those from nonmetropolitan Alberta in the Flames market that already attend games would attend an additional three games in addition to the two suggested by the NEWARENA coefficient each year. Those from the rest of Alberta in the Oilers market that already attend games would also attend an additional three games each year in a new downtown arena.

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could also enjoy shopping or dining in the area. In this case we would expect the travel cost elasticity to be less than the ticket price elasticity.

[10] The market price and travel cost weights are 0.75 and 0.25 respectively.

[11] Marginal effects are not reported in Table 3.

5.3 Other Results

In each model, an improvement in the standings would increase attendance. According to the marginal effects, 47 percent and 21 percent of Flames attendees and non-attendees would go to one additional game with a one-place improvement in standings; as would 26 percent and 30 percent of Oilers attendees and non-attendees. Flames attendees would go to five fewer games each year if the new arena also included a cultural complex. No other arena design features affect attendance. In terms of demographic variables, older respondents attend fewer games. For Oilers attendees, males attend two more games, married respondents attend almost three fewer games and each two years of schooling reduces attendance by one game. Oilers non-attendees would go to one additional game if the new arena contained a casino.

6. Benefits

The demand models in Table 3 provide the basis for consumer surplus estimates in Table 4. All of the consumer surplus values are obtained from the stated preference price coefficient. We use the demand slope based on the variation in stated preference prices with a new arena, which are lower than what most attendees paid for their tickets, to extrapolate the demand curve to the choke price. To the extent that this extrapolation is inaccurate, the consumer surplus results are inaccurate.

6.1 Consumer Surplus per Game

The base case consumer surplus per game is $50 for both the Flames and Oilers attendees ($50.37 and $50.14 in Table 4[12]) and $23 and $22 for Flames and Oilers non-attendees. That attendee consumer surplus exceeds that for non-attendees makes theoretical sense as the willingness and ability of non-attendees to pay for a game is lower according to the revealed

[12] Consumer surplus numbers reported in the text are rounded.

preference of non-attendance.

Consumer surplus per game may be an underestimate of the total value of the game trip for all consumers. The full value of the game trip is the consumer surplus of a game trip considering both ticket prices and travel costs. The only statistically significant coefficient for travel cost is for game attendees in the Flames market. The full price consumer surplus per game trip, $103, is weighted by the dollar shares of the different costs. However, interpretation of the full price consumer surplus per game trip is complicated by the possibility of multi-purpose trips. Since the travel cost coefficient is statistically insignificant in the other three models we do not further discuss its effect on the value of game trips until the conclusions, except to note that consumer surplus per game estimates do not include these values.

Under the latent demand interpretation of the revealed preference dummy variable – indicating that respondents would attend more games if seats were available – the consumer surplus for attendees is $9 per game and $11 for each additional Flames and Oilers game with the current arena and ticket prices, assuming the respondent could obtain a ticket. This result makes intuitive sense as additional games are subject to diminishing returns and should be expected to generate lower value.

The consumer surplus of each additional game in a new downtown arena is $12 and $45 for Flames attendees and non-attendees residing in Calgary, and $0 and $16 for Oilers attendees and non-attendees living in Edmonton. In nonmetropolitan Alberta the consumer surplus of each additional game in a new downtown arena is $29 and $36 for Flames attendees and non-attendees, and $21 and $30 for Oilers attendees and non-attendees. The quality factor can be interpreted either as an increase in perceived value of games in a new arena with additional

amenities or, in the case of Edmonton, that the downtown location is preferred due to more convenience or proximity to additional downtown amenities.

The bandwagon effect is evident in that each additional place in the standings is worth $3 and $6 in additional consumer surplus per game to Flames attendees and non-attendees, and $2 and $8 to Oilers attendees and non-attendees. Adding a casino to a new downtown arena would increase consumer surplus by $30 per game for current Oilers non-attendees. But, perhaps indicating that artistic culture and sport do not mix (Johnson et al., 2008), adding a cultural complex to a new arena in Calgary would reduce consumer surplus per game by $31 for Flames attendees.

6.2 Consumer Surplus per Season

Combining the marginal effects (trip) estimates with the consumer surplus per game estimates provides estimates of the change in consumer surplus per season. Considering the base case without additional travel costs or higher ticket prices, Flames fans who attend an average of 5 games enjoy consumer surplus of $261 over the course of the season. Oilers fans who attend an average of 4 games enjoy consumer surplus of $193 per season. Flames and Oilers fans who attend games would enjoy an additional $13 and $14 per season, if seats were always available.

With a new arena Flames attendees and non-attendees and Oilers non-attendees in the metropolitan area would enjoy an additional $23, $75 and $9 in consumer surplus over the course of the season. Similarly, with a new arena Flames attendees and non-attendees, and Oilers attendees and non-attendees from nonmetropolitan Alberta would enjoy an additional $136, $48, $56 and $32 in consumer surplus over the course of the season. Since the impact on consumer surplus of a rise in the standings affects all games attended, not only the increase in games, the seasonal effect on consumer surplus is the product of the change in consumer surplus per trip and

the sum of baseline trips and the marginal effect of a change in the standings. Flames attendees and non-attendees would enjoy $14 and $27 in additional consumer surplus during the season, while Oilers attendees and non-attendees would get an additional $11 and $41 for a one unit rise in the standings. Assuming the value of games attended with a new arena is also affected, the cost of a cultural complex to Flames attendees is $53 in lost consumer surplus over the course of the season. The benefit of a casino to current Oilers non-attendees is $46 in additional consumer surplus over the course of the season.

6.3 Policy Implications

Our results can inform policy makers considering arena subsidies: do the consumption benefits of a new arena justify the cost? There are a number of alternative scenarios for the consumption benefits and we consider one. Suppose the new arena reaches the maximum NHL capacity of 21,273 seats and the additional seats are filled with current nonattendees. The per game consumer surplus for additional seats in a new arena is $45 and $16 for those metropolitan residents in the Calgary and Edmonton markets who do not currently attend games. Forty-one home sellout games would generate additional annual consumer surplus of $3.6 million and $2.8 million in Calgary and Edmonton. We consider two alternative discount rates: 2 percent and 7 percent. With a 2 (7) percent discount rate and benefits accruing for 30 years, the present value of consumer surplus is $82 ($48) million and $64 ($37) million in Calgary and Edmonton. An average new NHL arena costs between $275 million and $400 million. Therefore, the consumption benefits of new seating for the Flames and Oilers do not appear to justify a new downtown arena funded entirely with public funds.

However, the Calgary Flames generate additional consumption benefits. Current metropolitan attendees in the Calgary Flames market would enjoy an additional $12 in consumer

surplus per game in a new arena. At current arena capacity over 41 home games, the annual benefits are $9.5 million. Discounted at 2 (7) percent over 30 years, the present value to existing attendees of a new arena is $217 ($126) million. The present value of consumption benefits to existing and new Flames consumers is $299 ($174) when discounted at 2 (7) percent over 30 years. When benefits are discounted at 2 percent the present value of benefits exceed the lower end of the arena cost range by $24 million. Also, the full consumer surplus of Flames game trips based on ticket prices and travel costs are about twice as high as the consumer surplus per game based on ticket prices alone. The present value of net benefits of a new Flames arena would be even higher if the full consumer surplus is used.

7. Conclusions

This paper is the first to estimate game trip demand functions for individual sports fans using microdata. Because capacity constraints are often binding in the NHL, estimation of individual hockey demand functions using revealed preference data alone would be difficult, even if individual level microdata were available. The results show that hockey fans who already attend games would buy more tickets each year if seats were available at lower prices. The results also show that fans are sensitive to team quality, and that each rung a team climbs in its divisional standings will increase game trip demand. We include travel costs as an additional variable to explain demand behavior and find some evidence that it is a significant determinant of game attendance. The full price consumer surplus per game trip is twice as great as the consumer surplus per game.

Binding capacity constraints have a large impact on the number of games attended by metropolitan fans of the Calgary Flames, imposing a large deadweight loss. Capacity constraints also have a large effect on nonmetropolitan Alberta residents in both markets. These results

suggest the benefits of new arenas in Calgary and Edmonton would accrue to a large extent to non-metropolitan residents. That the capacity constraints could impose such large welfare costs may seem surprising, but other evidence is consistent with this conclusion. For instance, the average ticket prices in Calgary and Edmonton were among the highest in the NHL during the 2008-09 season, according to Team Marketing Report, a firm that compiles ticket price data for professional sports teams. The high ticket prices and sold out seasons, along with the fact that Calgary and Edmonton are among the smallest metropolitan areas in the NHL, are evidence of a high per capita demand for hockey tickets, consistent with the survey responses and estimated demand functions in this paper.

Stadium and arena complexes built or proposed in the past decade have increasingly included features and amenities far beyond the actual sports building. Petco Field, a baseball stadium in San Diego, and Nationwide Arena, a hockey arena in Columbus, Ohio, are the anchors of development districts including housing, entertainment, and other features. Proponents of stadiums and arenas as tools for urban revitalization often argue that sports venues alone cannot succeed in transforming decaying urban districts. Other types of development, together with a stadium or arena, they say, can bring round the clock activity and life to a downtown or other depressed neighborhood (Rosentraub, 2008).

We find that features such as housing, arts and cultural space, and casinos in arena development projects would have little effect on the demand for hockey tickets in Calgary and Edmonton, with two exceptions. Demand for hockey by Calgarians who already attend games would fall if a new arena complex included arts and cultural space, while demand for Oilers tickets by non-Edmontonians would rise substantially if a casino were built alongside a new arena. That non-sports features mostly have no effect on demand for hockey, and may even

decrease the demand for hockey, suggests that increased consumer surplus of hockey fans cannot be considered a benefit of diversity in development projects. However, these additional features may attract non-hockey fans to the development complex.

The results of the base case annual consumer surplus estimation in this paper, based on individual demand functions estimated from both revealed and stated preference data, are broadly consistent with the estimates of annual consumer surplus from Major League Baseball developed by Irani (1997). Using the full consumer surplus of a new arena for the Calgary market suggests that the efficient outcome is to build the arena. However, since the benefits would accrue to the fans attending games rather than to the public at large, and because the Flames could finance much of the cost by extracting additional consumer surplus, it would be difficult to use the increased consumer surplus to justify a public subsidy.

Future research should investigate more detailed hypothetical scenarios to determine the sensitivity of our results to survey design. New stadiums and arenas incorporate many advances in construction technology and architectural design that result in higher demand for tickets. Better sightlines, more restrooms, restaurants and concession stands made easily accessible by wide aisles and concourses make for more comfortable environments for spectators. Such improvements mean that, at least in the honeymoon period, fans are willing to buy more tickets at higher prices. The hypothetical scenarios presented in the surveys in Alberta did not mention such amenities. Perhaps respondents assumed such amenities, common in new arenas, would be included. But to the extent they did not, the potential gains to consumer surplus from a new arena might be different than the gains estimated in this paper.

Previous nonmarket valuation methods, such as the CVM, applied to sports public goods have been used in isolation from others. Future research should use multi-methods and consider

the convergent validity of consumer surplus estimates. For example, a comparison study between the hedonic pricing method, contingent valuation method and travel cost method could be designed to estimate the benefits of sports teams to a city. If the consumer surplus estimates converge, or diverge for theoretical or methodological reasons, then confidence in the individual estimates is enhanced.

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Table 1. Dependent Variables—Games Attended in Various Scenarios

	Scenario		Calgary Flames				Edmonton Oilers			
			Attend = 1		Attend = 0		Attend = 1		Attend = 0	
Arena	Price (Flames, Oilers)	Finish	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Old	RP*	3, 5	5.19	7.85	0.00	0.00	3.84	4.42	0.00	0.00
Old	35, 45	1	7.08	11.86	0.27	0.80	5.76	9.10	0.57	2.85
Old	35, 45	5	5.62	10.53	0.13	0.66	4.87	10.42	0.23	0.91
Old	35, 45	3	5.95	10.31	0.19	0.70	4.97	7.86	0.32	0.97
New	20, 30	3	10.47	13.52	1.67	5.20	7.85	12.77	1.44	4.12
New	10, 20	3	13.30	15.59	2.68	7.34	9.48	13.54	2.10	5.57
New	30, 40	3	8.99	12.19	1.13	3.62	6.35	8.28	0.81	1.65
Cases			133		246		148		301	

*Revealed preference during 2006-07 season.

Note: The mean figures show the average number of games attended in various scenarios. Those in Row 1 are the average games actually attended, according to revealed preference responses. Those in Rows 2-7 are stated preference averages under scenarios that differ according to whether the arena is old or new, ticket prices and divisional finish. The responses in each of the two markets are broken down among those who attended games in 2006-07 (Attend = 1) and those who did not (Attend = 0).

Table 2. Independent Variables

		Calgary Flames				Edmonton Oilers			
		Attend = 1		Attend = 0		Attend = 1		Attend = 0	
Variable	Description	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
RP-PRICE	actual ticket price	82.08	35.87	-	-	78.33	23.50	-	-
TRAVCOST	travel cost to downtown	26.36	67.45	43.75	65.76	39.47	57.68	59.87	83.35
INCOME	household income ($1000s)	110.86	35.23	77.30	36.99	93.78	38.09	70.57	39.30
MALE	1 if male	0.63	0.48	0.43	0.50	0.59	0.49	0.39	0.49
MARRIED	1 if married	0.73	0.45	0.65	0.48	0.72	0.45	0.71	0.45
AGE	age of respondent	42.83	13.66	50.15	15.25	43.28	14.49	51.68	16.46
EDUC	years of schooling	14.50	2.10	14.11	2.22	13.84	2.12	13.73	2.59
LIVE	1 if lives in downtown	0.08	0.26	0.06	0.24	0.02	0.14	0.05	0.22
WORK	1 if works in downtown	0.25	0.43	0.11	0.31	0.13	0.34	0.11	0.31
PROPERTY	1 if owns property in the area	0.69	0.46	0.50	0.50	0.56	0.50	0.48	0.50
TENURE	length of time at residence	19.95	16.09	17.18	17.40	20.31	17.91	21.24	21.57
ALBERTA	1 if Alberta survey	0.14	0.34	0.30	0.46	0.25	0.43	0.35	0.48
Cases		133		246		148		301	

Table 3. Random Effects Panel Data Poisson Model: Hockey Game Attendance Demand (Attendee vs. Non-attendee)

	Calgary Flames				Edmonton Oilers			
	Attend = 1		Attend = 0		Attend = 1		Attend = 0	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
Constant	4.153	4.38	0.990	0.46	3.335	3.69	3.363	1.79
RP	-0.177	-6.06			-0.214	-5.47		
RP-PRICE	0.002	0.66			0.005	1.03		
SP-PRICE	-0.020	-15.66	-0.044	-23.12	-0.020	-10.63	-0.046	-14.60
TRAVCOST	-0.004	-2.52	-0.001	-0.20	-0.001	-0.61	0.002	0.51
NEWARENA	0.237	9.80	1.943	28.86	0.004	0.13	0.718	9.41
NEWARENA x ALBERTA	0.341	11.35	-0.387	-3.16	0.420	19.14	0.663	7.68
FINISH	-0.058	-7.81	-0.241	-2.95	-0.043	-4.90	-0.386	-11.90
INCOME	0.001	0.26	0.006	0.89	0.007	2.26	-0.003	-0.62
MALE	0.051	0.26	0.069	0.14	0.334	1.63	0.404	1.09
MARRIED	0.230	0.82	0.415	0.73	-0.421	-1.86	-0.031	-0.06
AGE	-0.019	-2.32	-0.034	-2.26	-0.014	-1.81	-0.047	-3.23
EDUC	-0.083	-1.24	-0.001	-0.01	-0.079	-1.74	0.003	0.03
GREEN	0.271	1.16	0.261	0.37	-0.045	-0.17	-0.335	-0.71
CASINO	0.225	0.75	-0.082	-0.10	-0.024	-0.08	1.362	2.00
HOUSING	0.285	0.86	0.243	0.33	-0.172	-0.61	-0.075	-0.13
ARTS	-0.616	-1.90	-0.607	-0.74	0.347	1.17	0.876	1.29
α	1.185	5.93	5.591	7.57	0.914	7.89	4.731	7.88
LL	-2733		-1198		-2703		-1508	
Cases	133		246		148		301	
Periods	7		7		7		7	

Table 4. Consumer Surplus Estimates

	Calgary Flames				Edmonton Oilers			
	Attend = 1		Attend = 0		Attend = 1		Attend = 0	
Consumer Surplus (CS) per Game (X)	CS/X	t-stat	CS/X	t-stat	CS/X	t-stat	CS/X	t-stat
Base Case	50.37	15.66	22.92	23.12	50.14	10.63	21.71	14.60
Change in CS per Game	ΔCS/X	t-stat	ΔCS/X	t-stat	ΔCS/X	t-stat	ΔCS/X	t-stat
With current arena	8.89	5.34			10.75	4.30		
With new arena for metro residents	11.92	6.14	44.52	14.84	0.22	0.13	15.59	5.84
With new arena for Alberta residents	29.10	8.37	35.66	10.29	21.30	6.07	29.98	7.58
Additional place in standings	2.95	6.38	5.52	2.85	2.14	5.18	8.37	8.89
With new arena and green design	13.65	1.17	5.97	0.37	-2.26	-0.17	-7.26	-0.71
With new arena and casino	11.35	0.75	-1.87	-0.10	-1.20	-0.08	29.58	1.95
With new arena and affordable housing	14.37	0.85	5.58	0.33	-8.62	-0.62	-1.63	-0.13
With new arena and cultural complex	-31.01	-1.87	-13.91	-0.74	17.41	1.18	19.02	1.29

Appendix

This appendix provides the telephone survey questionns used to elicit revealed and stated preference data for the Calgary Flames games. Similar questions were used for the Edmonton Oilers games.

The next few questions are about your attendance at Calgary Flames games.

C1. How many Calgary Flames games did you attend during the 2006-07 season?

_____games IF zero, skip to C3.

C2. About how much do you usually pay for your Flames tickets?

_____ Dollars

C3. Suppose the Flames are expected to finish first in their division and challenge for the Stanley Cup this season. About how many Flames games would you plan to attend in Calgary this season?

_____ games – if zero, go to C6

C4. Now suppose that the Flames are expected to finish last in their division. About how many Flames games would you plan to attend in Calgary this season?

_____ games

C5. Now suppose that the Flames are expected to finish third in their division and make the playoffs this season. About how many Flames games would you plan to attend in Calgary this season?

_____ games

C6. Suppose that the Flames build a new professional hockey arena [+ casino, affordable housing, cultural complex] in downtown Calgary. The new arena will have additional upper level seating with unobstructed views and luxury suites. For these questions,

please assume that your personal situation stays the same. For example, you have the same job, income and family situation. Also assume that the Flames are expected to finish third in their division and make the playoffs. OK?

C7. If other ticket prices don't change at the new arena and there are plenty of additional upper level seats with unobstructed views available at a price of $20 per game, how many Flames games would you plan to attend in the new downtown Calgary arena during the season?

_____ games

C8. If the tickets for the additional upper level seats with unobstructed views are available at a price of $10 per game, how many Flames games would you plan to attend in the new downtown Calgary arena during the season?

_____ games

C9. If the tickets for the additional upper level seats with unobstructed views are available at a price of $30 per game, how many Flames games would you plan to attend in the new downtown Calgary arena during the season?

_____ games