

# **The Relation between New Arenas and Gate Receipts in the National Hockey League**

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## **Abstract**

This study examines the relation between the attributes of National Hockey League (NHL) arenas and gate receipts generated by NHL clubs over a period spanning the 1989/1990 through 1997/1998 NHL seasons. We find that the annual gate receipts of eight established NHL clubs increased on average by 47% after they moved into new arenas during the 1990s. This increase greatly exceeds a corresponding increase of 17% for other NHL clubs over the same period. These results hold after controlling for other factors that affect gate receipts, including the quality of clubs, the population and per capita income of a club's metropolitan area, and a time trend variable. We estimate that a new arena with the average number of luxury and club seats of other new arenas would increase the gate receipts of the Pittsburgh Penguins by approximately \$6 million per season in constant 1997 dollars. In short, this study documents that new arenas have a substantial effect on the revenues of NHL clubs.

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## **The Relation between New Arenas and Gate Receipts in the National Hockey League**

### **1. Introduction**

Earlier this year, the Katz Graduate School of Business was engaged by the Pittsburgh Penguins to estimate the effect that a new arena would have on the revenue stream of the Penguins. The Penguins presently play in the Civic Arena, which was constructed in 1961, making it the second oldest arena in the NHL. Although the Civic Arena has been renovated several times, some observers argue that its age and seat configuration impair the Penguins' revenue stream. This study attempts to test this conjecture by estimating the relation between the attributes of arenas and gate receipts of NHL clubs.

The sample for this study consists of all NHL clubs over a period spanning the 1989/1990 through 1997/1998 NHL seasons. The empirical analysis consists of two parts. First, we examine the experience of eight established NHL franchises that moved into new arenas during the sample period. We find that the annual gate receipts of these franchises increased by more than 47% on average within two years, versus a corresponding increase of 17% for other clubs in the league over the same period. The increase appears related to a significant change in the inventory of seats in the new arena – the number of luxury suites and club seats increased by 320% and 2,568% on average, respectively, in the new arenas.

The second approach we employ is a regression model in which the per season gate receipts of NHL clubs are regressed on a series of variables, including the attributes of NHL arenas. The advantage of regression analysis is that it allows one to control for other factors that are associated with gate receipts, such as the quality of clubs, demographic factors in a

club's market (e.g., population, per capita income, etc.), and the time trends in gate receipts. We find that more than 60% of the variation in NHL gate receipts is explained by these factors and the arena variables that we include in the analysis. Controlling for these factors, we find that new arenas add roughly \$4.5 million to the per season gate receipts of NHL franchises and luxury suites add \$39,900 per suite to gate receipts.

Extrapolating from the experience of other NHL clubs, we estimate that the Penguins would realize annual increases in gate receipts of roughly \$6 million, or approximately 25%, in a new arena that has the typical mix of luxury suites and club seats of other new arenas in recent years. While this result suggests that a new arena would benefit the financial condition of the Penguins, a more thorough analysis would be required before one can conclude that a new arena in Pittsburgh makes economic sense. Specifically, one would have to estimate whether the present value of all cash flows generated by a new arena, including cash flows generated by both hockey and other events, exceeds the cost of constructing a new arena. This analysis would also have to reflect other characteristics of the Pittsburgh market, particularly as they affect the demand for additional premium seating. Furthermore, this study does not address whether a new arena, if it is viable, should be constructed with public or private funds. The study does, however, show that arenas are important determinants of revenues generated by NHL franchises.

## **2. The effect of new arenas on gate receipts for eight NHL clubs that moved into new arenas during the 1990s**

To examine the effect of new arenas on gate receipts of NHL clubs, we first examine the experience of eight clubs that moved into new arenas during the 1990s – Boston, Buffalo, Chicago, Montreal, Philadelphia, St. Louis, Tampa Bay, and Vancouver. These

clubs represent all established NHL franchises (i.e., not expansion clubs) that moved into a new arena in the same metropolitan area as their old arena (i.e., it excludes clubs that relocate to a new city) during 1990-1997. The Washington Capitals moved into the MCI Center in 1997, but we exclude it from the analysis because the present season, which is not complete, is the first full year in which the Capitals have played in the new arena.

To measure the change in “premium seating” after the construction of the eight new arenas, we collected data on two variables – the number of luxury suites and the number of club seats in both the old and new arenas. Data on luxury suites and club seats were obtained from the Pittsburgh Penguins and a 1999 publication by Media Adventures entitled *Revenues from Sports Venues – the National Hockey League*. In addition, we collected data on seating capacity in both the old and new arenas. The source of capacity data are two web sites -- [www.mediacity.com/~csupes](http://www.mediacity.com/~csupes) and [www.ballparks.com](http://www.ballparks.com) (both addresses lead to the same site).

We define gate receipts as revenues derived from ticket sales, net of all applicable taxes. For this study, gate receipts exclude all ancillary forms of revenue such as advertising, concessions, merchandising, broadcasting rights, and other revenue streams that could be affected by a new arena. Data on gate receipts was obtained from an NHL report entitled “Gate receipts after taxes” for the 1993/1994 through 1997/1998 seasons. For the 1989/1990 through 1992/1993 seasons, the information was obtained from a different NHL report, entitled “Comparative statement of paid admissions.” To facilitate comparisons of gate receipts over time, we express gate receipts in each year in constant 1997 U.S. dollars.

Table 1 presents data showing how the seat configuration of arenas and gate receipts changed after the eight clubs moved into their respective new arenas. The average number

of luxury suites increased from 25.1 in the old arena to 105.4 and the average number of club seats increased from 77.7 to 2,072.8. Similar results are obtained when one examines changes in the median values of these variables, although the change in club seats is even more pronounced (increasing from a median value of zero to 2,421). Average seating capacity increases from 18,207 to 19,409.

Average gate receipts increase substantially for clubs after they move into new arenas. In the season before the move, average gate receipts are \$19.2 million. After the move into the new arena, average gate receipts increase to \$28.2 million, an increase of 47%. In all eight cases, gate receipts increased after the move into a new arena. The percent increase in gate receipts ranged from 8% to 111% with a median increase of 40%. Although the sample size is small, there appears to be some correspondence between changes in gate receipts and changes in seat configuration. The median changes in luxury suites and club boxes for the three clubs with the largest changes in gate receipts are 72 and 2,600, respectively. The corresponding changes for the three clubs with the smallest changes in gate receipts are only 38 and 1,640, respectively.

To adjust for any secular trend in gate receipts in the NHL over the same periods, we computed the average gate receipts for all other NHL clubs over synchronized periods for each of the eight clubs. In the last full season before the clubs' moves, average gate receipts in the NHL were \$17.6 million. In the first full season after the moves, average gate receipts for the other NHL clubs increased to \$20.7 million, an increase of 17%. The median increase in NHL gate receipts over the eight periods is 11%. Hence, the increase in the gate receipts of the clubs moving into new arenas greatly exceeds the corresponding increase for other NHL clubs. In seven of the eight cases, the percent increase in gate receipts was

higher for the club than it was for the league as a whole. The data strongly suggests that new arenas have a substantial impact on the revenue stream of NHL clubs, in part because of the dramatic change in premium seating that occurs.

### **3. Regression results**

To complement the results reported in the previous section, we estimate an ordinary least squares regression in which the gate receipts of NHL clubs serves as the dependent variable. A major advantage of regression analysis is that it allows us to isolate the independent relation between gate receipts and the attributes of arenas, while controlling for other factors likely to affect gate receipts, such as the quality of clubs and the demographics of the markets in which clubs play. We estimate this regression on a panel data set consisting of data for each NHL club over an eight year period consisting of the 1989/1990 season through the 1997/1998 season, exclusive of the 1994/1995 strike shortened year.

Although our principal interest is to document the relation between the attributes of arenas and gate receipts, we also control for several other variables that are likely to affect gate receipts. These variables include three variables that proxy for the quality of a club. The first proxy is the number of points achieved by a club in a given season. Clubs are awarded two points for each win and one point for each tie. The source of this data was the 1998-1999 edition of *The National Hockey League Official Guide & Record Book*. The second and third proxies for club quality are variables describing the club's playoff performance in the prior year. We expect that if a team makes the playoffs and performs well in the playoffs, its gate receipts will increase in the following season. To proxy for this variable, we use two dummy variables. The first dummy variable takes the value of one if

the club made the playoffs in the prior year and zero otherwise. The second dummy variable takes the value of one if the club made it to at least the third round of the playoffs in the prior year and zero otherwise. The source of this data also was the 1998-1999 edition of *The National Hockey League Official Guide & Record Book*.

In addition to controlling for the quality of clubs, we control for two demographic variables – the population and per capita income of the metropolitan areas in which clubs play. Data on the population of U.S. metropolitan areas was obtained from a publication by the U.S. Bureau of the Census entitled “Population Estimates Program, Population Division.” The data was accessed through the bureau’s web site at [www.census.gov](http://www.census.gov). Because information was unavailable for 1997 and 1998, the 1996 estimates were applied to these two years. Population data for Canadian cities was gathered from annual surveys produced by E&P Research, Inc. The producer of this information noted that Canada performs a census in the middle of each decade (i.e. 1995). Data on per capita income for U.S. metropolitan areas was collected from the *Statistical Abstract of the United States* for each year 1989–1997. Per capita income data for Canadian cities was gathered from annual surveys produced by E&P Research, Inc. All information was provided in Canadian dollars and converted at the applicable year-end U.S. dollar to Canadian dollar exchange rate. Per capita income data in each year is expressed in terms of constant 1997 U.S. dollars.

The principal focus of the regression analysis is to examine the relation between the attributes of an arena and gate receipts of NHL clubs. We test whether gate receipts are related to four arena variables – whether or not an arena is new, the number of luxury suites in an arena, the number of club seats in an arena, and the seating capacity of an arena.

We expect clubs with newer arenas to generate higher gate receipts than older arenas for two reasons. First, there is the “curiosity factor” -- newer arenas are likely to attract fans who want to check out the new facilities. Second, newer arenas are more likely to have seat configurations and amenities (e.g., retail shops, restaurants) that are tailored to current tastes and demand. To estimate the age of an arena on gate receipts, we create a dummy variable for “new” arenas that takes a value of one if the arena is five years old or less and zero otherwise. We expect the first variable to be directly related to gate receipts and the second variable to be inversely related to gate receipts. The Internet addresses [www.mediacity.com/~csupes](http://www.mediacity.com/~csupes) and [www.ballparks.com](http://www.ballparks.com) were the sources of information on the years in which NHL arenas were built.

Data on luxury suites and club seats was collected to examine the association of "premium seating" with gate receipts. Our expectation is that a direct relation exists between the number of available premium seats and gate receipts. As stated above, data on premium seating was obtained from the Pittsburgh Penguins and a 1999 publication by Media Adventures entitled *Revenues From Sports Venues – National Hockey League*. Data for five Vancouver Canuck seasons (1989/1990 through 1993-1994) was not available from these sources. We also include the seating capacity of the arena in which a club plays as an independent variable in the regression to examine whether a relation exists between gate receipts and this variable.

We also include a time trend variable to control for any secular trend in gate receipts in the NHL. This variable takes the value of 0 in the 1989/1990 season, 1 in the 1990/1991 season, 2 in the 1991/1992 season, and so forth.

The mean values and standard deviations of these variables, and all other variables used in the regression analysis are contained in table 2.

### ***Results***

The regression results are contained in table 3. The model does a good job of explaining the variation in gate receipts – the adjusted R-squared is 0.606, meaning that 60.6% of the variation in gate receipts is explained by the variables included in the model.

Club quality is strongly associated with gate receipts. The coefficient on the number of points achieved by a club in a season is 88,384, meaning that each additional point translates into an estimated \$88,384 of additional gate receipts. This coefficient is statistically significant at the 0.99 level, meaning that there is more than a 99 in 100 chance that this relation is not random. The coefficient on whether a club made the playoffs in the previous year is 2,125,093. This means that the regular season gate receipts of clubs that make the playoffs in the prior year are \$2,125,093 higher than other clubs. Similarly, the coefficient of whether a club made the third round of the playoffs is 2,444,306 which means that making the third round of the playoffs adds another \$2,444,306 to regular season gate receipts. Hence, the total impact of reaching the third round of the playoffs in a given year on the following year's gate receipts is \$4,569,399, i.e., the sum of the two playoff coefficients. Both of the playoff variables are significant at the 0.99 level.

The regression reveals that population in the MSA is an important factor associated with gate receipts. The coefficient on this variable is 0.232, meaning that each additional one million people in a metropolitan area increases a club's gate receipts by roughly \$232,000 (i.e., 0.232 times \$1 million). This variable also is significant at the 0.99 level. Per capita income enters with a coefficient of 81.9, meaning that each additional \$1,000 in

per capita income increases a club's gate receipts by \$81,900. However, this variable is not statistically significant.

The coefficient on the time trend variable is 864,991, meaning that each successive year is associated with an increase of \$864,991 in the gate receipts of NHL clubs. Since we deflated gate receipts by the CPI, this increase represents a real increase in gate receipts, not an increase induced by inflation over time. This variable is significant at the 0.99 level.

The key variables of interest are the arena variables. The coefficient on new arenas is 4,468,850, meaning that new arenas are associated with an additional \$4,468,850 in gate receipts. This result is significant at the 0.99 level. The coefficient on luxury suites is 39,900, which indicates that each additional luxury suite is associated with an additional \$39,900 in gate receipts. This result also is significant at the 0.99 level. The coefficient on club seats is 121.8, meaning that each additional club seat is associated with an increase of \$121.80 in gate receipts. However, this result is not statistically significant. Finally, seating capacity enters with a coefficient of -310.9, indicating a negative relation between seating capacity and gate receipts. This result, which is a bit puzzling, is statistically significant at the 0.90 level. In short, the regression results reveal that controlling for the quality of clubs, demographic factors, and the time trend in gate receipts, the attributes of arenas are highly related to the gate receipts generated by NHL clubs.

#### **4. The estimated effect of a new arena in Pittsburgh on the Penguins' gate receipts**

The regression analysis can be used to estimate the effect that a new arena in Pittsburgh would have on the gate receipts generated by the Penguins. For purposes of this exercise, we rerun the regression model without data on the Penguins. The results from this new regression model are provided in table 4 and are very similar to the results in table 3.

We provide a range of estimates of the effect of a new arena on the Penguin's gate receipts. The first estimate considers only the effect of the new arena itself, assuming no change in the number of luxury suites, club seats or total seating capacity. From table 4, the coefficient on the new arena variable indicates that a new arena, in and of itself, is estimated to increase annual gate receipts by \$4,608,608 per season.

For the second estimate, we assume that the new arena would be constructed with more luxury suites, club seats and total seating capacity than the Civic Arena. To estimate the amount of additional seating, we assume for this second estimate that the new arena in Pittsburgh would have the average number of luxury suites, club seats, and seating capacity of the eight new arenas used in section 2. We then estimate the incremental change in these variables as the difference between these values and the corresponding numbers for the Civic Arena. For example, the average number of luxury suites in the eight new arenas is 105. Presently, the Civic Arena has 54 luxury suites. Hence, we assume that with a new arena, the number of luxury suites would increase by 51 (i.e.,  $105 - 54$ ). Similarly, the average number of club seats in the eight new arenas is 2,073 versus the 1,696 that currently exist in the Civic Arena. Hence, we assume that the number of club seats would increase in a new arena by 377 (i.e.,  $2,073 - 1,696$ ). Finally, the average seating capacity of the eight

new arenas is 19,408 versus 17,004 for the Civic Arena. Hence, we assume that the seating capacity for Penguins' hockey would increase by 2,404 in a new arena.

To estimate how the incremental changes in luxury suites, club seats, and seating capacity in a new arena would affect the Penguins' gate receipts, we simply multiply these changes by the respective coefficients from the regression analysis in table 4. For example, the coefficient on luxury suites is 39,697, indicating that each additional luxury suite increases gate receipts by \$39,697. Hence, an increase of 51 luxury suites would increase gate receipts by \$2,024,547 (i.e., 51 times \$39,697). Performing the same exercise for club seats and seating capacity results in changes in gate receipts of \$63,977 and -\$723,990, respectively.

The final step is to add the four effects – the new arena effect, the luxury suite effect, the club seat effect, and the seating capacity effect. The table below shows in Estimate #1 that considering the arena alone yields new gate receipts of \$4,608,608. Estimate #2 shows that if the Pittsburgh Penguins experienced the typical effect of other hockey clubs with new arenas, its gate receipts would increase by approximately \$6 million per season with a new arena.

Finally, in Estimate #3, we consider the possibility that such factors as the competing supply of premium seating in the new baseball and football stadiums being built in Pittsburgh may reduce the appropriate number of luxury suites and club seats in a new hockey arena in Pittsburgh. Specifically, Estimate #3 assumes that a new arena would have 26 rather than 51 additional luxury suites, 177 rather than 377 club seats, and 1,904 rather than 2,404 total additional seating capacity (based on estimates supplied by the Pittsburgh

Penguins). As shown below, under Estimate #3 the Penguins' gate receipts would increase by approximately \$5.1 million per season with a new arena.

	Estimate #1 Change in gate receipts	Estimate #2 Change in gate receipts	Estimate #3 Change in gate receipts
New arena itself	\$4,608,608	\$4,608,608	\$4,608,608
Change in luxury suites	-----	2,024,547	1,032,122
Change in club seats	-----	63,977	30,037
Change in seating capacity	-----	-723,990	-573,409
Total	<u>\$4,608,608</u>	<u>\$5,973,142</u>	<u>\$5,097,358</u>

In summary, the three estimates that we consider provide a range of \$4.6 million to \$6 million as the increase in annual gate receipts for the Penguins from a new arena.

**Table 1**

This table documents changes in the average number of luxury suites, club seats, capacity, and gate receipts of eight National Hockey League (NHL) clubs (Boston, Buffalo, Chicago, Montreal, Philadelphia, St. Louis, Tampa Bay, and Vancouver) that moved into new arenas during the 1990s. In addition, we show how average gate receipts changed over the same period for other NHL clubs.

<u>Variables</u>	<u>Before New Arena</u>	<u>After New Arena</u>	<u>% change</u>
Number of luxury suites	25.1	105.4	320%
Number of club seats	77.7	2,072.8	2,568%
Capacity	18,207	19,409	7%
Gate receipts	\$19,155,770	\$28,215,185	47%
Average NHL gate receipts	\$17,595,084	\$20,664,396	17%

**Table 2**

**Mean and standard deviation of variables used in regression analysis**

<b><u>Variable</u></b>	<b><u>Mean</u></b>	<b><u>Standard Deviation</u></b>
Annual gate receipts	\$18.6m	\$6.6m
Points	82	17
Playoffs	0.657	0.476
Third round of playoffs	0.163	0.370
Population of MSA	6.4m	6.4m
Per capita income of MSA	\$25,974	\$4,425
New arena	0.197	0.399
Number of luxury suites	53	40
Number of club seats	1,046	1,203
Capacity	17,459	2,269

**Table 3**  
**Regression Results ? All Teams**

Ordinary least squares regression of gate receipts per season for National Hockey League (NHL) clubs, during a periods spanning the 1989/1990 through 1997/1998 seasons: Independent variables include (i) the number of points achieved by the club in that season, (ii) a dummy variable that takes the value of one if the club made the playoffs in the previous year and zero otherwise, (iii) a dummy variable that takes the value of one if the club made the third round of the playoffs in the previous year and zero otherwise, (iv) the population in the club's metropolitan statistical area (MSA), (v) per capita income in the club's MSA, (vi) a dummy variable that takes the value of one if the club plays in a "new" arena, defined as an arena that is no older than five years, (vii) the number of luxury suites in the club's arena, (viii) the number of club seats in the club's arena, and (ix) the capacity of the club's arena. T-statistics are in parentheses. \*\*\* Represents statistical significance at the 0.99 level. \* Represents statistical significance at the 0.90 level.

<b>Independent Variable</b>	<b>Coefficient (t-statistic in parenthesis)</b>
Intercept	3,894,133 (1.2)
Number of points	88,384 (4.2)***
Playoffs in previous year	2,125,093 (2.9)***
3 <sup>rd</sup> round of playoffs in previous year	2,444,306 (2.8)***
Population of MSA	0.232 (3.9)***
Per capita income of MSA	81.9 (0.9)
New arena	4,468,850 (4.3)***
Number of luxury suites	39,900 (4.0)***
Number of club seats	121.8 (0.4)
Capacity	-310.9 (-1.9)*
Time trend	864,991 (6.6)***
Number of observations	186
Adjusted R-squared	0.606

**Table 4**  
**Regression Results ? Without Penguins**

Ordinary least squares regression of gate receipts per season for National Hockey League (NHL) clubs, during a periods spanning the 1989/1990 through 1997/1998 seasons: Independent variables include (i) the number of points achieved by the club in that season, (ii) a dummy variable that takes the value of one if the club made the playoffs in the previous year and zero otherwise, (iii) a dummy variable that takes the value of one if the club made the third round of the playoffs in the previous year and zero otherwise, (iv) the population in the club's metropolitan statistical area (MSA), (v) per capita income in the club's MSA, (vi) a dummy variable that takes the value of one if the club plays in a "new" arena, defined as an arena that is no older than five years, (vii) the number of luxury suites in the club's arena, (viii) the number of club seats in the club's arena, and (ix) the capacity of the club's arena. T-statistics are in parentheses. \*\*\* Represents statistical significance at the 0.99 level. \* Represents statistical significance at the 0.90 level.

<b>Independent Variable</b>	<b>Coefficient (t-statistic in parenthesis)</b>
Intercept	4,007,145 (1.2)
Number of points	85,930 (3.9)***
Playoffs in previous year	2,008,406 (2.7)***
3 <sup>rd</sup> round of playoffs in previous year	2,582,839 (2.8)***
Population of MSA	0.241 (4.0)***
Per capita income of MSA	79.2 (0.9)
New arena	4,608,608 (4.4)***
Number of luxury suites	39,697 (4.0)***
Number of club seats	169.7 (0.6)
Capacity	-301.2 (-1.8)*
Time trend	833,239 (6.1)***
Number of observations	178
Adjusted R-squared	0.605