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PRICING

Ticket Price Determination in Professional Sports: An Empirical Analysis of the NBA, NFL, NHL, and Major League Baseball

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Abstract

The purpose of this paper is to explain both cross-sectional differences in ticket prices among teams and causes for the size and direction of seasonal price changes for each of the four major sports leagues in the United States. Based on data from 1996-2002, *playing in a new stadium* and *population size* are important determinants of cross-sectional differences in average ticket prices among teams. *Playing in the first year of a new stadium* and *reaching the postseason the previous year* are important determinants of the size of seasonal increases in average ticket prices for a given team. Larger payrolls lead to higher ticket prices in baseball and basketball, but not in hockey or football. Seasonal changes in team payroll significantly affect the size of ticket price increases only in baseball, where the correlation between winning and payrolls is strong, and the variability of team payrolls is higher than any other league.

Introduction

The purpose of this paper is twofold. First, to analyze why ticket prices differ among cities (i.e., what factors cause cross-sectional differences in ticket prices in a given year among teams within a given league). Consequently, this will help to understand what factors influence the decisions made by sports teams to change their ticket prices in a given year. These issues are addressed separately for each of the four major sports leagues in the United States: Major League Baseball (MLB), the National Basketball Association (NBA), the National Football League (NFL), and the National Hockey League (NHL). Also, in addressing these issues, this paper presents additional information concerning the hotly debated topic of whether ticket price increases are tied to changes in team payrolls.

"Playing in the first year of a new stadium, a change in win percentage from the previous year, reaching the conference championship game, and the size of the previous year's ticket price increase were important determinants of the size of seasonal increases in ticket prices for individual teams."

Background

Conceptually, the groundwork for addressing these issues began with the work by Reese and Mittelstaedt (2001) and was extended by Rishe and Mondello (2003). Specifically, Reese and Mittelstaedt (2001) submitted an electronic questionnaire following the end of the 1998 season to all 31 NFL teams to qualitatively determine two things. First, the researchers wanted to determine whether pricing administrators (i.e., persons within each organization that determine team ticket prices and various pricing strategies for season tickets, group sales, and the like (e.g., director of season ticket sales, director of marketing, team president) for these organizations followed some type of standard procedure for ticket pricing. Second, they wanted to discover which factors were considered the most important when devising a pricing strategy for the upcoming season. Collectively, they concluded that the most important determinants of a team's pricing structure were 1) team performance from the previous season, 2) the revenue needs of the organization, 3) public relations

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issues, 4) price sensitivities of the market, 5) fan identification, and 6) the average NFL ticket price.

One of the methodological strengths of the study was the researchers' direct access to people who are responsible for making future pricing decisions within these organizations. However, using a survey approach only allowed the researchers to rank factors in the order of importance. The survey approach does not allow for a more precise measurement of the relationship between ticket prices, ticket price increases, and the factors that could cause these to differ among teams and across seasons.

Consequently, Rishe and Mondello (2003) created an empirical model to identify factors that cause cross-sectional differences in average ticket prices among NFL teams, and separately, to identify factors that influence the size of seasonal ticket price increases for individual teams. With NFL data from 1996-2001, those authors used ordinary least squares regression analysis (corrected for heteroskedasticity and autocorrelation using the Newey-West estimation technique) to generate their empirical findings. Overall, those researchers found that *playing in a new stadium*, *previous year's success*, *fan income levels*, and *population size* were important determinants of cross-sectional differences in average ticket prices among NFL teams. Similarly, *playing in the first year of a new stadium*, *a change in win percentage from the previous year*, *reaching the conference championship game*, and *the size of the previous year's ticket price increase* were important determinants of the size of seasonal increases in ticket prices for individual teams.

Furthermore, Rishe and Mondello (2003) found that neither the size of team payroll nor seasonal changes in team payroll significantly affected ticket prices among teams or the size of seasonal ticket price increases. They argued that this result was not inconsistent with the possibility that salary caps might influence why team payrolls do not affect ticket prices in football. Hence, one extension of the current paper is to attempt to understand what potential impact a salary cap might have on the pricing process among the major sports leagues. This offers a useful opportunity for a natural experiment, given that two of these leagues (NFL and NBA) have salary caps, while the other two leagues (MLB and NHL) do not. Therefore, if the presence of salary caps minimizes the cross-sectional differences in payrolls among teams, as well as limits the size of payroll increases from season to season for individual teams, then it is highly unlikely that team payroll will affect ticket prices.

There is a strong economic argument for why ticket prices should not be influenced by the size of a team's payroll. For example, Leeds and Von Allmen (2002) argued that team payrolls should not influence ticket prices because payrolls are a fixed cost, and as such, cannot factor into the profit-maximizing rule of setting marginal revenue equal to marginal cost. They maintain that the marginal cost of selling an additional ticket and allowing an additional person into a facility is essentially zero prior to full capacity, and then infinitely large once maximum capacity is reached. Furthermore, unless capacity size is altered, this marginal cost curve will not shift since marginal revenue is ultimately governed by demand and shifts as demand shifts. Intuitively, the only factor that would cause variations in ticket prices for a given team, assuming that the team is not playing in a new stadium, would be changes in demand to watch the team perform.

Fundamentally, the reason why the presence of a correlation between prices and payroll is interesting is because most owners of professional sports teams argue that they have to raise ticket prices to cover escalating payrolls. Isidore (2002, April 5) noted that one of the great myths of modern sports is the belief held by fans that ticket prices are tied to team payrolls.

"The correlation between ticket prices and playoff success (not just merely making the playoffs) is especially strong in hockey and football. For example, teams that reach the conference finals raise prices by roughly 7% and 9% respectfully, in the NHL and NFL."

Specifically, he noted that if the cost of a product determined pricing, then few companies would worry about losses because they would just raise prices when their own costs increased. However, with a free market economy, costs including payroll expenses, do not determine pricing. Furthermore, he noted that if teams raised prices above fans' perceived value of the team, their sales would drop. Thus, even if the team's payroll increases significantly, market forces limit the amount owners can charge fans (Isidore, 2002, April 5). Isidore (2002, December 27) also argued that the proliferation of variable pricing is further evidence that player salaries do not drive ticket prices.

Methodology

Rishe and Mondello (2003) provide the motivation behind the model specifications presented below. The specification in equation 1 uses a cross-sectional analysis to address what factors cause ticket prices to vary among teams in a given year. The specification in equation 2 addresses what factors cause seasonal price changes for individual teams over time.

$$LTIX_{j,t} = a_0 + a_1 HWIN_{j,t-1} + a_2 INCOME + a_3 PAY_{j,t} + a_4 POPL + a_5 TREND + a_6 CAP_{j,t-1} + a_7 STAD$$

(equation 1)

$$\_TIX = a_0 + a_1 PLAY_{j,t-1} + a_2 CAPCHG_{j,t-1} + a_3 PAYCHG_{j,t-1} + a_4 STAD + a_5 PREVTIX + a_6 TREND + a_7 WCHG$$

(equation 2)

$LTIX_{it}$ is the natural log of the average ticket price for team *i* in year *t*. By transforming the dependent variable into natural logs, the coefficients can now be interpreted as percentage changes in ticket prices given a one-unit change in a given independent variable.

HWIN measures the average number of wins a team posted in the previous three seasons. Teams that are more successful in the recent past are likely to have higher ticket prices than teams that had poor success in the recent past.

INCOME is a proxy for the average per capita income level of people from a given city. It is hypothesized that higher per capita income levels will yield higher ticket prices.

PAY measures the team's payroll for the upcoming season.

POPL is a proxy for the size of the local metropolitan statistical area for a given team. Population is often used as a proxy for demand. The larger the population, the larger the demand to see a team play, and hence higher ticket prices.

TREND is inserted to simply capture any trend in absolute ticket prices or the size of ticket price increases over the sample period.

CAP measures attendance as a percentage of a team's total capacity. Ceteris paribus, ticket prices should be higher for teams with larger filled capacities. If attendance is above 95% of facility capacity, a team is more likely to have higher prices the following year than if the attendance is only 75% of facility capacity.

STAD is a dummy variable denoting whether the team is in the first year of playing in a new facility. A team playing in a new facility will have higher ticket prices than other teams because they will attempt to shift the burden of paying for a new facility onto fans.

PLAY is a dummy variable with a value of one if the team made the playoffs the previous year, and a value of zero if the team did not make the playoffs the previous year. Also, it is hypothesized that teams that qualify for the post season are more likely to realize ticket price increases because reaching the playoffs enhance consumer expectations of performance for the following season.

CAPCHG measures the percentage change in a team's attendance as a percentage of capacity from year t-2 to year t-1. The larger the improvement in percentage of capacity filled, the larger the increase in ticket prices.

WCHG measures the percentage change in a team's number of wins from year t-2 to year t-1. The larger the improvement in number of wins, the larger the increase in ticket prices.

PAYCHG measures the percentage change in a team's payroll from year t-1 to year t. This variable is central to the analysis herein. That is, if it is generally true that a rise in team payroll forces the team to increase their ticket prices, then the coefficient on PAYCHG will be statistically significant and positive.

"Team payroll significantly impacts cross sectional ticket price differences in baseball and basketball, but not hockey and football."

PREVTIX measures the percentage point ticket price increase from year t-2 to year t-1 for a given team. This variable is a proxy for the public relations element noted by Reese and Mittelstaedt (2001). This variable is included to see whether a team's decision to raise ticket prices in one season is influenced by the size of ticket price changes from the preceding season.

Lastly, it should be noted that a dummy variable accounting for Canadian teams was added to equations 1 and 2 when analyzing data from the NHL. Since 6 of the 30 NHL teams are Canadian, when multiplied over six years of data, this yields 36 data points. Canadian teams were not accounted for in MLB or the NBA because their sample size is negligible. For example, there are only two Canadian baseball teams and two Canadian basketball teams. Hence, for each data set, this yields only fourteen data points (which is roughly 4% of the entire sample).

Data

The sample period is seven years (1996-2002) for each sport except the NHL, for which the sample period is only six years due to data limitations (1997-2002). Data regarding ticket prices and ticket price increases was obtained from Team Marketing Reports (TMR). This data source is widely used by academics and media alike. The only flaw with respect to average ticket price data is that it usually is not weighted properly. Because average ticket prices are typically estimated by finding the average price among different seating sections, without weighting the average based on how many seats are in each pricing section, the estimates tend to be inflated. Moreover, research has shown this could cause the weighted average ticket price to differ from those reported in TMR by $1-$3 (Rishe, 2002).

However, without precise information regarding the precise number of seats in each section of every stadium, the average ticket price data from TMR is the best resource available.

Team won-loss records and payroll data are widely available through various sports web sites, as are records on postseason appearances. Data regarding the percentage of capacity filled and the opening dates of new facilities were obtained from www.ballpark.com. This data is based on paid attendance, as opposed to turnstile attendance. Differences can certainly exist between these two measurements of attendance if people that paid to attend a particular game do not actually attend the game. This explains why paid attendance is larger than turnstile attendance. However, paid attendance is more appropriate for this study. If fans and firms are buying tickets but do not attend the games, teams still receive that ticket revenue, and hence, have little incentive to reduce ticket prices until 'no-shows' stop buying tickets altogether.

Data on city population and per capita income levels was obtained from the Dismal Scientists' web site (www.dismal.com), a highly reliable source of demographic and economic information. Population is measured for a given city's metropolitan statistical area as of 2000. Collectively, the data herein is a cross-sectional, time-series data set. Initial estimation using ordinary least squares suggested the potential presence of both heteroskedasticity and autocorrelation. The Newey-West correction for these statistical problems was applied to yield consistent estimates.

Results

Cross-Sectional Price Differences Among Cities

The first set of results for each sport is presented in Table 1 and based on equation 1. Equation 1 is specified to explain cross-sectional differences in the average ticket prices charged among teams in each league.

$$LTIX_{j,t} = a_0 + a_1 HWIN_{j,t-1} + a_2 INCOME + a_3 PAY_{j,t} + a_4 POPL + a_5 TREND + a_6 CAP_{j,t-1} + a_7 STAD$$

In MLB, average ticket prices were

- 2.69% higher for each additional 100,000 people in a city's population relative to other cities;
- 33.69% higher for teams playing their first year in a new stadium;
- 1.2% higher for each two percentage point increase in attendance as a percentage of capacity;
- 3.6% higher for each additional $10 million in team payroll compared to other teams;
- growing at an annual rate of 4.7% over the sample period.

Though average number of wins over the last few seasons was not significant, this statistical finding largely owes itself to the strong correlation between winning and payrolls in baseball. Income is also statistically significant, but the magnitude of its impact is quite small based on the size of the coefficient.

In the NBA, average ticket prices were

- 3.77% higher for each additional 100,000 people in a city's population relative to other cities;
- 10.75% higher for teams playing their first year in a new arena;
- 3.98% higher for averaging 10 more wins than its opponents over the previous three seasons;
- 7.9% higher for each additional $10 million in team payroll compared to other teams;
- growing at an annual rate of 1.6% over the sample period.

Attendance is statistically significant, but the magnitude of its impact is quite small based on the size of the coefficient. Income is not significant in explaining cross-sectional ticket price differences among NBA cities.

Table 1: Cross-Sectional Differences in Average Ticket Prices Among Cities

Table 1 reports regression results of estimating equation 1 in an attempt to uncover the determinants of cross-sectional differences in average ticket prices among teams. The analysis is done separately for each league. The dependent variable is the natural log of the average ticket price for a given team in a given season. This allows the coefficients to be interpreted as percentage differences in average ticket prices. Ordinary least squares was the estimation technique used, augmented with the Newey-West correction for heteroskedasticity and autocorrelation. Coefficients in bold print are statistically significant beneath the 0.05 level. Italicized coefficients are statistically significant beneath the 0.10 level.

In the NFL, average ticket prices were

- 1% lower for each additional 100,000 people in a city's population relative to other cities;
- 22.63% higher for teams playing their first year in a new stadium;
- 1.3% higher for averaging 1 more win than its opponents over the previous 3 seasons;
- growing at an annual rate of 5.8% over the sample period.

Income is statistically significant, but the magnitude of its impact is quite small based on the size of the coefficient. Neither cross-sectional differences in attendance nor payroll could explain cross-sectional differences in ticket prices among NFL cities.

In the NHL, average ticket prices were

Table 1

Variable	MLB Coefficient	MLB t-Statistic	MLB Prob.	NBA Coefficient	NBA t-Statistic	NBA Prob.	NFL Coefficient	NFL t-Statistic	NFL Prob.	NHL Coefficient	NHL t-Statistic	NHL Prob.
C	1.521	12.012	0.000	2.965	20.749	0.000	2.886	18.890	0.000	3.172	16.410	0.000
POPL	0.000	5.404	0.000	0.000	5.036	0.000	0.000	2.287	0.023	0.000	2.246	0.026
INCOME	0.000	3.991	0.000	0.000	0.208	0.836	0.000	3.645	0.000	0.000	0.669	0.504
STAD	0.337	5.356	0.000	0.108	3.180	0.002	0.226	3.357	0.001	0.321	4.087	0.000
HWIN	0.000	0.091	0.927	0.004	3.459	0.001	0.013	2.190	0.030	0.001	0.369	0.713
CAP	0.006	8.210	0.000	0.000	2.968	0.003	0.002	1.325	0.187	0.005	3.951	0.000
PAY	0.004	4.192	0.000	0.008	5.341	0.000	0.001	0.607	0.545	0.002	1.099	0.273
TREND	0.047	6.803	0.000	0.016	1.616	0.100	0.058	6.735	0.000	0.009	0.718	0.474
CAN										-0.146	-3.167	0.002
Adjusted R-squared			0.778			0.488			0.443			0.292
F-stat			98.366			28.227			24.763			9.545
F-significance			0.000			0.000			0.000			

- 1.27% higher for each additional 100,000 people in a city's population relative to other cities;
- 32.05% higher for teams playing their first year in a new stadium;
- 0.9% higher for each two percentage point increase in attendance as a percentage of capacity;
- 14.6% lower for Canadian teams, on average.

Cross-sectional differences in local income, recent on-ice success, and payroll did not explain cross-sectional differences in average ticket prices among NHL cities. Furthermore, there was apparently no strong trend in overall NHL prices during the sample period.

Seasonal Ticket Price Increases

The first set of results for each sport is presented in Table 2 and are based on equation 2. Equation 2 is specified to explain what factors influence the size of ticket price increases for individual teams.

$\_TIX = a_0 + a_1\ PLAY_{j,\ t-1} + a_2\ CAPCHG_{j,\ t-1} + a_3\ PAYCHG_{j,\ t-1} + a_4\ STAD + a_5\ PREVTIX + a_6\ TREND + a_7\ WCHG$

In MLB, average ticket price increases for individual clubs

- increased 50.7% if playing their first season in a new stadium;
- increased 3.64% if their team reached the playoffs;
- increased 0.61% for each additional $10 million spent on payroll;
- increased 0.89% for each additional 1% increase in attendance as a percentage of capacity.

There was no trend over the sample period with respect to the size of ticket price increases. Furthermore, decisions to change prices for MLB clubs do not seem to be influenced by the size of the previous year's ticket price increase.

In the NBA, average ticket price increases for individual clubs

- increased 27.27% if playing their first season in a new arena;
- increased 4.53% if their team reached the playoffs;
- decreased 1.4% over the course of the sample period.

Table 2: Factors that Influence the Size of Seasonal Ticket Price Increases for Individual Clubs

Table 2 reports regression results of estimating equation 2 in an attempt to uncover the factors that influence the size of seasonal ticket price increases for individual clubs. The analysis is done separately for each league. The dependent variable is the percentage point change in a given team's average ticket prices from the previous season. Ordinary least squares was

Table 2

Variable	MLB Coefficient	MLB t-Statistic	MLB Prob.	NBA Coefficient	NBA t-Statistic	NBA Prob.	NFL Coefficient	NFL t-Statistic	NFL Prob.	NHL Coefficient	NHL t-Statistic	NHL Prob.
C	**5.457**	**3.453**	**0.001**	**10.127**	**4.467**	**0.000**	**7.054**	**4.343**	**0.000**	**8.745**	**2.481**	**0.014**
STAD	**50.671**	**6.466**	**0.000**	27.269	5.189	0.000	**25.827**	**3.371**	**0.001**	**27.082**	**3.227**	**0.002**
PLAY	2.314	1.357	0.176	**4.526**	**2.964**	**0.003**	**4.177**	**2.542**	**0.012**	3.192	1.707	0.090
PAYCHG	**0.061**	**2.307**	**0.022**	-0.023	-1.019	0.310	0.012	0.311	0.756	-0.012	-0.346	0.730
PREVTIX	-0.066	-1.261	0.209	-0.088	-1.420	0.157	**-0.176**	**-3.993**	**0.000**	-0.096	-1.538	0.126
TREND	0.147	0.365	0.715	**-1.421**	**-3.144**	**0.002**	-0.187	-0.471	0.639	**-1.512**	**-2.281**	**0.024**
WCHG	-0.041	-0.930	0.353	**0.064**	**2.709**	**0.007**	**0.019**	**2.001**	**0.047**	0.012	0.272	0.786
CAPCHG	**0.089**	**2.038**	**0.043**	-0.002	-0.542	0.589	0.112	1.462	0.145	0.117	0.966	0.335
CAN										0.598	0.239	0.812
Adjusted R-squared			0.520			0.268			0.278			0.185
F-stat			31.809			11.470			12.213			6.197
F-significance			0.000			0.000			0.000			0.000

the estimation technique used, augmented with the Newey-West correction for heteroskedasticity and autocorrelation. Coefficients in bold print are statistically significant beneath the 0.05 level. Italicized coefficients are statistically significant beneath the 0.10 level.

There was a significant but small direct impact on ticket prices if a team improved its regular season performance. Additionally, changes in team payroll did not have a significant impact on the size of ticket price increases for NBA clubs throughout the sample period.

In the NFL, average ticket price increases for individual clubs

- increased 25.83% if playing their first season in a new stadium;
- increased 4.18% if their team reached the playoffs;
- decreased 1.9% if prices were raised 10% the previous year.

There was no trend over the sample period with respect to the size of ticket price increases. There was a significant but small direct impact on ticket prices if a team improved its regular season performance. Lastly, changes in team payroll did not have a significant impact on the size of ticket price increases for NFL clubs throughout the sample period.

In the NHL, average ticket price increases for individual clubs

- increased 27.08% if playing their first season in a new arena;
- increased 3.2% if their team reached the playoffs.

Decisions to change prices for NHL clubs do not seem to be influenced by either the improvement in a team's win percentage or the size of the previous year's ticket price increase. Furthermore, changes in team payroll did not have a significant impact on the size of ticket price increases for NHL clubs throughout the sample period.

Notably, equations 1 and 2 seemed to have the strongest fit with MLB data, and the weakest fit with NHL data. The adjusted R-squared using MLB data was 78% and 50% respectively, for equations 1 and 2. Comparatively, the adjusted R-squared using NHL data was 23% and 18%, respectively, for equations 1 and 2. This evidence suggests that it might be harder to understand the pricing process in the NHL relative to MLB. Lastly, equations 1 and 2 had a similar fit with NBA and NFL data. The adjusted R-squared for these data sets were 47% and 25% respectively, for equations 1 and 2.

Generally speaking, it is not unusual to obtain low adjusted R-squared statistics when working with cross-sectional data. Furthermore, the F-statistic is more important in the sense that it reveals whether the overall model has some explanatory power. For each of the eight regressions run above, the F-statistic suggests that

each model has overall explanatory power (though in some cases it may only be explaining 20% of the variation in the dependent variable). Invariably, the fact that much remains unexplained can be tied to the fact that many of the key issues that teams must consider when setting prices as discussed in Reese (2001) are difficult to quantify. Therefore, the omission of variables that are difficult to quantify, may potentially explain why the adjusted *R*-square values are relatively low in some of the models. Finally, because research addressing ticket pricing and sports is still in a developmental phase, perhaps future research will produce models with additional explanatory power.

Other notable statistical findings:

- When using 'fan income levels' as a proxy for income, income becomes statistically significant in explaining cross-sectional differences in NBA ticket prices. Fan incomes could not be used as the proxy for income for each league due to data limitations.
- The correlation between ticket prices and playoff success (not just merely making the playoffs) is especially strong in hockey and football. For example, teams that reach the conference finals raise prices by roughly 7% and 9% respectively, in the NHL and NFL.

Discussion

Explaining Ticket Price Differences Among Cities

Playing in a new facility is the most important determinant of cross-sectional ticket price differences among cities. Based on the results, teams playing their first season in a new facility can expect to have ticket prices that are from 10-33% higher than other teams in the same sport, other things held constant.

Population size is significant and positive for each data set except the NFL. This suggests that teams in larger cities should have higher ticket prices, reflecting the larger demand present when there are more potential consumers in the market. The negative sign on the population coefficient in football most likely stems from the fact that small-market teams (e.g., Jacksonville, Denver, Minnesota, Kansas City, Green Bay) have ticket prices above the league average. In addition, it may also reflect the fact that there are a higher percentage of NFL fans that travel from outside of the local MSA to attend games. This occurs largely because of the timing of NFL contests (Sundays, when most people have the time and flexibility to travel longer distances).

Attendance as a percentage of capacity is significant in explaining cross-sectional ticket price differences for each league except the NFL (where most teams sellout most games over the sample period). This is consistent with the notion that teams with higher attendance have a higher demand for their product, and as such, will have higher ticket prices. The insignificance of attendance in explaining cross-sectional differences in NFL ticket prices may be due to the fact that many teams have attendance figures that are in excess of 90% of capacity. Without much variation in the attendance data among NFL teams, it becomes difficult to obtain a statistically significant attendance coefficient.

Team payroll significantly affects cross-sectional ticket price differences in baseball and basketball, but not hockey and football. The fact that payroll affects price differences in baseball is not surprising given that the correlation between winning and team payroll is strongest in baseball. Hence, this is the one sport where team ownership may have a legitimate argument that ties payroll to ticket prices. Because the NBA functions under a league salary cap, it is somewhat surprising that team payroll affects price differences in professional basketball. However, the salary cap in the NBA is considered a 'soft cap' because of the numerous salary cap exceptions and loopholes that exist compared to the NFL salary cap, and these allow for a wide variation in team payrolls among teams in a given year. Because the NFL employs a 'hard' salary cap, the variation of team payrolls among teams is the lowest of any of the leagues under examination. As such, it is not surprising that there is no statistical evidence of a correlation between cross-sectional ticket prices and payrolls.

To further illustrate this point, Table 3 offers a comparison of the relative variability among team payrolls across the four leagues. Each number refers to the coefficient of variation of team payroll, which measures the standard deviation of team payroll divided by the average team payroll for a given year. Even though both the NFL and the NBA have salary caps, the data reveals that the relative dispersion among NBA payrolls is larger than for NFL payrolls.

Subsequently, one might expect a correlation between cross-sectional ticket prices and payrolls in the NHL, largely because the NHL does not have a salary cap. Hence, without a salary cap containing payroll expenditures, one might expect payroll dispersions in hockey to be similar to that in baseball. However, the data on payroll dispersion demonstrates that during the early part of the sample period (1995-1997), despite operating with salary cap restrictions, the NBA had greater payroll dispersion than the NHL. Though the degree of NHL payroll dispersion has exceeded 32% each of the last three years, its relative stability initially is most likely the reason team payroll proved to be statistically insignificant when explaining cross-sectional ticket price differences among NHL teams.

Other relevant findings:

Table 3
Measuring Relative Payroll Dispersion across Leagues

	MLB	NBA	NFL	NHL
1995	0.339	0.274	0.145	0.222
1996	0.377	0.289	0.152	0.254
1997	0.358	0.281	0.121	0.201
1998	0.375	0.230	0.111	0.277
1999	0.431	0.236	0.141	0.294
2000	0.383	0.246	0.135	0.327
2001	0.380	0.195	0.148	0.34
2002	0.366	0.288	0.189	0.32
average	0.376	0.255	0.143	0.279

The numbers above measure the coefficient of variation in team payrolls in a give year for each league. The coefficient of variation is obtained by dividing the standard deviation of payrolls by the average team payroll for teams in a given year. The larger the number, the larger the degree of payroll dispersion.

- Though income has a statistically meaningful impact on cross-sectional price differences across cities of each league except the NBA, the practical importance of local income levels on ticket pricing is small considering the size of the coefficient on income.
- Recent success has more of an impact on cross-sectional price differences in the NBA and NFL. However, due to the stronger correlation between winning and payrolls in the cap-free sports of baseball (and to a lesser extent) hockey, the statistical insignificance of winning may be due to multicollinearity.
- Average ticket prices have had a stronger upward trend in baseball and football over the sample period than the other sports. This suggests that the overall demand for baseball and football has increased over the last six years, whereas the overall demand for hockey and basketball has been somewhat stagnant.

Explaining Seasonal Price Increases for Individual Teams

Playing in a new facility for the first season was the primary determinant of the size of seasonal price increases for individual teams in any league. Specifically, the average ticket price increase the following season was from 26-28% for NBA, NFL, and NHL teams and was over 50% for MLB teams during the sample period. The next important factor was tied to a team's post-season exploits from the previous season. For each league, teams reaching the playoffs significantly raised ticket prices the following season by 3-5%. Additionally, teams reaching the conference championships raised NHL and NFL ticket prices the following year by 7% and 9%, respectively.

Table 4
Measuring Relative Payroll Dispersion across Leagues

Variable	Coefficient	t-Statistic	Prob.
C	5.058	1.427	0.156
STAD	**26.089**	**3.183**	**0.002**
PLAY	2.299	1.354	0.178
PAY	**0.158**	**1.980**	**0.050**
PREVTIX	-0.114	-1.763	0.080
TREND	**-1.964**	**-2.561**	**0.011**
PTSCHG	0.021	0.497	0.620
CAPCHG	0.120	1.001	0.319
CAN	1.568	0.606	0.546
Adjusted *R*-squared			0.194
F-statistic			5.815
Prob(*F*-statistic)			0.000

With regard to regular season success, winning additional games significantly affected ticket prices in basketball and football, but not in baseball and hockey. Given the strong correlation between ticket prices and payroll in baseball, perhaps there is multicollinearity between the WCHG and PAYCHG variables, robbing WCHG of explanatory power. For hockey, the strong statistical significance of reaching the playoffs (as well as making a deep run in the playoffs) may be too highly correlated with improved regular season performance. Similarly, this would deprive WCHG of explanatory power.

Other findings:

- Pricing decisions in the NBA and NFL were somewhat sensitive to the size of the previous season's price increase. The same cannot be said for MLB and NHL teams.
- Over the sample period, NBA and NHL teams on average showed a trend towards smaller ticket price increases from season to season. This is consistent with the stagnant overall demand over the last six years associated with both the NBA and NHL.

The only sport for which *changes in team payroll* significantly affected the size of ticket price increases the next season was Major League Baseball. This is not surprising, given the strong statistical correlation between winning percentages and payroll over the last several years in baseball. Team ownership assumes that con-

sumer expectations regarding team performance will increase if fans think ownership is trying to field a competitive team rather than maximizing profits. This is largely because recent trends in baseball suggest that there is a high likelihood of reaching the baseball postseason if the team has one of the top ten payrolls in the league. With higher expectations, fans are willing to spend more money on ticket prices. Also, as illustrated in Table 3, baseball possesses the largest degree of payroll dispersion and this exacerbates the impact the potential impact that payroll increases might have on ticket prices.

This argument has less merit in any of the other sports leagues considered herein, namely because the correlation between winning and team payroll is not as pronounced as it is in baseball. Accordingly, the results show there is no evidence that *seasonal changes in team payroll* affect the size of ticket price increases in basketball, hockey, or football.

There was some evidence that ticket price increases in hockey are influenced by the *absolute size of team payroll.* Consequently, Equation 2 was slightly modified such that absolute payroll replaced the percentage change in payroll as the proxy for the impact of payroll on ticket prices. This modification had no significant impact on the statistical results reported in Table 2 for MLB, NBA, or NFL. However, this modification to equation 2 did significantly alter the results from the NHL.

Specifically, the absolute size of an NHL team's payroll does have a small influence on the size of ticket price increases. The results above suggest that for each additional $1 million in team payroll, the average ticket price will increase by 1.5% points the following season. It is suspected that the reason why the NHL data was sensitive to the modification to equation 2 is that the relative dispersion among NHL payrolls has more closely resembled MLB payrolls in the last couple of years. Subsequently, this has enhanced the correlation between winning and payrolls in the NHL over the last several years.

Lastly, the analysis herein offers statistical evidence that the price determination process is quite subjective for every individual professional sports team, and thus, is hard to completely standardize. The intercept term for both equations 1 and 2 is positive and significant for each league's data set. This suggests there are significant explanatory factors missing from these data sets that would improve the quality of the models presented. For example, referring to seasonal ticket price changes, Reese and Mittelstaedt (2001) noted that team revenue needs, public relations considerations, fan identification, and price sensitivities were factors that affected the pricing decisions of many NFL clubs, yet it is difficult to develop a quantitative proxy for some of these variables (leading to their exclusion from any quantitative model specification). Hence, the statistical significance of the intercept term throughout the analysis above most likely owes itself to the fact that it is difficult to build a model that completely captures the subjective decisions made by team management.

One suggestion for future research in this area might be to address a related but separate question: what factors influence the *likelihood* that a team will alter ticket prices by various amounts? This can be done by specifying that the dependent variable in equations 1 and 2 be a qualitative variable, with a value of '1' if prices were changed by some amount, and '0' if prices were changed by less than some amount (or unchanged or decreased). Subsequently, the coefficients in the statistical analysis would reveal the likelihood of prices being increased by 'x' amount in response to changes to the independent variables (which would be similar to the variable specified herein). Different values of 'x' could be used as filters to gauge how sensitive the probability of ticket price increases is the face of various phenomena. For example, such a model would be useful for answering such questions as follows:

- What is the likelihood that a new stadium will increase ticket prices by at least 20%?
- What is the likelihood that prices will increase by at least 25% if a team reaches the championship round of their sport?

This analysis could help to set industry benchmarks as to what would be considered a 'fair, market-based' ticket price increase in response to organizational changes, including new facilities or improved team performance.

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