The Stadium Game: Cities Versus Teams

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The Stadium Game

Cities Versus Teams

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The intangible benefits of sports teams are a source of social value that cannot be captured completely by teams through ticket sales and other revenues. A model is developed in which teams attempt to capture social value through stadium subsidies. The number of teams in the league, determined endogenously, increases when subsidies to teams are permitted. The size of the subsidy paid by a city depends on the threat point of teams based on the social value of a team to the largest city without one. Larger cities pay smaller subsidies and may not pay anything. Cartelized leagues substantially increase subsidies by reducing the number of teams, but subsidies are not eliminated in the case of free entry.

Keywords: *economic impact; stadiums; subsidies; sports leagues*

The growth in popularity of professional sports has led to a surprising development. As revenue generated by professional sports teams has grown, so have public subsidies to these teams through stadiums. One estimate puts the total amount of subsidies for professional sports between 1992 and 1998 at $4.4 billion (Quirk & Fort, 1999, p. 140). Economists have shown convincingly that the so-called economic impact of stadiums is greatly exaggerated (Noll & Zimbalist, 1997a). Concern about the size of subsidies has led to increased opposition in recent years, but public funding of stadiums does not appear to be disappearing any time soon.

Key to understanding why cities subsidize sports teams is the possibility that teams have a public good element to them that teams cannot capture through ticket sales, media contracts, or other avenues. Sports economists acknowledge there may be intangible benefits from teams that are large enough to explain stadium subsidies. "Whether the value of the external benefits of a major league team to consum-

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ers really does exceed stadium subsidies is uncertain, but by no means implausible" (Noll & Zimbalist, 1997b, p. 58). If the intangible benefits of sports teams such as existence value, civic pride, and other forms of nonmarket consumption cannot be captured by teams directly, then teams will seek other avenues for capturing these rents.

The existence of intangible benefits does not mean, however, that cities should simply hand over the value to team owners. If professional sports or any other product can be provided profitably at the same level of quality without subsidy, then no subsidy should be provided. Many cities are faced with a situation where they at least perceive that no team will locate, or stay, in their city without a subsidy. If the choice is between a subsidized team or no team at all, a subsidized team may be the better choice. The battle over stadium funding can be viewed as a bargaining problem between teams and cities.

A critical element in determining the bargaining power of the parties is the market structure of sports leagues. Professional sports are organized as cartels. Major League Baseball actually has an antitrust exemption, and other sports leagues have also been allowed to control many aspects of their league, including the number of teams and their location, on the basis of the unique coordination involved in staging games. Creating competition in the sports industry is one way to improve the bargaining position of cities and has been proposed many times. According to Baade and Sanderson (1997),

> The only certain, effective way to give cities and taxpayers a level playing field in their negotiations with sports teams and leagues is to have a larger supply of teams. This means changing the fundamental structure of our professional sports industries. The competitive ideal, even allowing for the necessary cooperative decision making that is required to schedule a contest, agree upon rules and keep records, would mean more teams in more cities, a wider range of viewing options for fans, and some redistribution of cartel profits back to cities and taxpayers. (p. 108)

This article examines the role of market structure in determining league size and subsidies from cities to teams. Although free entry in professional sports would drastically reduce the size of subsidies, they would not be eliminated. Bargaining power will be determined by each side's potential gains from trade: surplus social value for cities, and profit for teams.

TEAMS AND PROFITS

To understand the motivations of team owners bargaining with cities, it is necessary to examine the value of ownership. As with any business, the primary reason for owning a team is to make a profit. The highly visible nature of pro sports creates an additional motivation—satisfaction of an owner's ego.

The public attention given to professional sports in America gives owners of teams a celebrity status that they would not otherwise be able to achieve, regardless

of their success in other business fields. Because of this, the motivation for owning a team could at least partially be explained by an owner's desire for public adulation from owning a championship team. If that is the case, then an owner presumably would be willing to accept some level of diminished profits in exchange for ego satisfaction. Some models of sports leagues explicitly incorporate the ego factor by including winning percentage in the utility function of owners (Rascher, 1997).

As the costs of owning a team have escalated, the willingness or ability of owners to "subsidize their ego" has been diminished. It is common to hear people say that sports used to be a game but is now a business, even though owners of today are much wealthier compared to their predecessors, for whom sports teams were their primary income source. In the past, owners were more dependent on their team to make a living. Of course, being able to afford to lose money and being willing to lose money are two different things. The actions of owners concerning stadiums show that their desire for public adulation only goes so far.

The remainder of this article will treat profit as the only motivation of owners. Other motivating factors such as winning or celebrity could be incorporated in the model as leading to higher player costs and cutting into team profits, but the fundamental question of the model would not be significantly affected unless these other motivations are also present in stadium issues. The actions of owners make it clear that this is not the case. On the contrary, owners often use alleged losses from trying to bring a winner to a city as justification for stadium subsidies, as if the fans owe the owner for his financial sacrifice. When it comes to stadiums, owners do everything they can to avoid spending their own money, with little regard for their public image. Carl Pohlad in Minnesota and George Shinn and Ray Woolridge in Charlotte are two examples of owners whose pursuit of public money for stadiums has made them so unpopular that the simple fact that they own the team has become a roadblock for a subsidy.

How profitable is owning a major pro sports team? It is difficult to know the answer for certain due to the notoriously protective nature of owners over the private finances of their teams, but evidence suggests that teams are much more profitable than owners would have us believe. From 1991 to 1997, *Financial World* published estimates of operating profits and franchise values for all four major sports leagues; since 1999, *Forbes* has published the figures. Analysis of the *Financial World* data by James Quirk and Rodney Fort indicates that in terms of operating income, teams are only modestly profitable. For Major League Baseball, average annual operating income per team was $3.6 million during the 6-year period. Because the average franchise was worth between $100 and $175 million during this time, the average return was somewhere between 2.0% and 3.6% (Quirk & Fort, 1999, p. 98). Returns to teams in the other three leagues were similar, although somewhat higher for the National Basketball Association. In the estimates provided by *Forbes* for the 1998 season, things look even worse for baseball teams. Average operating income of $1.9 million for franchises whose average value is $220 million nets a return of 0.9% (1999, p. 144).

Despite unimpressive operating income, capital gains through franchise appreciation have made sports teams lucrative investments historically and in recent years. For example, the selling price of the Houston Astros went from $17.9 million in 1979 to $95 million in 1992, and the Baltimore Orioles were sold for $174 million in 1993, 5 years after being sold for only $70 million (Scully, 1995, p. 130).

Combining data on franchise sales since the inception of leagues compiled by Quirk and Fort with franchise value estimates from *Financial World*, Gerald Scully has calculated the rate of appreciation for 83 franchises. The average annual rate of appreciation up to 1991 for all sports was 15.1% and was fairly consistent across sports (Scully, 1995, p. 132). The rate of capital gains was not affected by market size, which is already capitalized in the franchise values, so capital gains most likely are the result of growth in league popularity or other factors affecting team profitability generally.

Capital gains have slowed somewhat in the 1990s but are still strong. A study of franchise sales from 1990 to 1998 found annual rates of return of 11.3% for baseball, 12.7% for basketball, 17.7% for football, and 10.7% for hockey. Returns were fairly consistent across teams, so "almost all owners earned double-digit rates of return on their investments in teams in the 1990s" (Quirk & Fort, 1999, pp. 111-112). Franchise appreciation in baseball remained above 11 percent for the 1998 season (Badenhausen & Sicheri, 1999).

When capital gains are factored in, franchise ownership can be a worthwhile investment with minimal or even negative operating profit. Total return (operating profit plus franchise appreciation) for Major League Baseball teams averaged 11.9% in 1998. The New York Yankees had the highest return (40.7%) and the Kansas City Royals the lowest (–22.4%) (Badenhausen & Sicheri, 1999). The calculation method used to estimate franchise values may exaggerate annual fluctuations because it bases franchise value on revenues, which fluctuate with team success on the field. Even if there is sufficient variability in the success of a team over time, long-term capital gains will be fairly consistent across teams, as was observed for the 1990 to 1998 period. During the past few seasons, however, the line between the haves and have-nots in baseball seems to have become more distinct. If this is the case, then franchise values will become more spread out as small market franchises fall in value.

Operating profit and capital gains are not the end of the story. Teams can be much more valuable to owners financially than it says on the bottom line. Profits from sports teams can be hidden in a variety of ways. Gerald Scully (1995) has taken a detailed look at profits in the sports business and how they are hidden:

> A common method of purchasing a club is for investors to form a separate corporation that owns the club. The investors lend the money for the purchase and receive interest payments. These payments are a cost on the club's books, but are in fact a method of taking cash flow from its operations. (p. 116)

An added benefit of being able to hide profits is that public support for stadium subsidies is easier to acquire if the owner appears to be losing money. When owners do release profit information to the public, it is most often to show how bad the books look to justify public spending. Still public subsidies to owners are more than simply a charity case. What do cities have to gain from subsidizing sports teams?

THE VALUE OF TEAMS TO CITIES

Measuring the value of a team to a city is much more difficult than measuring the value to its owners. The revenue that teams earn through ticket sales and other sources such as broadcast rights fees and memorabilia sales do not completely reflect the value of the team to area residents. For local residents to be willing to pay a subsidy to a sports team, there must be some benefit that the team cannot capture. Potential sources of benefit include: economic growth, job creation, civic pride, and consumer surplus. Most relevant and yet most difficult to quantify are the intangible benefits from the existence of the team.

Attempts to measure the social value of teams have centered on the misused economic impact study. The goal of the studies is to measure the increase in economic activity created by the presence of the team, which is magnified as new spending ripples through the economy. Economic impact studies are, unfortunately, riddled with numerous errors that greatly exaggerate the importance of teams on local economies. Sports economists have argued convincingly that the actual economic impact of sports teams in terms of generating spending, creating jobs, and attracting businesses is just a small fraction of what impact studies predict—too small to justify public expenditure on stadiums (e.g., see Baade & Dye, 1988a).

Just as unfortunate as the misuse of economic impact studies to justify stadium subsidies is the resulting attention they have received from the sports economics field, which has prevented analysis of the real source of benefits of sports teams—their surplus value to consumers. Fans can benefit from the mere presence of a team, without attending games or even watching them on television by following the progress of a team in television reports and newspapers, or by word of mouth. Also, successful teams may instill a pride in the community even for people who are not particularly interested in the team. In economic terms, fans can be free riders, and provision of the public good by the government is a well-known solution to the free rider problem. These benefits, although difficult to measure, are the only way to truly calculate the social value of teams.

Critics of economic impact studies often conclude by recognizing the importance of incorporating consumption benefits in measuring the value of teams to cities, but the abstract nature of these benefits discourages attempts at measurement.

> It is next to impossible to quantify this aspect of the benefits of a team, but this does not mean that the benefits don't exist. It can be argued that recognition of this role for a

> pro sports team is what really underlies the large subsidies that cities have provided for sports teams, rather than the more mundane expenditures benefits. (Quirk & Fort, 1997, p. 176)

Some economists have utilized the contingent valuation method, which is used more commonly in environmental economics, to try to estimate the intangible benefits of sports teams. A contingent valuation survey on the Pittsburgh Penguins found the willingness-to-pay of local residents well short of the cost of a new arena (Johnson, Groothuis, & Whitehead, 2001). A contingent valuation survey of sports teams in Minneapolis and Detroit found aggregate willingness-to-pay for sports teams could account for the size of stadium subsidies typically seen. Furthermore, individual willingness-to-pay depended on the interest level of the respondent, suggesting that local residents support subsidies based on their own interest in the team, not based on any perceived benefit to the local economy (Owen, 1999).

Any method used to measure the intangible benefits of sports teams will face numerous obstacles, but for the purposes of this article, what is important is the possibility that these benefits exist. If sports teams have a significant public good aspect to them, this value cannot be captured from consumers by teams through ticket prices or other means. The threat of moving, however, allows teams to capture a portion of this value through subsidies.

A MODEL OF A PROFESSIONAL SPORTS LEAGUE[1]

Teams and Leagues

Let there be an unlimited number of cities identified by size $\sigma_i = \sigma_1, \sigma_2, \sigma_3, \ldots$, where city size decreases as i increases. In the model, city size is a demand parameter that is exogenous to the team's talent decision. The only way a team can change city size is to move to another city. In a practical sense, city size could be interpreted in many ways. Population of the metropolitan area is the most obvious, but other demographic factors such as income could also factor in. A team's geographic market could extend beyond the metropolitan area, with fan interest declining with distance from the team. In short, city size can be thought of as containing all determinants of demand out of the team's control. It simply reflects the desirability of the market to a team; a larger city is a more appealing market (for a discussion of city size, revenue, and rents, see Porter, 1992).

The existence of multiple teams in the same city is not considered by the model. It could be assumed that the smallest city in the league is at least half the size of the largest city; otherwise, the next team would become the second team in the largest city. Cities with multiple teams seem to be a relic of the early years of leagues. No league today would consider adding an expansion team in a city with an existing team, nor would league rules allow a team to relocate into another's market.

There are n teams whose number is endogenously determined. The teams will be a priori identical, but teams will be identified by the city in which they locate since decisions and profits will differ depending on the city. Each team seeks to maximize profits in its home market by purchasing the optimal amount of talent (t_i).

Talent is a determinant of local demand, and as such will be a determinant of the ticket price chosen by the team. Better teams charge higher ticket prices, everything else equal. Team owners seek to maximize revenues based on the chosen level of talent. Once talent is chosen, there is a unique ticket price that maximizes revenue. Choosing ticket price is simply an intermediate step on the way to maximizing revenue by choosing the talent level. The team's revenue function $R(\sigma_i, t_i, T/n)$ gives the revenue from the optimal ticket price dependent on city size, team talent, and average talent for the league. It can be expressed without including ticket price because talent and ticket price are essentially chosen simultaneously. More specifically,

$$R_i = t_i^{\alpha}\sigma_i^{\beta}(T/n)^{\gamma} \quad \text{Where } \alpha, \beta, \gamma \text{ are between 0 and 1.} \tag{1}$$

Talent (t_i) is the team's talent. The talent levels of all teams in the league will sum to the talent pool, T. For a given league talent pool, team talent will be positively related to revenue because more team talent means a stronger team and a greater likelihood of winning. The revenue function is also increasing in the average talent in the league, T/n, which represents the quality of the league. Fans may come to games because their team is good or to see a game with a high level of play.

It is possible that a team can become so good relative to its competition that it diminishes its own revenue because the outcome of the game is not in serious doubt. There is evidence that uncertainty of outcome can be a factor in attendance (Knowles, Sherony, & Haupert, 1992). This complication will not be considered explicitly by the model, but the model can easily account for this problem. For simplicity it will be assumed that talent is dispersed evenly enough so that there is sufficient uncertainty in outcome. The model takes this problem into account indirectly by having diminishing marginal revenue as talent increases. High relative talent levels will have low marginal revenue, and a small enough α parameter would guarantee that no team reaches a point where marginal revenue is negative.

In actual leagues, competitive balance problems are not a factor in team decision making but rather are dealt by the league as a whole. Large market teams acquiring so much talent that their revenues fall should not be a permanent feature of actual leagues because all other teams in the league would be doubly injured: first by having bad teams, and second by having unevenly matched games. It would be reasonable to expect that the rules of such a league would be adjusted to promote competitive balance even before a team would dominate a league to its own detriment. The current debate over revenue sharing in Major League Baseball serves as an example. The New York Yankees have been dominant in recent years but may not have

reached a point where that dominance has adversely affected their revenues. Instead, teams from smaller markets, led by Commissioner Selig, have advocated changing league rules to create more balance. The small market teams are hurt by imbalance because it also means more losing, whereas in large markets, the lack of uncertainty is tempered by the benefits of winning.

For simplicity, the elasticities of the revenue parameters, including talent, are assumed to be the same for all cities. Allowing talent elasticity to vary by location would be an interesting variation. Differences in talent elasticity could be thought of as a loyalty factor. A high elasticity would reflect "fair weather" fans and a low elasticity would reflect "die hard" fans. A higher elasticity would be an incentive for owners to field good teams. Differences in talent elasticity could explain why some large market teams who have a loyal following (Cubs, Red Sox) do not have a history of field success. The economic incentive of teams in larger cities to field better teams is tempered by the loyalty of their fans, who show up whether the team is winning or losing. With this modification, city size could be thought of as the quantity of the fan base, and talent elasticity would be the quality of the fan base (Porter, 1992).

Overall league talent T increases with the number of teams simply because there are more players, but the average talent of teams declines because each additional team draws less talent into the league as players who were not good enough to be in the league before are added by expansion. The talent pool can be described as the following:

$$T = Zn^{\delta} \text{ where } 0 < \delta < 1 \text{ and } Z > 0. \tag{2}$$

Z is simply a productivity constant; a higher Z means a better talent pool. As more teams enter, the talent pool grows, but at a decreasing rate measured by δ.

Costs depend linearly on talent so are simply wt_i, where w is the wage per unit of talent. This does not mean players are all paid the same salary. Rosters have a fixed number of players. Differences in the amount of talent across teams reflect that some players are more talented than others. For the purposes of this article, it is enough that talent is unequally distributed, and teams with more talent have higher labor costs.

The cost function does not depend on the ticket sales because the marginal cost of an additional fan is assumed to be zero. All other costs are assumed to be fixed, including stadium costs. This is an unfortunate simplification in that stadiums are central to the article, but it does not necessarily mean that stadium size/cost is fixed. Subsidies to teams are earmarked for stadiums, so a larger subsidy means a more expensive stadium. Considering stadium costs as fixed in this context does not mean that the contribution the team is willing to make is fixed, just that they do not offer it up front. Also, stadium capacity constraints are not considered.

The team's profit-maximizing problem is

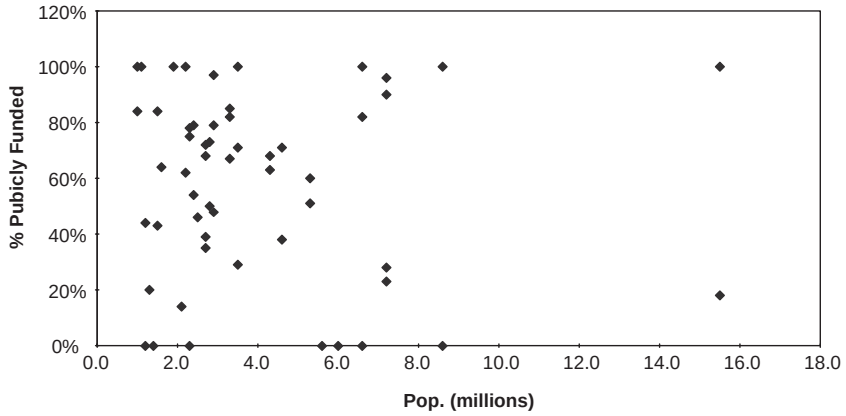

Figure 1: Team Payrolls Increase With City Size
SOURCE: U.S. Census Bureau and www.foxsports.com.

$$\max_t \pi_i = t_i^{\alpha}\sigma_i^{\beta}(Zn^{\delta} / n)^{\gamma} - wt_i \tag{3}$$

Setting marginal revenue equal to wage and solving for t gives the optimal hiring rule for talent:

$$t_i^* = [\alpha\sigma_i^{\beta}Z^{\gamma}n^{\gamma(\delta-1)} / w]^{1/(1-\alpha)} \tag{4}$$

The optimal level of talent increases with city size and decreases with the wage and the number of teams in the league. The optimal talent level (t^*) decreases as the number of teams increases, because with more teams a smaller percentage of the overall talent pool (T) is needed to maintain the same relative strength. A smaller slice of the talent pie will allow them to achieve the same on field success.

Figure 1 shows the positive relationship between city size and talent for baseball. Average payroll for the 1995 through 2000 seasons is used to represent talent as opposed to winning percentage because team payroll is a more accurate measurement of a team's expectation for success. Of course a higher payroll does not always guarantee more victories.

As the number of teams in a league increases, the cities of existing teams become larger relative to the average city size so there is incentive to increase talent level for existing teams; but average talent is decreasing, so the same level of success on the field can be achieved with less absolute talent. For example, when the Arizona Diamondbacks and Tampa Bay Devil Rays joined Major League Baseball, they were among the worst teams in the league, but their rosters included many players who were in the league the previous season and would have still been in the league

without expansion. New teams acquire more talent than is brought in by the expanded talent pool.

Substituting t_i* gives the value for revenue

$$R_i = [\alpha^{\alpha}\sigma_i^{\beta}Z^{\gamma} / w^{\alpha}n^{(1-\delta)}]^{1/(1-\alpha)} \tag{5}$$

and operating profit

$$\pi_i = (1-\alpha)[(\alpha / w)^{\alpha}\sigma_i^{\beta}(Z / n^{1-\delta})^{\gamma}]^{1/(1-\alpha)} \tag{6}$$

Currently, major professional sports are operated as cartelized leagues which control the number of teams. A sports cartel is different from the typical case in that members do not compete for the same customers as they would if they were selling their product to the same consumer base. Instead, entry hurts existing teams by diluting the talent level and reducing the revenue capability of member teams. This is more akin to the "tragedy of the commons" where firms are competing for a scarce resource, and the cartel serves to "solve" the problem by limiting access to the resource.

A league will add teams up to the point where

$$\pi_n = -\sum_{i=1}^{n-1} d\pi_i / dn. \tag{7}$$

Equation 7 reflects that for existing teams to agree to add a team, the profit of the new team must be large enough to offset the profit lost by existing teams. The profit of the expansion team can be captured by existing teams through franchise fees.

Equation 7 can be solved to find the size of the smallest city with a team in the league:

$$\sigma_n = \left[(1-\delta)\gamma / (1-\alpha)n\sum_{i=1}^{n-1}\sigma_i^{\beta/(1-\alpha)}\right]^{(1-\alpha)/\beta}. \tag{8}$$

The size of the last city in the league is decreasing in the number of teams already in existence because the negative effect from the dilution of talent impacts more teams. It is higher when the size of current cities with teams is larger because the magnitude of marginal profit is increasing in σ. Note also the effect of δ, the growth rate of the talent pool, on the minimum city size. A larger δ means a smaller acceptable city size because the talent pool is expanding relatively quickly. Additional teams do not rapidly deplete the talent pool. A smaller δ means only a small amount of additional talent is added to the league, adversely affecting the revenues of existing teams.

Cities and Subsidies

The public good aspect or social value of a team to a city, $V_i(\alpha_i, t_i^*, T/n)$, depends on city size, team talent, and league talent in the same way the team's revenue function does. For simplicity, let a city's social value be proportional to revenues so that

$$V_i = \lambda R(\sigma_i, t_i^*, T/n) = \lambda[\alpha^{\alpha}\sigma_i^{\beta}Z^{\gamma}/w^{\alpha}n^{(1-\delta)}]^{1/(1-\alpha)} \quad \text{where } \lambda > 0. \qquad (9)$$

Note that social value depends on the team's choice of talent made without accounting for any potential subsidy. This is because the subsidy will be a fixed revenue; the team will have no incentive to maintain a higher talent level once the subsidy is agreed to. The city can recognize the commitment problem and base their expected social value on the team's optimal talent level without a subsidy.

Each city wants to keep as much of the social value as possible, that is, they want to pay the lowest possible subsidy and still have a team. Cities maximize $V_i - S_i$, where $V_i = 0$ if no team is in the city.

How do subsidies affect the number of teams in a league? The league now adds teams up to the point where

$$\pi_n + S_n = -\sum_{i=1}^{n-1} d\pi_i/dn. \qquad (10)$$

To determine the size of S_n, note that city $(n + 1)$, the largest city without a team will offer their entire social value, V_{n+1} to acquire a team. The smallest city in the league must be at least as attractive to a team as city $n + 1$. This means $S_n = S_{n+1} - (\pi_n - \pi_{n+1})$. The league's condition in Equation 10 becomes

$$\pi_{n+1} + V_{n+1} = -\sum_{i=1}^{n-1} d\pi_i/dn. \qquad (11)$$

If $\pi_{n+1} + V_{n+1} > \pi_n$, then the number of teams in the league will be larger when cities subsidize teams.

Equation 8 showed the size of the smallest city in a league without subsidies. The following equation shows the size of the largest city not in a league with subsidies:

$$\sigma_{n+1} = [(1-\delta)\gamma/(1-\alpha+\lambda)n\sum_{i=1}^{n-1}\sigma_i^{\beta/(1-\alpha)}]^{(1-\alpha)/\beta}. \qquad (12)$$

The λ in the denominator makes the size of the city in Equation 12 less than in Equation 8. The difference in league size between the unsubsidized and subsidized situation depends on the size of λ, or how the magnitude of the social value com-

pares to team revenues. A large enough λ could mean many more cities have teams when subsidies are offered.

As a simple illustration, let $\alpha = \beta = \gamma = 1/2$. The minimum city size from Equation 8 is $(1 - \delta)\sum_{i=1}^{n-1}\sigma_i / n$ for an unsubsidized league, a fraction of the average city size. If δ, the elasticity of the talent pool, is close to one, then the minimum city size is smaller because additional teams dilute the talent pool by only a small amount. If δ is near zero, talent dilutes quickly so existing teams do not want to expand the league. For a subsidized league, the minimum city size from Equation 12 is $(1 - \delta)/(1 + 2\lambda)\sum_{i=1}^{n-1}\sigma_i / n$. When $\lambda = .1$, minimum city size is 5/6 of the unsubsidized city size, and for $\lambda = .5$, it falls to half the size.

The profit a team can earn by locating in the largest city without a team, $\pi_{n+1} + V_{n+1}$, serves as a threat point that all cities in the league must match. Larger cities, however, pay smaller subsidies since their size gives them larger profit potential. The subsidy a city pays can be written as:

$$S_i = \pi_{n+1} + V_{n+1} - \pi_i. \tag{13}$$

The subsidy is the difference between the most profit a team could earn in a city without a team minus the operating profit a team earns in city *i*, keeping in mind that there are no negative subsidies. The largest cities may not need to pay any subsidy as the profit a team can earn there exceeds the threat point. After substituting, Equation 13 becomes:

$$S_i = [(1 - \alpha + \lambda)\sigma_{n+1}{}^{\beta/(1-\alpha)} - (1 - \alpha)\sigma_i^{\beta/(1-\alpha)}][(\alpha/w)^{\alpha}(Z/n^{1-\delta})^{\gamma}]^{1/(1-\alpha)}. \tag{14}$$

If city *i* is close in size to city $n + 1$, it will have to pay a subsidy. The larger the city, the smaller the subsidy. Note also that the larger the social value, represented by λ, the larger a city must be before it no longer pays a subsidy.

The city size where it is no longer necessary to pay a subsidy can be found by setting Equation 14 equal to zero:

$$\sigma_i = [(1 - \alpha + \lambda)/(1 - \alpha)]^{(1-\alpha)/\beta}\sigma_{n+1}. \tag{15}$$

Once again, by letting $\alpha = \beta = 1/2$, $\sigma_i = (1 + 2\lambda)\sigma_{n+1}$. Cities 2λ percent larger than the largest city without a team will not pay a subsidy. If cities are similar in size, then subsidies could be captured by teams even in the largest cities, but if city size is more dispersed, then only some of the cities will have to offer a subsidy.

The largest metropolitan areas are in a much stronger bargaining position due to the high profitability they provide local teams. There are now only five stadiums

still in use that were constructed in the first half of the 20th century and all are in either New York, Boston, or Chicago. Large cities are also less inclined to provide public money for stadiums. Boston has never spent public funds on a stadium. This may change with the new Fenway Park, but so far a proposal for the city to pay for 15% of a $545 million stadium project has not been approved. The National Football League awarded its next expansion franchise to Houston because Los Angeles did not put together a stadium package that was suitable to the league.

Table 1 provides the cost and percentage of public funding for stadiums built since 1990, listed by size of the metropolitan area. Comparing city size and stadium subsidies for U.S. cities as a whole does not show a strong relationship either positively or negatively (see Figure 2). Keep in mind, however, that most of the oldest stadiums still in use are in the largest cities. The refusal of large cities to subsidize stadiums does not necessarily result in the teams paying a higher percentage of the new stadium costs; the teams simply keep the old stadiums longer. The new baseball stadiums built in Houston, Seattle, Milwaukee, and Pittsburgh all replaced facilities much younger than Yankee Stadium, Fenway Park, and Wrigley Field.

Other factors that can make observing a relationship between subsidies and city size difficult are the closeness in size of many cities, the role of local politics, and the difficulty in accurately measuring the subsidies.[2] For example, Baim (1994) finds that the Metrodome in Minneapolis, although publicly funded, was able to cover its fixed and operating costs during the first 10 years of operation through rent and other stadium revenues.

Uniformity of city size suggests that teams have an advantage in extracting subsidies because their "reservation wage" for staying in a city is likely to be close to the upper bound that the city is willing to pay. Teams can then allow cities to compete with each other for teams.

The role of politics in stadium subsidies cannot be incorporated into this simple model but is certainly an important factor in explaining how teams garner subsidies. Teams rely on local politicians, most often mayors, to promote stadium plans. Every negotiation between a team and local government has its own unique story, and the personalities involved will no doubt affect the outcome. A model of this type can only give an indication of a pattern that may develop in the big picture. It does not guarantee that smaller cities will always pay a larger subsidy, just as it does not guarantee that teams will be located in the largest cities available.

Free Entry

Subsidies to sports teams and their owners are rational in the sense that they maximize social value, but changes in bargaining conditions could improve the situation for cities. Free entry of teams into leagues is frequently proposed by sports economists as the best way to eliminate subsidies to teams and other problems:

TABLE 1: New Stadiums in U.S. Cities Since 1990, Ranked by Population (Population and Dollars in Millions)

City (MSA)	*Team*	*League*	*Population*	*Facility*	*Year*	*Cost ($)*	*% Public*
Los Angeles	Lakers	NBA	15.5	Staples Center	1999	330	18
Los Angeles	Clippers	NBA					
Los Angeles	Kings	NHL					
Los Angeles	Mighty Ducks	NHL	15.5	Arrowhead Pond	1993	84	100
Chicago	Bulls	NBA	8.6	United Center	1994	175	0
Chicago	Blackhawks	NHL					
Chicago	White Sox	MLB	8.6	Comiskey Park	1991	168	100
Washington/Baltimore	Ravens	NFL	7.2	PSINet Stadium	1998	220	90
Washington/Baltimore	Wizards	NBA	7.2	MCI Center	1997	260	23
Washington/Baltimore	Capitals	NHL					
Washington/Baltimore	Redskins	NFL	7.2	Fed Ex Field	1997	251	28
Washington/Baltimore	Orioles	MLB	7.2	Camden Yards	1992	228	96
San Francisco/Oakland/San Jose	Giants	MLB	6.6	Pacific Bell Park	2000	255	0
San Francisco/Oakland/San Jose	Warriors	NBA	6.6	The New Arena	1997	121	100
San Francisco/Oakland/San Jose	Sharks	NHL	6.6	San Jose Arena	1993	163	82
Philadelphia	Flyers	NHL	6.0	First Union Corp. Center	1996	206	0
Boston	Patriots	NFL	5.6	unnamed	2002	325	0
Boston	Celtics	NBA	5.6	Fleet Center	1995	160	0
Boston	Bruins	NHL					
Detroit	Lions	NFL	5.3	Ford Field	2002	300	51
Detroit	Tigers	MLB	5.3	Comerica Park	2000	361	60
Dallas	Mavericks	NBA	4.6	American Airlines Center	2001	325	38
Dallas	Stars	NHL					
Dallas	Rangers	MLB	4.6	The Ballpark in Arlington	1994	191	71
Houston	?	NFL	4.3	Harris County Stadium	2002	310	63

Houston	Astros	MLB	4.3	Enron Field	2000	250	68
Atlanta	Hawks	NBA	3.5	Philips Arena	1999	214	29
Atlanta	Thrashers	NHL					
Miami	Heat	NBA	3.5	American Airlines Arena	1998	175	71
Miami	Panthers	NHL	3.5	National Car Rental Center	1998	212	100
Atlanta	Braves	MLB	3.5	Turner Field	1997	235	100
Atlanta	Falcons	NFL	3.5	Georgia Dome	1992	214	100
Seattle	Seahawks	NFL	3.3	unnamed	2002	300	67
Seattle	Mariners	MLB	3.3	Safeco Field	1999	518	85
Seattle	SuperSonics	NBA	3.3	Key Arena	1995	114	82
Cleveland	Browns	NFL	2.9	Cleveland Stadium	1999	283	79
Cleveland	Indians	MLB	2.9	Jacobs Field	1994	175	48
Cleveland	Cavaliers	NBA	2.9	Gund Arena	1994	159	97
Minneapolis	Wild	NHL	2.8	Wild Arena	2000	130	50
Minneapolis	Timberwolves	NBA	2.8	Target Center	1990	117	73
San Diego	Padres	MLB	2.7	unnamed	2002	411	72
Phoenix	Cardinals	NFL	2.7	Los Arcos Stadium	2002	624	35
Phoenix	Diamondbacks	MLB	2.7	Bank One Ballpark	1998	349	68
Phoenix	Suns	NBA	2.7	America West Arena	1992	90	39
Phoenix	Coyotes	NHL					
St. Louis	Blues	NHL	2.5	Kiel Center	1994	139	46
Pittsburgh	Pirates	MLB	2.4	PNC Park	2001	209	79
Pittsburgh	Steelers	NFL	2.4	Steelers Stadium	2001	244	54
Denver	Broncos	NFL	2.3	New Mile High Stadium	2001	364	75
Denver	Nuggets	NBA	2.3	Pepsi Center	1999	160	0
Denver	Avalanche	NHL					
Denver	Rockies	MLB	2.3	Coors Field	1995	215	78
Tampa Bay	Buccaneers	NFL	2.2	Raymond James Stadium	1998	169	100
Tampa Bay	Lightning	NHL	2.2	Ice Palace	1996	139	62
Tampa Bay	Devil Rays	MLB	2.2	Tropicana Field	1990	208	100

(continued)

TABLE 1 (continued)

City (MSA)	*Team*	*League*	*Population*	*Facility*	*Year*	*Cost ($)*	*% Public*
Portland	Trail Blazers	NBA	2.1	Rose Garden	1995	94	14
Cincinnati	Bengals	NFL	1.9	Paul Brown Stadium	2000	400	100
Milwaukee	Brewers	MLB	1.6	Miller Park	2001	250	64
San Antonio	Spurs	NBA	1.5	Longhorn Arena	2002	175	84
Indianapolis	Pacers	NBA	1.5	Conseco Fieldhouse	1999	183	43
Columbus	Blue Jackets	NHL	1.4	Nationwide Arena	2000	150	0
Charlotte	Panthers	NFL	1.3	Ericcson Stadium	1996	248	20
Buffalo	Sabres	NHL	1.2	HSBC Arena	1996	128	44
Salt Lake City	Jazz	NBA	1.2	Delta Center	1991	101	0
Nashville	Oilers	NFL	1.1	Adelphia Coliseum	1999	290	100
Nashville	Predators	NHL	1.1	Gaylord Entertainment Center	1997	144	100
Raleigh	Hurricanes	NHL	1.0	Raleigh Ent. & Sports Arena	1999	122	84
Jacksonville	Jaguars	NFL	1.0	Alltel Stadium	1995	121	100

NOTE: MSA = metropolitan statistical area; NBA = National Basketball Association; NHL = National Hockey League; MLB = Major League Baseball; NFL = National Football League.
SOURCE: Rafool (1998); www.ballparks.com; www.foxsports.com; www.fieldofschemes.com.

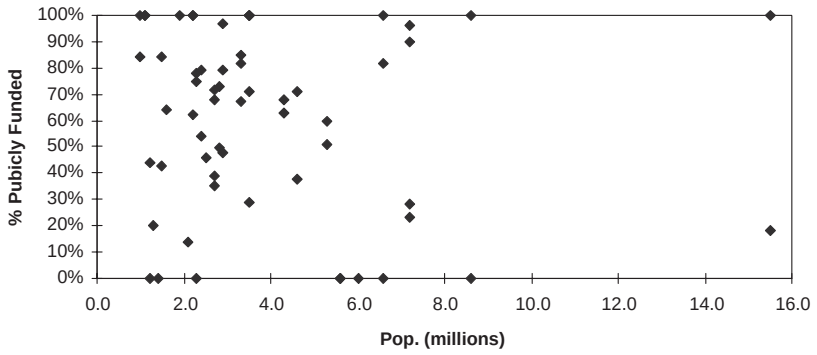

Figure 2: Public Subsidies for Stadiums in Relation to City Size

> Replacing the present monopoly league structure with a competitive sports industry would eliminate essentially all of the current problems of pro team sports. There would be more games available on TV, lower ticket prices, lower player salaries, no more owner threats against state and local governments, more competitive balance, and a team in every city capable of profitably supporting one. (Fort & Quirk, 1997, p. 15)

Competition would increase the number of teams and substantially reduce the size of subsidies, but it would not eliminate them. In a competitive environment, teams will enter as long as $\pi_n + V_n = C$. There will be "a team in every city capable of profitably supporting one" and more. In a case where there are no subsidies ($\pi_n = C$), the size of the smallest city with a team will be

$$\sigma_n(\text{no subsidy}) = [C/(1-\alpha)]^{(1-\alpha)/\beta}[(w/\alpha)^{\alpha}(n^{1-\delta}/Z)^{\gamma}]^{1/\beta}. \quad (16)$$

If cities are able to offer subsidies up to the social value of a team the minimum city size becomes

$$\sigma_n(\text{subsidy}) = [C/(1-\alpha+\lambda)]^{(1-\alpha)/\beta}[(w/\alpha)^{\alpha}(n^{1-\delta}/Z)^{\gamma}]^{1/\beta}. \quad (17)$$

The minimum city size is smaller in the subsidized case. Teams now locate in cities that are not capable of profitably supporting one. Any city where a team can earn a profit will not pay any subsidy, but the size of city where this is true increases due to the dilution of the talent pool as more teams enter. This is not to say that free entry would not affect the size of subsidies, they would be drastically reduced.

The difficulty with free entry into leagues is that it is not a stable situation. Because the quality of play matters, larger cities would be hurt by entry of teams as the talent pool is diluted. Smaller cities can free ride on the talent of teams in larger

cities. The teams in larger cities will not want to play the small market teams. Instead, the large market teams will only play each other and the cartel league will be reestablished. Unlike the typical cartel, leagues are stable in that there is no incentive to defect because teams do not compete for the same customers.

College football illustrates this process. Although there is free entry into Division I for any school that wishes to play at that level, conferences form that divide the industry into leagues of similar-sized institutions. Schools that have lower revenue potential and talent levels are in different conferences and only play larger schools occasionally and almost never at the stadium of the smaller school. The National Collegiate Athletic Association (NCAA) has formalized the process somewhat through designating Divisions IA, IAA, II, and III for college football. The same separation into leagues would occur in professional sports. Just as you do not see Notre Dame playing at Northern Illinois, you would never see the Chicago Bears playing at South Bend.

Free entry does not guarantee the end of subsidies. Cities compete to construct facilities or attract businesses even when not faced with a monopolized industry. The best example of this is convention centers. In recent years, subsidies for convention centers have been of similar magnitude to that of stadiums, with no monopoly power or owner threats. There is no league restricting the number of convention centers in the United States, yet cities make the same types of investments here as they do with sports stadiums. Subsidies for convention centers may be an even worse use of public money than stadiums because the residents of the city are not even the intended market of the convention centers; they are built to cater to everyone but the local residents (Sanders, 1998).

CONCLUSION

As the model shows, cities that cannot profitably support a team without a subsidy will be willing to offer a subsidy up to the unrealized social value of the team. This is not necessarily bad; it comes directly from the public good element of sports teams.

The model can be extended to incorporate other aspects of the relationships of cities, teams, and leagues. Revenue sharing maintains league size while increasing the potential profits in the cities without a team. This leads to even larger subsidies. The very definition of city size has been blurred in some sense with the changes in stadium design. Combined with the effects of revenue sharing, stadiums have become an important part of defining a team as small market or large market instead of simply population. Stadiums such as Camden Yards in Baltimore, the Ballpark in Arlington (Texas), and Jacobs Field (Cleveland) have the same effect as increasing market size because of their ability to produce higher stadium revenues.

Revenue sharing and stadium technology have distorted the location incentives of teams in the National Football League so much that Los Angeles is without a team. Teams who are considering a move benefit from having a large market to use

as a bargaining chip, but the league is hurt overall because the second-largest television market does not have a team. The league is so concerned by this that they have actually pledged more money to large market teams from their stadium fund.

Another criticism of professional sports that increased competition would supposedly solve is that there is too much money involved. A casual examination of European soccer shows that a more competitive system will not necessarily "take the money out of the game." Soccer players secure multimillion dollar contracts on par with the stars of American sports. Rupert Murdoch recently purchased Manchester United in England's Premier League for the largest sum ever paid for any professional sports franchise, $500 million. The amount of money involved in professional sports has much more to do with consumer demand than with monopoly power. Because monopoly power has been in place in leagues almost since their inception, it cannot explain the growth in the amount of money in sports during the past 20 years. Quirk and Fort (1997, p. 232) have found that the increases in player salaries in baseball since at least the late 1980s are explained almost entirely by increases in consumer demand for sports. There is no reason why the same explanation should not apply to other aspects of the industry such as franchise values and public subsidies.

The public good element of sports teams always will leave open the possibility of public subsidies for teams. It is not simply a matter of bargaining power. The incentive to subsidize teams will exist as long as the public benefits cannot be incorporated into private transactions.

NOTES

1. For examples of sports league models see El-Hodiri and Quirk (1971); Quirk and El-Hodiri (1974); Atkinson, Stanley, and Tschirhart (1988); and Fort and Quirk (1995).

2. Up front expenditures by cities for stadiums without taking into account lease arrangements may not accurately depict subsidies. See Baim (1994) and Hamilton and Kahn (1997) for individual case studies.

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