PUBLIC SUBSIDIES AND THE LOCATION AND PRICING OF SPORTS

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Abstract

Using public choice analysis, we determine how government subsidies affect location and pricing decisions of sport teams. We explain how voter referendums can create suboptimal outcomes for local communities and identify winners and losers in sport team subsidies. Subsidy bidding leads to higher subsidies and fewer sport franchises but does not alter team location. Sport subsidies generate additional revenue for owners and players at taxpayer expense, while non-fan taxpayers subsidize both the team and fans. To increase political support for subsidies, teams lower ticket prices below the apparent profit-maximizing level, which may cause inelastic ticket prices and ticket shortages.

I. Introduction

Municipal subsidies to private owners of sport team franchises are now so large that sport team subsidies threaten to crowd out local public spending on schools, infrastructure maintenance and expansion, and other high-valued municipal services. Using public choice analysis, this paper examines the effect of government subsidies on the location and pricing decisions of for-profit sport teams. Understanding the role of these government subsidies in sport team location and pricing decisions enables us to identify the winners and losers in subsidy bidding wars among cities and to understand how voter referendums can create suboptimal outcomes for local communities. We also show that municipal subsidies play an important role in sport ticket pricing. By including public choice analysis of subsidies in the pricing decision of team owners, we reconcile a long-standing conundrum in sport ticket pricing: Why do empirical studies consistently find ticket prices in the inelastic region of demand? While this paper focuses on municipal subsidies to sport teams, the importance of linking a firm's location and pricing decisions to the firm's pursuit of voter support for public subsidies may extend well beyond the business of sports to include bidding wars among cities to win corporate relocations.

This paper begins by employing a widely-accepted public choice model to determine a region's political support for team subsidies. Integrating this public choice model with private market demand for a sport team allows us to measure and compare the profit and subsidy potential of a region. We then demonstrate the two are positively related in nearly all cases. Rational team owners locate where the sum of private profits and public subsidies are greatest. Since the maximum subsidy a region will support is directly related to the level of market demand, our model reveals that subsidy bidding among communities anxious to host a sport team will <u>not</u> alter the geographic distribution of teams – a principle we call "location invariance." This principle is analogous to Rottenberg's [1956] famous principle describing the invariance in the distribution of player talent to rules governing bidding for players in sport labor markets. We find that community bidding serves only to redistribute wealth; in our case, from citizens at large to team owners (and players) and from non-fan taxpayers to fans.

Having established a formal public choice linkage between voter support and ticket prices, we next investigate the pricing decision of a team owner. Team owners can influence the political outcome of a subsidy vote by actions that build fan loyalty and community interest in the team. In particular, owners realize that lower ticket prices stimulate public support for greater subsidies. It is precisely the ability to trade lower ticket prices for increased subsidy support that resolves the troublesome observation that teams frequently price tickets in the inelastic region of demand, a practice that many sports economists have argued reduces profit for team owners. Using the more complete model of ticket pricing developed in this paper, we show that inelastic ticket pricing can indeed be profit-maximizing, and these "low" prices can also explain the persistent excess demand for tickets when stadium capacity is fixed. In addition, our analysis of sport subsidies suggests owners will practice a form of politically-motivated price discrimination in which persons of exceptional political influence are showered with valuable team-related consumption packages.

The paper begins by examining the location decision. In Section II we develop a formal public choice model of voter behavior and preferences for sport team subsidies, which leads to the location invariance principle. The paper then turns to the ticket pricing decision. Section III reviews the sport pricing literature, and Section IV utilizes the public choice model developed in Section II to explain why profit-maximizing team owners set ticket prices so low. In Section V we offer concluding remarks and suggestions for further research.

II. Subsidy Bidding and the Invariance of Team Location

Consider two cities or locations that might host a professional team. In the absence of a subsidy offer from either location, the team locates where demand is highest. We wish to know whether competition between locations that results in subsidy offers can alter a team's location decision. Specifically, can a location with less market demand offer a subsidy sufficiently greater than that of a location with more demand to attract a team? Because subsidy determination is a political process, public choice analysis provides the means to determine the maximum subsidy any particular location will support and to identify the winners and losers when cities compete for sport teams through subsidies. We demonstrate that, in general, municipal team subsidies cannot be used by "smaller" cities to lure teams away from "larger" cities – a principle we call location invariance.

We employ the public choice model developed by Goodman and Porter [1985, 1988, 2004]. The model characterizes the outcome of a vote – either a referendum or a vote among elected representatives – as a function of the "effort" that proponents and opponents supply to the political process to secure their preferred outcome. Effort can take many forms. Individuals can vote, contribute money, organize get-out-the-vote campaigns, and help to persuade others. A mayor or city official can combine the proposal with other proposals (logrolling), choose the time of the election, and control the agenda. Individuals in the print and broadcast media can provide an influential source of voter information, and so on. Because effort, unlike votes, can be continuously varied, the model highlights the different influence individuals can have on the political outcome. In what follows, we assume the subsidy decision is determined by a direct referendum vote although the analysis would apply in the same fashion to representative voting.

II.1 Referendum Voting Model

Suppose a community is composed of N persons who share the tax cost of the subsidy. Individual demand for the sport is $q_i(P, \alpha)$, where P is the team-determined price and α is a shift parameter that accounts for all non-price demand factors. Assume that $\partial q_i / \partial P \le 0$ and $\partial q_i / \partial \alpha \ge 0$. The subsidy's tax cost for individuals is $t_i S$, where t_i is the i^{th} voter's tax share and S is the amount of the subsidy. For any particular ticket price, $\bar{P}$, the net benefit of the subsidy for the i^{th} voter is

(1) $$NB_i(S) = V_i + CS_i(\bar{P}) - t_i S \,,$$

where V_i is any value not related to consumption and $CS_i(\bar{P}) = \int_{\bar{P}}^{\infty} q_i(p)dp$ is consumer's surplus for the i^{th} individual.

We assume there exists a homogeneous measure of the effort that individuals contribute to the voting process. Let H^i_{yes} and H^i_{no} be the effort that individual i contributes, respectively, in support of or in opposition to a team subsidy proposal:

(2)
$$H^i_{yes}(\bar{P}, S) = \begin{cases} y_i(NB_i) & if\ \ NB_i \ge 0 \\ 0 & otherwise \end{cases}$$

$$H^i_{no}(\bar{P}, S) = \begin{cases} n_i(NB_i) & if\ \ NB_i \le 0 \\ 0 & otherwise. \end{cases}$$

We also assume that $y_i(\cdot)$ and $n_i(\cdot)$ are continuous functions with $y_i(0) = n_i(0) = 0$. Voter indifference [Smithies, 1941] and rational voter behavior [Downs, 1957] imply that when alternatives in elections are of nearly equal value, voters will be nearly indifferent between outcomes and so exert little effort to influence elections. Conversely, when the stakes are high, voters will expend greater effort to secure their favored alternatives. Therefore, $y_i' > 0$ and $n_i' < 0$. Individuals may differ, then, in their support or opposition for the team subsidy according to the functions $y_i(\cdot)$ and $n_i(\cdot)$. For all individuals, the greater the net benefit (loss), the greater will be the effort for (opposition to) the subsidy. Assume that voter effort is equally productive in generating "yes" or "no" votes, and that votes are positive monotonic functions of effort. Thus, a subsidy referendum passes if $\sum_{i=1}^{N} H_{yes}^{i} > \sum_{i=1}^{N} H_{no}^{i}$ and fails if $\sum_{i=1}^{N} H_{yes}^{i} < \sum_{i=1}^{N} H_{no}^{i}$.

The maximum subsidy a community will support is the solution to the following constrained optimization problem:

$$\text{Maximize } S \text{ subject to } \sum_{i=1}^{N} (H_{yes}^{i} - H_{no}^{i}) > 0$$

The solution to this optimization problem, S^*, satisfies the following condition:

$$\sum_F y_f (CS_f(\bar{P}) - t_f S^*) = \sum_A n_a (CS_a(\bar{P}) - t_a S^*) + \gamma \tag{3}$$

where $F = \{f : NB_f > 0\}$ is the set of voters that favor the subsidy, $A = \{a : NB_a < 0\}$ is the set of voters who oppose the subsidy, and γ is an arbitrarily small positive number.

For any γ, S^* is unique. To see this, consider equation (3) when S = 0. The left-side of (3) is positive – representing fans with consumer surplus – and the right-side is zero. Now let the size of the proposed subsidy increase. For each individual there is a maximum subsidy they will not oppose, defined as

$$S_i^{\max} = [V_i + CS_i(\bar{P})] / t_i . \tag{4}$$ [2]

As the subsidy amount passes each individual fan's maximum level, that fan moves from set *F* to set *A*, causing the set of voters who favor the subsidy to shrink and the set of opponents to grow.

For later reference, we refer to this migration of voters as the "set effect." In addition to the set effect, an "effort effect" works to change the effort level of individual members of each set. As the size of the proposed subsidy rises, supporters' net benefits fall and they reduce their efforts, while simultaneously opponents' net benefits become more negative and they increase their efforts to defeat the proposal. As the subsidy increases, the set and effort effects combine to cause the number and effort of supporters to decline and the number and effort of opponents to increase, until S^* is reached and expression (3) is satisfied. No increase in team subsidy above S^* can win enough voter support to pass.

II.2 Location Invariance

When Rottenberg analyzed player movement under a reserve clause that forbade teams open competition for talent, he postulated what has become known as Rottenberg's Invariance Principle: "(A) market in which freedom is limited by a reserve rule … distributes players among teams about as a free market would" [1956, p. 255]. Rottenberg goes on to state that such reserve rules "lead to exploitation (when players) receive less than they would be worth in a free market uninhibited by (reserve) rules" [1956, p. 258]. Rottenberg is intentionally precise when he qualifies that player distribution under reserve rules is about like the distribution in free markets. He appears to anticipate Coase's [1960] insights concerning the importance of transaction costs. From Coase, we know that any difference in the distribution of player talent when there is a reserve clause and when there is free agency is the result of transaction costs.

In a fashion similar to Rottenberg, we ask whether public choice processes will allocate teams across competing locations about like a market free of subsidy competition, recognizing the considerable political transaction costs inherent in winning subsidy referenda. Based on our political model of sport team subsidies, we postulate a Location Invariance Principle concerning the location of sport teams and two corollary effects of location invariance concerning the redistributive consequences of competitive subsidy bidding for sport teams.

LOCATION INVARIANCE PRINCIPLE. A restriction that bans subsidies to sport teams distributes existing teams among competing locations in about the same pattern as the present subsidy bidding process.

Demonstration. In the absence of team subsidies, a team owner would choose to locate in the community where demand, and hence profitability, is greatest. The owner would be willing to move to a location with less demand only if it offered a sufficiently large subsidy. But as we demonstrate, a smaller market's maximum politically supportable subsidy will not be as large as the maximum subsidy voters will support in a location with higher demand.

It is a straightforward process to show that the maximum subsidy S^* rises with the level of sport demand in any particular location. All other things equal, market demand, $Q(P,\alpha)=\sum_{i=1}^{N} q_i(P,\alpha)$, will increase if individual demands increase ($\partial Q/\partial\alpha > 0$) or if the number of fans and hence taxpayers (N) increases. When α rises and individual demands and consumer's surplus increases and NB_i in equation (1) and $S_i^{\max}$ in equation (4) increase for some individuals. This, in turn, increases the number and effort of supporters of a subsidy while decreasing the number and effort of opponents. Therefore, the set and effort effects of an increase in individual demands increase the maximum politically acceptable subsidy S^*. As for the effect on S* of an increase in population, recall that $\sum_{i=1}^{N} t_i = 1$, so individual tax shares decrease as population grows. Reducing individual tax rates increases individual net benefits and thus induces set and effort effects that also support a greater maximum subsidy S^*.[3] Thus a team owner's location decision is unaffected by competitive subsidy bidding among locations.

Team owners are unmitigated beneficiaries of subsidy competition: bidding among cities forces the most profitable city to raise its subsidy offer in order to keep its team. Non-fan taxpayers are unmitigated losers in the subsidy battle: they receive no benefit from keeping the team but must pay their share of taxes needed for the subsidy. As we will see in the next section, the impact on taxpaying fans is ambiguous: they must pay taxes to fund the subsidy but owners will lower the price of the sport in order to secure fans' increased political support. Extending the model above offers a compelling explanation for the observed phenomena of low sport ticket pricing that we review in the next section.

Notice that our model of referendum voting does not require a majority of the population to be consumers of the sport in order for a subsidy referendum to pass. However, if sport consumers are a minority, they must put forth relatively more effort to secure passage of the subsidy than voters who do not consume the sport. Tullock's (1967) concept of rational ignorance explains how this can happen. Non-fans, for whom consumer's surplus is zero, suffer small negative net benefits equal to $-t_iS$ in equation (1). Fans who oppose a team subsidy ($NB_i < 0$) because of the tax cost receive positive consumer's surplus and therefore suffer even less. When the cost of a public decision is small for the individual there is no rational reason to be informed and to take action against the proposal because information and action are costly. However, a fan's surplus might be substantial and across the set of fans some will have high levels of surplus to protect. When the benefit of a public decision is great for some individuals, they are rationally well informed and stimulated to put forth significant effort to affect the electoral outcome. Thus, non-fan taxpayers (who might be required to pay as little as $25 or $30 per year in taxes to support the team subsidy) would be unlikely to understand the issue, to make significant efforts to influence the public choice process, or even to take time to cast a vote, while fans (whose surplus might range into the thousands of dollars) would be well informed and active supporters.

In addition to rational ignorance, team owners can, and do, affect the effort supplied by citizen-voters. As explained earlier, several public choice reasons can explain why someone influential person – such as a mayor, city council member, or county commissioner – might be more valuable to a political cause than other citizen-voters. For people capable of giving great effort in support of team subsidies, an owner will practice a form of price discrimination by selectively lowering price to increase CS_i or by offering a special consumption package to secure their support. Mayors and other important persons are frequently invited to enjoy games as the guest of owners in their private suites on the 50-yard line. Imagine the surplus generated by viewing the game for free from the best seats in the stadium in the company of other influential and famous people. In addition to game-related benefits, the team owner can offer other benefits, such as directing players to help in fundraisers or charity events. In this fashion owners can secure considerable contributions at relatively small cost.

II.3 Some Limited Empirical Support for Location Invariance

One way to test the Location Invariance Principle would proceed as follows. First, estimate a model explaining the distribution of professional sport teams across locations based specifically on the underlying market demand for professional sports in each area. Demand-side determinants would include area population, per capita income, and the number of substitutes, and so provide a benchmark model explaining the variation in number of teams based exclusively on market demand. Then, the benchmark model would be re-estimated by adding subsidy data as an explanatory variable. Since the Location Invariance Principle relies on the premise that team subsidies are determined by market demand, the introduction of the subsidy variable would not be expected to increase the explained variation beyond the benchmark model.

Such a test is not possible because reliable subsidy data is not available for most teams. Estimating only the benchmark model, however, does provide some useful information. Specifically, it reveals the importance of market demand alone in the determination of team locations, and, perhaps of more importance, it indicates how much unexplained variation remains to be explained by other unobserved influences such as team subsidies.

Table 1 presents data on the 38 Census Metropolitan Statistical Areas (CMSA) that host at least one professional team from among the four professional team sport leagues prominent in North America – Major League Baseball, the National Basketball Association, the National Football League and the National Hockey League – as well as the number of minor league baseball teams and Women's National Basketball Association teams. We represent the distribution of teams across CMSAs as a rank ordering of the number of major league teams in each CMSA, where ties are broken by the number of minor league baseball and WNBA teams. Such a representation treats major league teams as perfect substitutes and minor league and WNBA teams as weak substitutes. In addition, we rank CMSAs by population and income per capita.

Estimating an ordinary least-squares rank regression model results in the following estimated equation:

$$\begin{aligned} &TeamRank = \underset{1.085}{1.90} + \underset{7.19}{0.87}\,PopRank + \underset{0.25}{0.03}\,IncomeRank \\ &R^2 = 0.80 \end{aligned}$$

where TeamRank is the CMSA's rank by number of teams in Table 1 (column 7), PopRank is the CMSA's rank by population (column 8), and IncomeRank is the CMSA's rank by income per capita (column 9). The rank regression is significant at the 99.99 percent confidence level. The population and income rank of each location prove sufficient to explain 80 percent of the variation in the rank number of teams, which is somewhat remarkable since cross-sectional models seldom explain more than 75 percent of dependent variable variation. Population rank serves as the dominant influence with a simple Spearman's rank correlation coefficient with TeamRank equal to 0.90. This "benchmark" estimation suggests that the "missing" subsidy variable could explain, at most, something less than 20 percent of the variation in the number of teams across CMSAs. While far from conclusive, this limited empirical analysis suggests that better data on subsidies would not likely undermine the principle of location invariance, as the benchmark model leaves little room for significant subsidy effects.

We will now employ the political model of subsidy determination developed in this section to offer a new and compelling explanation of two well-documented anomalies in sport ticket pricing: inelastic ticket prices and persistent ticket shortages.

III. Team Owner Pricing Behavior with Public Subsidies

It has been more than 30 years since Noll [1974] first observed that prices in professional sports are lower than would be expected from profit-maximizing team owners. Initially, Noll's observation of low ticket prices was regarded as an econometric error or perhaps a temporary disequilibrium situation. After much further observation, however, the accumulated empirical evidence reveal that low prices for professional sports are a deliberate strategy of team owners. We first briefly review the literature on sport ticket pricing to motivate the importance of adding public choice analysis of subsidy bidding. Then we explain why profit-maximizing owners would purposely price where demand is inelastic and even creating persistent shortages in some cases.

III.1 Current Understanding of Sport Ticket Pricing

Two lines of reasoning attempt to explain why owners appear to sell tickets at less-than-profit-maximizing prices. The first raises concerns about econometric difficulties either with the nature of sport industry data or with the estimation of price elasticities of sport tickets. The belief was that owners do price in the unitary to elastic region of demand but, because of statistical difficulties, estimated price elasticities give incorrect values. However, because the earlier demand studies have been replicated with different or expanded data sets, for many sports, and using different estimation techniques, there now exist overwhelming empirical evidence that professional sports teams purposefully set ticket prices in the inelastic region of demand.[4]

A related phenomenon is persistent excess demand. Estimates of demand and demand elasticity are not possible when there is excess demand because capacity, rather than demand, limits sales so that there is no observed demand response to price changes. Noll described excess demand in American professional football as "a recent phenomena, which explains why adjustments to it – in terms of more games, higher prices, more teams and leagues, larger stadiums – are still being made" Noll [1974, p. 141]. Perhaps because the empirical literature ignores occurrences of excess demand or because Noll previously dismissed it as a short-run phenomenon, very little attention has been paid to pricing strategies that result in persistent ticket shortages. A survey of Internet websites of the 32 National Football League teams reveals that half of the NFL teams advertise their season ticket waiting list, and a phone call to the other teams reveals that all of them have sold out at least some of their sections of season tickets. Indeed, season tickets in some locations are so valuable they have become celebrated centerpieces of property settlements in divorce cases. Excess demand is also common in professional soccer worldwide and in sport events like the Super Bowl, NCAA Basketball Tournament, and MLB All-Star Games.

When subsequent empirical work confirmed the pervasiveness of inelastic pricing, the second line of inquiry focused on finding explanations that were consistent with profit-maximizing behavior by team owners. Heilmann and Wendling [1976] make explicit the point that all revenue streams must be considered when estimating the elasticity of demand. Focusing only on gate receipts would underestimate the elasticity. However, in a recent paper, Coates and Humphreys [2004] used an index of the total cost of attending a game including transportation costs as a proxy for full price and found demand to be inelastic.

Boyd and Boyd [1996] make the argument that lower ticket prices increase attendance and thereby increase home field advantage. This advantage improves the home winning percent and, subsequently, increases attendance at future games. DeSerpa [1994] argues that excess demand for a subset of games in a season may be rational if lower prices are needed to induce season ticket sales. However, these explanations fail to address the related issue of excess demand for individual games and for season tickets, suggesting that something else is at work.

In an important departure from previous lines of reasoning, Fort [2004b] takes the first step toward linking municipal team subsidies with lower ticket pricing. Fort assumes that state and local politicians use team subsidy as an incentive for team owners to lower prices. In Fort's model politicians negotiate lower ticket prices at games in exchange for subsidies. Thus, in Fort's reasoning prices are low because owners are paid to keep them low. Because paying the subsidy in advance would permit the owner to behave opportunistically and raise prices in the future, this model requires either a binding contract or subsidies that, by design, decrease when prices increase.

The public choice model developed in this paper also finds an inverse relation between ticket prices and team subsidy, however, in political equilibrium causality runs in the opposite direction: political subsidies depend on price. The direction of causality matters greatly, and the political equilibrium developed in this paper provides a more compelling explanation than Fort's reliance on a "contractual" arrangement between team owners and politicians to (exogenously) determine subsidy levels. We show that, politics, not politicians, determine the price-subsidy tradeoff, which, in turn, endogenously determines the level of team subsidy.

III.2 Team Owner Pricing Behavior with Public Subsidies

When determining ticket price, *P*, a team owner must consider how its pricing decision will impact the maximum subsidy, *S**, that can be extracted from the political process. To explain the crucial relation between *S** and *P*, we begin with equation (1), which defines net benefit to voters for any level of subsidy. Note that individual consumer's surplus varies inversely with price ($dCS_i / dP = -q_i < 0$) for all consumers, while consumer surplus is independent of price for all non-consumers ($dCS_i / dP = 0$). Now suppose the owner reduces ticket price. In the effort equation set (2), notice that a price reduction increases the effort forthcoming from supporters by increasing their positive net benefits. At the same time, the price reduction decreases the effort of those opponents who are consumers by eliminating some of the negative net benefits that they suffer because of the tax cost of the subsidy. Non-fan opponents are unaffected by a price change. In addition, price reductions have a set effect by moving some individuals from the set of opponents to the set of supporters as their negative net benefits become positive. Thus, the set and effort effect of a price reduction increases the left-hand-side and reduce the right-hand-side of equation (3). This, in turn permits a larger maximum politically supported subsidy that restores the balance. Hence, it follows that

(5) $$dS^* / dP < 0.$$

Notice that, while our model preserves the inverse relation between price and subsidy first identified by Fort ($dP/dS < 0$), it reverses the causality: team subsidy depends on ticket price. As such, this model predicts very different behavioral consequences for team owners and local politicians. First, the team owner (not politicians) designs a strategy of pricing to elicit voter support. This model requires no contractual arrangement between owners and local politicians, because team owners set ticket prices and then the political process determines the level of support by voters for taxpayer subsidies. Second, in Fort's model prices would be fixed after the subsidy is determined. Our model predicts that prices will tend to be fixed before the subsidy is determined and to rise significantly afterward. This important difference in the time profiles of ticket prices provides the basis for the empirical examination of prices presented below.

While owners may not understand much about public choice models or political market equilibrium, they certainly understand the political environment of their host communities and the value of loyal fans at the referendum ballot box. In the period before a referendum on subsidies when fan expectations concerning their individual consumer surpluses are formed, team owners know they can use ticket prices as a tool for building fan loyalty both on the field and at the ballot box.

Knowing that lower sport ticket prices increase the size of team subsidies that voters will support, profit-maximizing team owners rationally lower ticket prices below the level that would have been profit maximizing in the absence of a subsidy.[5] This realization provides a straightforward explanation for both inelastic pricing and excess demand. This section examines ticket pricing in the presence of politically determined subsidy under two circumstances: (1)

when the host city's stadium can be built large enough to accommodate ticket demand at the optimal ticket price, and (2) when long-run constraints on stadium size prevent accommodation of all the fans who wish to buy tickets.

III.3a Ticket Pricing: No Stadium Size Constraint

First, consider the situation when the size of the stadium is sufficient to accommodate the equilibrium level of ticket sales. The demand and inverse demand functions for tickets are, respectively,

$$Q = Q(P) = \sum_{i=1}^{N} q_i(P) \text{ and } P = P(Q),$$

where $\partial P/\partial Q = 1/(\partial Q/\partial P) < 0$. Expressing demand in both direct and inverse forms proves to be convenient in the analysis that follows. Denote team costs by $C\left[Q(P)\right]$ and $dC/dQ \geq 0$. The team's profit, including a team subsidy, can be expressed as a function of output:

$$\Pi = \Pi(Q) = P(Q)Q + S^*[P(Q)] - C(Q).$$

where the team's maximum subsidy S^* is politically determined.

The first-order necessary condition for team profit maximization yields the following condition:[6]

$$\frac{d\Pi}{dQ} = P + Q\frac{dP}{dQ} + \frac{dS^*}{dP}\frac{dP}{dQ} - \frac{dC}{dQ} = 0. \tag{6}$$

Rearranging terms yields

$$P\left(1 - \frac{1}{|\eta|}\right) = \frac{dC}{dQ} - \frac{dS^*}{dP}\frac{\partial P}{\partial Q}. \tag{7}$$

The left-hand side of equation (7) is the well-known expression for marginal revenue in terms of ticket price and the price elasticity of demand, η. The right-hand side of equation (7) expresses the subsidy-adjusted marginal cost of an additional ticket buyer. The direct marginal cost is dC/dQ, which is non-negative by assumption. The second term on the right-hand side of equation (7) is the marginal subsidy. Since dS^*/dP is negative from equation (5) and $\partial P/\partial Q$ is negative by the law of demand, $(dS^*/dP)(\partial P/\partial Q)$ must be positive.

Inspection of the profit-maximizing condition in political equilibrium reveals the necessary and sufficient condition for profit-maximizing and inelastic sport ticket pricing.

PROPOSITION 1. If the gain in team subsidy associated with an increment of attendance is greater than marginal cost, then profit-maximizing owners in political equilibrium will price in the inelastic region of demand. A sufficient condition for inelastic ticket pricing is that the marginal cost of attendance is zero.

Proof. By inspection of profit-maximizing condition (7), if $(dS^*/dP)(\partial P/\partial Q) > dC/dQ$, then the left-hand side of equation (7), which is marginal revenue, must be strictly negative and ticket prices are set in the inelastic portion of ticket demand ($|\eta| < 1$). It follows immediately that a sufficient condition for inelastic pricing is $dC/dQ = 0$.

In the short-run, during which capacity costs are fixed, marginal cost involves only the service needed for an additional consumer and is virtually zero. Accordingly, researchers should not be surprised by econometric estimates of *short-run* ticket price elasticity in the inelastic portion of demand. For short-run econometric studies, it is a finding of elastic pricing that should be interpreted as evidence of non-profit-maximizing behavior by team owners. In the long run when marginal cost includes adding capacity, the matter of inelastic pricing is not as clear. However, if the gain in team subsidy associated with an increment of attendance exceeds long-run marginal cost, Proposition 1 explains inelastic ticket prices in the long run.

III.3b Ticket Pricing: Stadium Size Constrained

Now consider the team's pricing decision when the size of an existing stadium (the short run) or the size of a planned stadium (the long run) is too small to accommodate all the sport fans who wish to purchase tickets at the price that maximizes profit. While instances of excess demand could be the result of fluctuations in demand with capacity fixed in the short run, excess demand in professional sports like American football and soccer in Europe continue over long periods of time and over periods that span the construction of new stadiums.[7] This section examines stadium constraints that are long-run in nature and may lead to persistent situations of ticket shortages when a political market for team subsidies makes it profitable to set ticket prices below the long-run market clearing level.

In the long run, stadium capacity constraints arise because additional seating comes at an ever-increasing cost and fan proximity to the field of play limits how big a stadium or sport arena can be and still attract fans. Like floors in a skyscraper, the upper seats in a stadium are more costly to build; they require larger support structures, moving materials over greater distance, and greater risk during construction. In addition, seating farther from the game is less attractive and must be priced lower to sell. Thus, diminishing marginal value and rising marginal cost limit the practical size of a stadium even in the long-run planning period.

Let $\bar{Q}$ represent maximum stadium capacity in the long run. Then, for some set of ticket prices, stadium size $\bar{Q}$ will be less than quantity demanded. At these prices, some sport consumers will be unable to obtain tickets even though they are willing and able to pay the price for a ticket. Accordingly, the net benefit function in equation (1) must be modified for circumstances of excess demand. Let δ denote the probability of acquiring a ticket when there is excess demand, and assume this probability is related to stadium capacity and ticket demand as

$$\delta = \delta(P, \bar{Q}) = \frac{\bar{Q}}{Q(P)},$$

and $0 < \delta < 1$ when $Q(P) > \bar{Q}$. Since getting a ticket is no longer assured the net benefit of a team subsidy to the i^{th} voter is expressed as a probability-weighted expected value:

$$ENB_i = ENB_i(P, S) = \delta(P, \bar{Q})CS_i(P) - t_i S$$

where ENB_i is the expected net benefit consumer *i* enjoys when the ticket price (*P*) causes excess demand.

Recall that in the absence of excess demand, the maximum politically viable subsidy is inversely related to the price of tickets. In the case of a long-run stadium constraint that creates excess demand, the relation between the maximum subsidy and ticket price can be either direct or inverse, depending on the level of ticket prices. However, team owners will always choose ticket prices in the range of prices for which $d\hat{S}/dP$ is negative. To understand why this is true, consider the effect on the expected net benefit of a consumer when price changes:

$$\frac{dENB_i}{dP} = \left[\delta \frac{dCS_i}{dP}\right] + \left[\frac{d\delta}{dP} CS_i\right], \text{ where } \frac{d\delta}{dP} = \frac{-(dQ/dP)\bar{Q}}{[Q(P)]^2} > 0.$$

The first bracketed term on the right-hand side of $dENB_i/dP$ measures the rate at which the consumer's expected consumer surplus weighted by the probability she can purchase a ticket rises as ticket price falls. This term is unambiguously negative because reducing the price of tickets increases consumer surplus. The second bracketed term captures the effect of lowering ticket prices on the probability of securing a ticket. This term is positive because lowering ticket price increases quantity demanded relative to the fixed capacity. Clearly, then, if ticket price falls far enough, the positive second term can offset the negative first term, and the voter's expected consumer surplus falls. However, we can be assured that owners will never cut price to levels where $d\hat{S}/dP > 0$, because then the price cut both reduces revenue (ticket sales are fixed at $\overline{Q}$ by the stadium constraint) and reduces the maximum subsidy for the team. Therefore, $d\hat{S}/dP$ is negative at any ticket price chosen by the team owner.

Let $\hat{P}$ be chosen from the set of prices that induce excess demand. When there is a binding capacity constraint at the optimum price ($Q(\hat{P}) > \overline{Q}$) profit is

$$\Pi = \hat{P}\overline{Q} + S^*(\hat{P}) - C(\overline{Q})$$

and the profit maximizing price satisfies

(6a) $$\frac{d\,\Pi}{d\hat{P}} = \overline{Q} + dS^* / d\hat{P} = 0\ .$$

Now it is possible to answer the question "Why would team owners not choose to raise ticket prices in a situation of long-run excess demand?" In the model of the political marketplace developed here, raising price reduces the level of team subsidy that voters will support. Under the binding stadium constraint, a one-dollar price increase causes the team's total revenue to rise by $\overline{Q}$ dollars. If the amount of subsidy lost by raising price is greater than $\overline{Q}$, a team owner will not raise ticket price to reduce or eliminate the ticket shortage. Thus we can establish the following proposition:

PROPOSITION 2: If it is profit maximizing for the team to lower price sufficiently to sell out a stadium of maximum capacity and if, at full capacity, the dollar gain in team subsidy associated with a further decrease in price is greater than stadium capacity, then profit-maximizing owners in political equilibrium will price so that there is excess demand.

Proof: $-dS^* / dP > \overline{Q}$ requires decreasing *P* to satisfy equation (6a). If this condition holds at capacity a reduction in price will cause excess demand.

Excess demand in sports ticket pricing is less likely than inelastic pricing for two reasons. First, the largest stadiums approach 100,000-person capacity. It takes an extraordinary event to fill the largest stadiums and anything less could be accommodated by a stadium or arena of the appropriate dimensions. Second, with excess demand the owner's lost profit from a price reduction ($d\Pi / dP = \bar{Q}$ in equation (6a)) is greater than when there is not a supply constraint ($d\Pi / dP = Q + P(dQ / dP) - dC / dQ$ in equation (6)) necessitating a larger subsidy effect to encourage excess demand than inelastic pricing.

III.4 Empirical Evidence: Patterns of Sport Ticket Pricing

The model of owner pricing and its effect on public subsidies has testable implications. From Peltzman (1990), we know that in national elections voters tend to be myopic, weighing more heavily recent events than distant events. This should be even more pronounced in locate referenda issues where voter migration implies that the more distant events were experienced by fewer of today's voting population. In our model, myopia implies that ticket prices immediately prior to a subsidy referendum are more critical in forming voter expectations than prices after a referendum when, presumably, the owners next subsidy demand will be in the distant future. As such, our model predicts that owners will generally refrain from ticket price increases in the immediate period before a vote and significantly increase prices in the period after the vote.[8]

Using ticket pricing data provided by Team Marketing Report,[9] Table 2 shows pricing patterns for all of the teams in Major League Baseball and the National Football League (a total of 12 teams) that sought public subsidies over the period 1998 through 2002, the most recent period for which pricing data exist both before and after their subsidy referenda. Columns R–3, R–2, and R–1 show the three seasons prior to each referendum. Column R presents ticket prices for the seasons following each referendum vote while teams continued to play in their old stadiums. Columns O and O+1 show ticket prices for the first two seasons played after the new stadium opened.[10]

Table 2 reveals a convincing pattern of ticket prices: prices that remain constant before referendum votes and rise sharply thereafter. Ticket price hikes in seasons prior to each referendum (in columns R–3, R–2, and R–1) averaged just 3.79 percent, roughly the rate of inflation. Following the referendum votes, but prior to opening a new stadium, ticket prices rise an average of 17.68 percent. After opening new stadiums, price hikes are much greater, averaging 59.68 percent. In a comparison of all means across the three time periods in Table 2, we found all differences to be statistically significant at the 99.9 percent confidence level, indicating a distinct difference in the teams' pricing strategies in each period. Price increases after each referendum while the team still plays in an old stadium are particularly informative, because price hikes cannot be caused by any improvement in the quality of seating – a plausible explanation for price hikes once a new stadium is opened. Notice that three teams (the Pirates, Brewers, and Giants) actually reduced ticket prices over the three years prior to the referendum. Three more teams (the Broncos, Steelers, and Patriots) held ticket prices constant over this period. Immediately after their referendum votes, these six teams raised prices an average of 18.23 percent. In sum, the data in Table 2 strongly support the pattern of ticket price increases suggested by the political marketplace for team subsidies developed in this paper.

IV. Concluding Remarks

This paper presents evidence that professional sport team owners understand the political process that determines the subsidies host communities will provide and employ gate pricing strategies designed to extract higher subsidies. In particular, owners keep prices low, even reducing them, in the periods preceding a subsidy determination and significantly increase them once a determination is made. In addition, owners can practice a form of politically-motivated price discrimination, differentially pricing team-related consumption and amenities to court the support of the more influential people in the community. Exploring the implications of the public choice model of team subsidies reveals two interesting propositions and resolves a long-standing conundrum in studies of sport ticket prices.

First, the same characteristics that create market demand and profits from ticket sales also create votes for subsidies, with the implication that communities with higher levels of demand will also be willing to support higher subsidy offers for the right to host a team. For this reason, subsidy bidding wars among communities for the rights to host a team do not alter the location of the existing teams – a principle we term location invariance. Characteristics of market demand are shown to explain 80 percent of the spatial distribution of professional teams, leaving little room for subsidy offers to affect team locations – an indirect test of the location invariance principle.

Subsidy bidding does alter the distribution of income. Team owners (and players) are unambiguous winners, and non-fan taxpayers are unambiguous losers. Fans pay taxes but enjoy lower gate prices as a reward for their loyalty at the ballot box. If it were possible to end community subsidies to professional sport teams, perhaps by government action, teams would pay for their own stadiums, owners and players would earn less, fans would pay more for their personal benefits, and taxpayers would be relieved of the burden of taxes that pay for an activity they may not consume. Of course, bidding wars among communities are the result of leagues that restrict the number of teams. While this paper does not model the leagues' decisions, we offer the following conjecture and suggestion for further research. If cities did not compete for teams by offering subsidies, leagues would provide more teams and they would locate in many of the communities that were unsuccessful in attracting a team with a subsidy offer.

The second implication of the model is that team owners price tickets lower than what appears to be profit maximizing. For more than 40 years empirical estimates of sport demand have consistently found price inelasticity. In addition, we observe numerous sports and sporting events with persistent excess demand. We now see that this is rational behavior for a profit motivated owner as lower prices at the gate buy increased support for subsidies at the ballot box.

This paper motivates several lines of further inquiry. First, a league-wide model including subsidies should explore the conjecture that there will be more teams if there are no public subsidies. Second, this paper suggests a way to directly test the location invariance principle if adequate subsidy data can be obtained. Third, empirical estimates of the demand for sports should include a variable to account for the elapsed time from prior subsidy determinations as it is more likely that teams price in the elastic region of demand immediately following a successful subsidy referendum. Fourth, there should be a discernable pattern of subsidies associated with area population. If community A generates gate revenues of R_A for a team and an alternative community B that tries to attract the team would generate revenue $R_B < R_A$, an informed community A need only offer subsidy $S_A = S_B - (R_A - R_B)$ in response to community B's subsidy offer of S_B to keep its team. This would explain why the City of New York offers only a modest subsidy to construction of a new Yankees' stadium and why Los

Angeles appears willing to hold out against the National Football Leagues' demand for subsidy concessions to attract an expansion team.

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FOOTNOTES

1. In a median voter model only those who actually vote matter, each individual can contribute only one vote, and the outcome is uniquely determined by the wishes of the median voter.

2. For individuals who receive no value from the sport, $V_i + CS_i = 0$ and $S_i^{\max} = 0$.

3. It is possible that population and demand can grow in ways that lead to a decrease in the maximum subsidy if the population increase changes the nature of the community. If, for example, there is a relatively small increase in the set of supporters and a large increase in the set of opponents, the growth in the relative number of opponents to the subsidy might create a set effect in equation (3) sufficient to overcome the positive impact of reduced individual taxes. In this event, demand might increase while the subsidy decreases. Perhaps it is this small chance of success that keeps small markets active in the franchise bidding wars.

4. See Fort [2004a and 2004c] for extensive reviews of the many ticket demand elasticity studies. In a table summarizing price elasticity estimates of attendance demand covering 24 different studies over the period 1973 – 2002, Fort finds that "20 of 24 studies (over 80%) generate estimates of inelastic ticket prices, ranging from completely inelastic to an elasticity estimate of –0.68" (Table 1 in Fort [2004c, p.13]).

5. A similar pricing phenomenon occurs with monopoly newspapers whose price to readers appears to be low. However, low prices attract readers and increase advertising revenues (Blair and Romano [1993]).

6. Since the traditional profit function is strictly concave, a sufficient condition for profit maximization is that the subsidy function be concave in Q. As there is a practical limit on just

how large subsidies can be, we assert the subsidies will increase with increases in Q (decreases in P) at a decreasing rate.

7. Most teams do not practice variable ticket pricing over the course of a season, which would be one way to eliminate shortages when short-run stadium capacity is fixed. Thus, during the course of a season, popular games may experience excess demand. Although team owners usually adjust ticket prices between seasons, shortages of season tickets are nonetheless commonplace.

8. The predicted pattern of price increases also test the validity of our model that predicts an inverse relation between subsidy and price vis-à-vis Fort's assertion that politicians use subsidies as payment for owners to lower prices. Fort's model would predict price increases to be less <u>after</u> the subsidy was given.

9. Source: http://www.teammarketing.com/index.cfm.

10. For example, consider the Denver Broncos in the first row of Table 2. Their new stadium was approved in November 1998, more than halfway through the 1998 regular season of play. Consequently, the Broncos first opportunity to raise prices following the referendum was the 1999 season (i.e., R = 1999). For the Denver Broncos 1996, 1997, and 1998 seasons are denoted by, respectively, columns R–3, R–2, and R–1. The new Denver stadium opened for the 2001 season, so O = 2001 and O+1 = 2002.

Table 1: Professional Teams and Population

CMSA	POP.	INCOME PER CAPITA	NUMBER MAJOR LEAGUE TEAMS	NUMBER WNBA TEAMS	NUMBER MINOR LEAGUE TEAMS	NUMBER OF TEAMS RANK	POP RANK	INCOME RANK
Atlanta	4112198	$16,670	4	0	2	9	11	8
Boston	5819100	$19,288	4	0	0	14	6	3
Buffalo	1170111	$13,560	2	0	2	28	35	34
Charlotte	1499293	$14,611	3	1	2	19	31	24
Chicago	9157540	$16,683	5	1	3	4	3	7
Cincinnati	1979202	$14,401	2	0	3	23	23	28
Cleveland	2945831	$15,092	3	0	0	21	16	17
Columbus	1540157	$14,537	1	0	2	36	30	27
Dallas	5221801	$16,218	4	0	3	7	8	12
Denver	2581506	$16,539	4	0	1	13	19	9
Detroit	5456428	$15,649	4	1	1	11	7	14
Greenbay	226778	$13,906	1	0	1	38	38	31
Houston	4669571	$15,073	3	1	2	15	10	18
Indianapolis	1607486	$14,936	2	1	2	26	28	21
Jacksonville	1100491	$14,141	1	0	4	33	37	30
Kansas City	1776062	$15,030	2	0	2	25	25	19
Los Angeles	16373645	$16,149	6	1	2	3	2	13
Memphis	1135614	$12,851	1	0	3	34	36	35
Miami	3876380	$13,686	4	0	1	12	12	33
Milwaukee	1689572	$14,785	2	0	1	29	26	23
Minneapolis	2968806	$16,721	4	1	2	10	15	6
Nashville	1231311	$14,567	2	0	2	27	34	26
New Orleans	1337726	$12,005	2	0	1	30	32	37
New York	21199865	$17,397	9	2	10	1	1	5
Orlando	1644561	$14,591	1	0	1	37	27	25
Philadelphia	6188463	$16,354	4	0	2	8	5	10
Phoenix	3251876	$14,970	4	1	5	6	14	20
Pittsburgh	2358695	$13,785	3	0	2	18	21	32
Portland	2265223	$15,286	1	0	5	31	22	16
Sacramento	1796857	$15,570	2	1	2	24	24	15
Salt Lake City	1333914	$12,029	1	0	5	32	33	36
San Antonio	1592383	$11,828	1	1	2	35	29	38
San Diego	2813833	$16,220	2	1	3	22	17	11
San Francisco	7039362	$22,049	5	0	3	5	4	1
Seattle	3554760	$17,921	3	1	1	20	13	4
St. Louis	2603607	$14,847	3	0	2	16	18	22
Tampa	2395997	$14,374	3	0	2	17	20	29
Washington DC/ Baltimore	4923153	$20,935	6	1	3	2	9	2

Table 2: Patterns of Ticket Price Increases

	R-3	R-2	R-1	R	O	O+1	Average change 3-years Prior to Approval	Change After Approval Prior to Opening	Change Upon Opening
NFL									
Broncos' Average Ticket Price R=1999 O=2001	$35.83	$35.83	$35.83	$46.40	$52.50	$52.50	0.00%	29.50%	13.15%
Steelers' Average Ticket Price R=1999 O=2001	$35.76	$35.76	$35.76	$40.76	$49.83	$49.83	0.00%	13.98%	22.25%
Buccanneers' Average Ticket Price R=1996 O=1998	$24.06	$29.57	$29.73	$35.46	$64.58	$64.65	11.12%	19.39%	82.12%
Bengals' Average Ticket Price R=1996 O=2000	$24.78	$28.43	$31.99	$34.09	$56.21	$43.54	13.62%	6.56%	64.89%
Lions' Average Ticket Price R=1997 O=2002	$29.10	$28.54	$33.70	$35.79	$50.23	$53.91	7.61%	6.20%	40.35%
Patriots' Average Ticket Price R=2000 O=2002 (1)	$39.45	$34.47	$39.45	$47.77	$76.19	$75.33	0.00%	21.09%	61.83%
						Average Increase NFL	5.39%	16.12%	47.43%
MLB									
Pirates' Average Ticket Price R=1999 O=2001	$10.09	$9.86	$9.33	$11.80	$19.51	$20.52	-3.99%	26.47%	65.34%
Mariners' Average Ticket Price R=1997 O=2000	$7.96	$9.73	$9.73	$13.40	$19.01	$23.43	10.56%	37.71%	41.87%
Astro's Average Ticket Price R=1996 O=2000	$8.26	$8.91	$8.91	$11.40	$20.03	$17.72	3.86%	27.95%	75.70%
Brewers' Average Ticket Price R= 1996 O=2001	$9.80	$9.51	$9.51	$9.58	$16.32	$17.63	-2.96%	0.74%	70.35%
Tigers' Average Ticket Price R=1998 O=2000 (2)	$10.60	$10.60	$10.40	$12.23	$24.83	$20.95	-0.96%	17.60%	103.03%
Giants' Average Ticket Price R=1997 O=2000 (3)	$10.16	$10.61	$11.55	$12.12	$21.24	$19.10	6.62%	4.94%	75.25%
						Average Increase MLB	2.19%	19.24%	71.92%
						Average Increase NFL and MLB	3.79%	17.68%	59.68%
						Standard Deviation NFL and MLB	5.96%	11.51%	25.79%

(1) The Patriots built their own stadium after several failed referendums in the mid to late 1990s. It opened in 2002. We consider ticket pricing with A=2000 the year construction began.

(2) Stadium funding for the Tigers was approved in 1997 pending Tigers securing a loan for their share of the cost. This was not accomplished until the middle of the 1998 season.

(3) After four attempts to secure public funding failed the Giants built their own park.