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Research Note

Can We Find It at the Concessions?

Understanding Price Elasticity in Professional Sports

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The sports economics literature regularly finds that sports teams price admissions in the inelastic range of demand. Given that marginal revenue is negative in this range, yet marginal cost is always nonnegative, this result suggests an inconsistency in the profit motive of owners. In this article, we attempt to explain inelastic ticket pricing by considering the complementarity between tickets sold and concessions. Depending on marginal revenue and cost parameters, we show that it is entirely possible to find profit-maximizing owners pricing tickets in the inelastic region of demand to sell more concessions.

Keywords: *concession revenues; inelastic pricing in MLB*

> The economics literature that analyzes the demand for attendance consistently finds inelastic ticket pricing.
>
> R. Fort, 2003

The cost of attending a Major League Baseball (MLB) game, although not as steep as that in the National Football League (NFL) or National Basketball Association (NBA), has risen dramatically during the past decade. Team Marketing's annual survey of the cost of att3ending a professional sporting event reports that the average ticket price for a baseball game more than doubled between 1991 and 2002. When all costs of attending a game are considered, the costs to a family of four of

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TABLE 1: Literature Background Regarding Price Elasticity

Author	*Sport*	*Estimated Elasticity*
Demmert (1973)	MLB	–.93
Noll (1974)	MLB	–.14
Siegfried & Eisenberg (1980)	Minor League Baseball	–.25
Bird (1982)	English Soccer	–.20
Scully (1989)	MLB	–.61
Coffin (1996)	MLB	–.11 to –.68
Fort and Quirk (1996)	MLB	–.14 to –.36
Depken (2001)	NFL	–.58
Garcia & Rodriguez (2002)	Spanish Soccer	–.3 to –.9
Hadley & Poitras (2002)	MLB	–.21
Winfree, McCluskey, Mittelhammer, & Fort (2003)	MLB	–.06

NOTE: MLB = Major League Baseball; NFL = National Football League.

attending a game rose from about U.S. $80 to more than $140—about twice the rate of inflation across all recreational services.

In spite of the popular criticism laid on owners for charging so much, sports economists regularly find that fans pay a lower price than that which would maximize team profits. In fact, what is evident from a search through the literature is that ticket prices of sporting events are regularly priced in the inelastic range of demand. In El-Hodiri and Quirk (1974), and then extended by Heilmann and Wendling (1976), the authors outline the possibility of a rational trade-off between different sources of revenues. Zimbalist (1992) later suggested a possible relationship between gate and concession revenues in his model of revenue maximization.[1]

In this article, we focus on the complementarity between two sources of revenue associated with the gate: attendance itself and the resulting amount of concessions sold. Depending on parameters of the model, we show that it is theoretically plausible for profit-maximizing owners to price tickets in the inelastic region of demand to sell more concessions. In fact, if the marginal costs of attendance is zero (i.e., the revenue-maximization model), then ticket prices will be set in the inelastic range of demand.

BACKGROUND STUDIES OF PRICE ELASTICITY

Table 1 gives a partial list of articles that include an estimate of the own-price elasticity of demand for sporting events. What is evident from the point estimates presented in this table is that the literature is nearly unanimous in its finding that teams price their tickets in the inelastic range of demand. Although most of these studies would not reject the hypothesis that prices are set at the unitary point (i.e., revenue maximization), neither could one reject the hypothesis of inelastic prices. If owners do set prices in the inelastic range, then we are left with the difficult task of discerning whether owners are simply irrational, or that they consider other things in their optimization problem.

There are many implications of inelastic ticket prices, starting with the fundamental issue of the proper objective of the team. If teams price in the inelastic range of demand, then one might question whether owners maximize profits.[2] One alternative that has been explored in the literature considers the possibility that owners receive utility from controlling a professional sports team. This approach, termed the sportsman hypothesis, suggests that the objective of a team owner is to maximize utility rather than profits (DeGennaro, 2003; Ferguson, Stewart, Jones, & Dressay, 1991; Sloane, 1971). However, because so little empirical work has been done on this alternative hypothesis, its merits remain uncertain.

The public choice explanation of inelastic prices focuses on political arrangements between politicians and team owners (Fort, 2000, 2004b). According to this argument, owners agree to keep prices low in exchange for special political considerations when dealing with the local government (especially on the issue of public funding of stadiums). Fort (2004a) concludes, for the NFL in any case, that there exists weak evidence suggesting a trade-off between ticket prices and stadium subsidies.

Another attempt at explaining inelastic pricing looks at demand from a habitual consumption model (Ahn & Lee, 2003). In this analysis, fan loyalty creates so-called addictive or habitual behavior, leading to a dynamic model specification of demand. Maximizing long-run profits suggests that the team will set short-run marginal revenue (MR) below marginal costs (MC), a necessary condition for inelastic pricing. Although still preliminary, this approach is quite intriguing and promising.

A final consideration that merits discussion surrounds the selection and measurement of the price variable used in these studies. When collecting data to estimate demand, the analyst faces a large number of possible prices (ranging from cheap bleacher seats to expensive luxury box accommodations)—choosing one price out of this array of possibilities in and of itself is rather heroic. Analysts have answered this challenge by measuring price in one of the following manners. The most common approach is to create a weighted-average price, where the weights are determined by the proportion of seats in each price category in the stadium (Coffin, 1996; Demmert, 1973; Noll, 1974; Team Marketing, 1991-2004). The primary drawback of this method is that it understates the price of the expensive, most desirable seats (which are typically sold out), while it overstates the price of the cheap, least desirable seats (which often go unsold). An alternative method is to define price as the average revenue (AR) derived by dividing total revenue (TR) by quantity (Scully, 1989; Siegfried & Eisenberg, 1980). However, the correspondence between price and AR is more complicated than it seems. Although higher prices reduce Q (the denominator), it will either increases or decreases TR (the numerator) depending on whether demand is inelastic or elastic. Finally, some authors have picked one of the many prices charged by the team, in hopes of getting a good proxy for the consumer's marginal expenditure of an available seat (Bird, 1982; Garcia & Rodriguez, 2002; Hadley & Poitras, 2002). Although this approach is theoretically appealing, it is probably most appropriate for explaining the quantity demanded of just those particular seats (rather than the total attendance across the entire stadium). Unless owners willingly divulge attendance data by seat type, the implication of regressing total attendance on this particular price is unknown.

In any case, the question remains as to why so many point estimates coming from demand studies impute inelastic prices. We argue here that inelastic pricing may be explained by recognizing that owners get more than just gate revenues when they sell tickets to the game. If complementary sources of revenue are more than able to compensate for the lower gate revenues associated with inelastic pricing, then such pricing behavior may be optimal. Although one could consider a whole host of complementary outputs, in this article we focus on the most obvious joint product—concessions. In the next section, we develop a model of profit maximization that includes sales of tickets and concessions and show how optimal behavior can result in ticket prices being set in the inelastic range of demand.

MODEL

A professional sports team typically generates revenue from four sources: tickets (R^T), concessions (R^C), revenue sharing (R^{RS}), and broadcasting (R^B). Although revenue-sharing and broadcast revenues are relatively independent of the quantity (Q) of tickets sold, ticket and concession revenues surely vary with Q. As such, the team's total revenue function (TR) is given by:

$$TR = R^T(Q) + R^C(Q) + R^{RS} + R^B. \tag{1}$$

The first-order conditions for profit-maximization gives MR = MC, or

$$MR^T + MR^C = MC, \tag{2}$$

where MR^T is the team's marginal revenues from tickets, and MR^C is the marginal revenues from concessions. To illustrate, let the team's demand for tickets be given by:

$$Q = a - b\,P. \tag{3}$$

In this case, ticket revenues are given by:

$$R^T = \left[\frac{a}{b}Q - \frac{1}{b}Q^2\right]. \tag{4}$$

For concession revenues, let the relationship be given by:

$$R^C = g\,Q, \tag{5}$$

where g = MR^C. Finally, let the team's total costs (TC) be given by

$$TC = m + c\,Q, \tag{6}$$

where c is the marginal cost (MC) of admitting another fan into the stadium, and m is the fixed costs of the team.[3]

At this point, it is easy to see the source of the confusion that has permeated the literature on optimal ticket pricing. When the analyst ignores concession revenues, the corresponding so-called ticket-only marginal revenue (MR^T) function is equated to MC, giving:

$$MT^T = \left[\frac{a}{b} - \frac{2}{b}Q\right] = c. \tag{7}$$

Since $c \geq 0$, such a misspecification of the problem yields the familiar conclusion that a profit-maximizing team would never set ticket prices in the inelastic range of demand. Under these conditions, Equation (7) gives implied expressions for the number of tickets sold and price as:

$$\begin{aligned} Q^T &= \left[\frac{a}{2} - \frac{bc}{2}\right] \\ P^T &= \left[\frac{a}{2b} + \frac{c}{2}\right]. \end{aligned} \tag{8}$$

However, the correct specification of the profit-maximization problem, one which considers concession revenues as well, gives the team's actual first-order conditions as:

$$MR = MR^T + g = c \tag{9}$$

Rearranging (9) gives:

$$MR^T = (c - g) \tag{10}$$

Equation (10) highlights the main point of this article. If $c < g$, then prices are set such that $MR^T < 0$—and we observe inelastic ticket prices. In fact, if $c = 0$, then the right-hand side of (10) is unambiguously negative, and we get a variation of the revenue-maximization model. It should be noted, however, that (10) implies that a revenue-maximizing owner would optimally set ticket prices in the inelastic (rather than unit-elastic) range of demand.

Solving (10) for the profit-maximizing quantity and price, Q^* and P^*, we get:

$$\begin{aligned} Q^* &= \left[\frac{a}{2} - \frac{bc}{2}\right] + \frac{bg}{2} = Q^T + \frac{bg}{2} \\ P^* &= \left[\frac{a}{2b} + \frac{c}{2}\right] - \frac{g}{2} = P^T - \frac{g}{2}. \end{aligned} \tag{11}$$

Hence, Equation (11) implies that teams will sell more tickets ($Q^* > Q^T$) and charge a lower price ($P^* < P^T$) than would be the case if the team did not have any claims to concession revenues.

EMPIRICAL RESULTS

To understand the degree to which concession revenues affect the profit-maximizing behavior of owners, we need an estimate of MR^C. If we had reliable data on concession revenues, we could estimate MR^C in the standard fashion. Unfortunately, obtaining these data is complicated by the proprietary nature of most teams' finances. *Financial World* (1991-1997) (and later, *Forbes*, 1998-2005) did provide an annual survey of professional sports revenues, including what they referred to as "stadium revenues." However, because these data contain revenue from sources completely unrelated to concessions (e.g., revenue from suites and luxury seating), it is doubtful that regressing these revenues on attendance would give us anything close to the team's MR^C.

As an alternative, we used the Team Marketing annual reports (1991-2004) that construct the fan cost index (FCI) for the four major professional sports. The FCI is an estimate of the cost to a typical family of four of attending a sports event, broken down into the costs of tickets, snacks, souvenirs, parking, and the like.[4] Because the cost of a ticket is broken out in this report, we constructed a proxy for the concession revenues per ticket in the following manner:

$$\hat{g} = \left[\frac{FCI - (4 \times ticket\ price)}{4}\right]. \tag{12}$$

The rationale behind (12) is that because the FCI is a measure of the total cost to a family of four, we subtracted out the family's ticket costs, (4 × ticket price), then divided by 4 to get the concession revenue per ticket.[5] To illustrate using MLB in 2004, the league average FCI was $155.52 while the average ticket price was $19.82. Thus, our estimate of MR^C is calculated by multiplying $19.82 by 4 (= $79.28), subtracting this product from $155.52 (= $76.24), then dividing by 4 (= $19.06).

In Table 2, we report the imputed MR^C, along with the actual price and ratio of P^T to P^*, for the four major professional sports over the time period 1992 through 2004. One interesting finding is that the average ticket price in MLB is only about one third that of the other three sports. Furthermore, the estimates of MR^C vary between $17 (in MLB) to more than $21 (in the NFL). Assuming that the ticket price reported by Team Marketing is the optimum (i.e., P^*), and given that (11) implies the $P^* = P^T - \left(\frac{g}{2}\right)$, we can also infer the relative size of P^T to P^*. Table 2 shows that P^T is about 57% larger than P^* in MLB, while the other sports discount their ticket prices by about 20% to 25%. Of course, without more information about demand and cost functions, it is impossible to say whether this implies demand is elastic or inelastic at P^*. However, given a difference of this magnitude, inelastic ticket prices should not be so surprising.

TABLE 2: Marginal Revenue of Concessions: Professional Sports 1992-2004

	MLB			*NFL*		
Season Beginning	$\hat{g}$	P^*	p^T/p^*	$\hat{g}$	P^*	p^T/p^*
1992	16.29	12.50	1.65	17.98	36.51	1.25
1993	16.92	12.55	1.67	18.90	36.90	1.26
1994	16.98	13.33	1.64	17.93	38.78	1.23
1995	16.72	13.13	1.64	19.90	41.16	1.24
1996	17.16	13.44	1.64	19.44	42.46	1.23
1997	16.75	14.39	1.58	19.97	46.10	1.22
1998	17.28	15.63	1.55	20.96	48.23	1.22
1999	17.27	16.78	1.51	21.24	50.37	1.21
2000	17.64	18.19	1.48	22.32	53.41	1.21
2001	18.44	18.57	1.50	23.36	49.99	1.23
2002	18.66	18.96	1.49	23.40	51.83	1.23
2003	19.11	19.34	1.49	22.88	53.87	1.21
2004	19.06	19.82	1.48	25.66	54.75	1.23
Average	$17.56	15.90	1.56	$21.07	46.49	1.23
	NBA			*NHL*		
1992	17.94	31.97	1.28	—	—	—
1993	19.41	35.01	1.28	—	—	—
1994	19.69	37.77	1.26	$19.44	42.13	1.23
1995	19.92	38.89	1.26	19.72	42.50	1.23
1996	19.91	40.77	1.24	19.92	45.18	1.22
1997	20.04	42.83	1.23	19.12	48.95	1.20
1998	20.05	49.13	1.20	19.39	48.95	1.20
1999	20.35	54.72	1.19	20.39	51.88	1.20
2000	20.74	55.49	1.19	20.02	51.62	1.19
2001	20.21	44.12	1.23	19.78	43.18	1.23
2002	20.80	45.23	1.23	19.22	43.07	1.22
2003	20.99	45.45	1.23	20.19	44.32	1.23
2004	—	—	—	—	—	—
Average	$20.00	$43.45	1.23	$19.72	$46.18	1.21

NOTES: MLB = Major League Baseball; NFL = National Football League; NBA = National Basketball Association; NHL = National Hockey League.
All monetary values given in real (2004) dollars. Values in table correspond to league averages. Team Marketing began breaking out the average price of so-called premium tickets in 2001 for the NBA and NHL.

CONCLUDING REMARKS

In this article, we include concessions directly in the profit-maximization problem and derive the team's optimal price and quantity functions. We find that teams lower their prices, perhaps into the inelastic range of demand, to augment their nonticket revenues. In fact, if a team's marginal cost is zero, we show that the revenue-maximizing owner sets ticket prices in the inelastic (rather than unit-elastic) range of demand.

Our empirical results suggest that concession revenues allow professional sport teams to discount their ticket prices significantly. For MLB, this discount is somewhere around 56%. In this regard, our analysis supports the claim made by Fort, Zimbalist, and others that complementary revenues may make up for the lost gate revenues resulting from inelastic pricing.

NOTES

1. Although the typical study looks at demand from the perspective of selling tickets, an alternative approach models the team's optimization problem in terms of the selection of talent (winning), which is then sold at the gate and on television (Fort, 2004a; Fort & Quirk, 1995). Under this specification, the authors outline a trade-off between the marginal revenue from the gate and the marginal revenue from television. This trade-off then generates conditions under which a team chooses winning (and hence, the price) such that marginal revenue from the gate is negative (i.e., inelastic pricing). Although this approach is intriguing, and gives us insight into such issues as differences in revenues arising from local broadcasting, it does not address the separate issue examined here of how ticket sales are used to enhance concessionary revenues.

2. The first-order conditions of profit maximization dictate that the firm set marginal revenue (MR) equal to marginal costs (MC). Because MC is strictly nonnegative, yet MR is negative in the inelastic range of demand, inelastic pricing suggests that teams are not satisfying the first-order conditions.

3. It is often assumed that, when the season begins, most of the teams' costs are fixed, including player salaries, management costs, player development expenses and so on (Noll, 1974; Zimbalist, 1992). If so, then the marginal cost of admitting one more fan into the stadium is zero (i.e., $c = 0$ in Equation [6]), and the revenue maximization model emerges. For a dissenting opinion on this assumption, see Fort and Quirk (1996) and Fort (2004a).

4. "The FCI includes: two adult average price tickets; two child average price tickets; four small soft drinks; two small beers; four hot dogs; two programs; parking; and two adult-sized caps" (Team Marketing Report, 2004, p. 1). This particular market basket, chosen by Team Marketing, is based on their market research studies.

5. Assuming that concessionary revenues are proportional to the number of tickets sold gives AR = MR = g. Of course, if the team only receives a proportion of the concession items (e.g., because of the Stadium Agreement), then this estimate of g will overstate the team's actual MRC.

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