Optimal Ticket Pricing for Performance Goods

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When purchasing a ticket to a performance good, such as a movie or sporting event, the consumer does not actually buy the product, but simply access to viewing the product. Although the performance is the primary impetus for the ticket purchase, many performance goods offer complementary products such as concessions to their patrons. This paper suggests that when the price setter receives a share of revenues from concessions, overall profits will be maximized when tickets are priced in the inelastic section of demand. The model can be used to explain inelastic point estimates for ticket pricing found in other performance good studies. © 1997 John Wiley & Sons, Ltd.

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INTRODUCTION

The market for tickets to a performance, be it theater, film, or a sporting event, must be distinguished from that of most consumption goods. Although the 'product' that attracts moviegoers, for example, is clearly the movie, the customer is not actually sold the film. What is sold, or rented, more specifically, is access to a viewing of the film. One would be hard-pressed, however, to label the rented seat as the 'product', since it is doubtful that any seat would be sold even at a zero price absent the performance. Owing to the peculiar aspects of performance goods, therefore, this paper examines ticket pricing in this type of setting.

An important implication regarding performance goods ticket pricing is derived. Because the number of available seats is fixed, variable costs associated with the number of tickets purchased are virtually nil. This would normally suggest a standard model of rent where the profit-maximizing price would lie in the unitary section of demand: revenue-maximization implies profit-maximization. However, most performance goods markets complement admissions with concessions and similar products. Thus, the ticket price offers not only admission to the performance but also access to complementary products whose sales add to the firm's overall profits.

The key distinction between the pricing for performance goods and general multiproduct pricing is that consumers cannot purchase the concessions without first purchasing a ticket. Further, the primary impetus for the purchase of the ticket is the performance, not the concession. One would not expect a consumer to go to a movie theater simply to buy popcorn or to attend a baseball game simply to buy beer.

The model derived in this paper shows that the profit-maximizing ticket price for performance goods lies in the inelastic section of demand. Because a ticket buyer gains access to both the performance and the concessions, tickets are priced below unity to increase the number of concessions patrons.

Interestingly, whereas several empirical studies in performance goods industries have produced point elasticity estimates in the inelastic section of demand (Demmer, 1973; Noll, 1974; Scully, 1989; Whitney, 1988, 1993), none of the empiricists acknowledged any significance in the finding. This paper provides a theoretical foundation for those results.

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Ticket pricing in major league baseball is used to test the implications derived in this paper. An attractive feature of baseball is that it is profit-oriented, unlike some performance goods industries which are non-profit. Second, major league baseball consists of a series of regional monopolies, thereby lending itself as a laboratory for monopoly pricing studies. Finally, ticket prices for clubs are available over a prolonged time period.

PRIOR LITERATURE

Two existing models of pricing behaviour bear some similarity to the performance goods market. First is the two-part tariff developed by Oi (1971). The two-part tariff is a model or a pricing structure once used at Disneyland, where admission fees and separate prices for rides were charged to consumers. The performance goods model differs from the two-part tariff in that admission to Disneyland provides little if any utility absent the purchase of tickets to rides and other amenities. With performance goods, the viewing of the performance is the main impetus for attendance, with concessions merely complementing the experience. Nonetheless, the two-part tariff is relevant in that it refers to a setting in which a producer with market power must consider the interdependence between goods when making pricing decisions.

Another pricing model somewhat analogous to performance goods was developed by Barro and Romer (1987). Here, the pricing of admissions to ski areas was modeled. As with performance goods, the costs of ski areas are described as fixed and not dependent upon the number of skiers. However, unlike the performance goods model, a major consideration driving the pricing decisions in the ski-lift model is the queuing and congestion that occurs at ski lifts.

THEORETICAL MODEL

In deriving a model for the pricing of tickets for performance goods, the demand for tickets (Q) is assumed to be a function of the ticket price (P), the quality of the performance (q), and the characteristics of the local market (m), or

\[ Q = Q(P, q, m) \]  

The demand for concessions (S) is modeled as a function of the price of concessions (R) and is also a function of the ticket price and the quality of the performance. Ticket prices and performance quality are included in the concession demand function because concessions are available only to those purchasing tickets. Hence, ticket prices and performance quality determine the size of the potential market for concessions. The demand for concessions is:

\[ S = S(R, P, q) \]  

In modeling consumer demand and its ultimate impact upon ticket prices, note the implicit assumption that the primary rationale for purchasing a ticket is the enjoyment of the performance, not the purchase of concessions. Because concession purchases are not compulsory for patrons, the price of the complementary good appears only in the concession demand function. As will be illustrated later, this assumption is not crucial to the implication of inelastic ticket pricing.

The firm’s profit function is:

\[ \pi = (P - h)Q - F^Q + (R - r)S - F^S - w(q)q \]  

where the cost of providing seats includes both variable and fixed components:

\[ Q = hQ + F^Q \]  

and likewise for the provision of concessions:

\[ S = rS + F^S \]  

\[ W(q)q \] represents the cost of the performer.

Taking the first-order conditions with respect to P, R, and q yields:

\[ [(P - h)Q_p + Q] + (R - r)S_p = 0; \]  

\[ S + (R - r)S_R = 0; \]  

\[ (P - h)Q_q + (R - r)S_q - w(q) - w_qq = 0 \]  

respectively.

Equation (6) suggests some interesting implications regarding the setting of ticket prices. Absent the concession term, the equation would read:

\[ [(P - h)Q_p + Q] = 0 \]
Factoring out $Q$ and rearranging the terms would yield:

$$Q(P/Q_{Q_P} + 1) = hQ_P, \text{ or }$$

$$Q(\epsilon_P + 1) = hQ_P$$  \hspace{1cm} (10)

Equation (11) is equivalent to the familiar $P = MC(1/1 + 1/\epsilon_P)$ pricing strategy for monopolists. Because the seats are constructed well in advance of the actual spectator event, the empirical studies cited earlier assumed that the marginal costs of seat provision are minimal and that the cost of seat provision consists primarily of fixed costs. As $h$ approaches zero, then Eqn (11) becomes:

$$Q(\epsilon_P + 1) = 0$$  \hspace{1cm} (12)

which implies that profits are maximized in the unitary portion of the demand curve. Clearly, this is the standard implication when supply is fixed. With the inclusion of the concession term, however, Eqn (11) reads:

$$Q(P/Q_{Q_P} + 1) + R_S = hQ_P + rS_P$$  \hspace{1cm} (13)

Equation (13) suggests a pricing strategy of multiple product pricing, where decisions are made based on the complementarity of ticket and concession sales. Thus, the monopolist in a performance good scenario will price the tickets so that the marginal revenue from admissions and concessions equals the marginal cost of seat provision and concessions.

Factoring out $Q$ and rearranging the terms yields:

$$Q(\epsilon_P + 1) = hQ_P - (R - r)S_P$$  \hspace{1cm} (14)

As the marginal cost of seat provision approaches zero, and substituting $(R - r)$ from Eqn (7), Eqn (14) becomes:

$$Q(\epsilon_P + 1) = -(S/S_R)S_P$$  \hspace{1cm} (15)

Equation (15) indicates the optimal performance goods pricing strategy. The standard model of rent yields a unitary pricing strategy as shown in Eqn (12). When complementary concessions revenue is built into the model, however, the profit-maximizing ticket price falls into the inelastic section of the demand curve.\(^5\) The rationale is straightforward. The market for concessions is limited to those purchasing tickets. By lowering the price of tickets below unity, the potential market for concessions is increased. The optimal price is that which maximizes overall profits from tickets and concessions.

This strategy is based on the assumption that the purchase of tickets is not compulsory, and therefore, concession prices are not included in the ticket demand function. In other words, consumers do not consider concession prices when making ticket purchase decision, but ticket prices ultimately determine the size of the potential market for concessions.

If concession prices are permitted to enter the ticket demand function, ticket prices will still be in the inelastic section of demand. First, consider the case in which concession prices do not enter into ticket purchasing decisions. Rearranging Eqns (6) and (7), the profit-maximizing ticket and concession prices are shown to be:

$$P = (hQ_P - (R - r) - Q)/Q_P$$  \hspace{1cm} (16)

$$R = -S/S_R + r$$  \hspace{1cm} (17)

respectively. Allowing $h$ to approach zero, and substituting $(R - r)$ from Eqn (17) into Eqn (16), the profit-maximizing ticket price may be expressed as:

$$P = ((S/S_R)S_P - Q)/Q_P$$  \hspace{1cm} (18)

Now consider the case in which concession prices enter into ticket purchase decisions. Taking the first-order conditions of Eqn (3) with respect to $P$ and $R$ reveals:

$$\pi_P = (P - h)Q_P + Q + (R - r)S_P = 0$$  \hspace{1cm} (19)

$$\pi_R = PQ_R + S + (R - r)S_R = 0$$  \hspace{1cm} (20)

Rearranging Eqn (20) shows a profit-maximizing concession price of:

$$R = -S/S_R + r - PQ_R/S_R$$  \hspace{1cm} (21)

which implies a lower concession price if concession prices weigh into ticket purchasing decisions. Rearranging Eqn (19), substituting $(R - r)$ from Eqn (21), and allowing $h$ to approach zero reveals a profit-maximizing ticket price of:

$$P = ((S/S_R)S_P - Q)/Q_P \times 1/\Theta$$  \hspace{1cm} (22)
where
\[
\Theta = [1 - (Q_R/S_R)S_P]
\] (23)

Comparing Eqns (18) and (22), one can still see that monopolists will charge an even lower price when trying to attract a concession-price-conscious ticket purchaser. Implications regarding elasticity can be obtained by rearranging the terms of Eqn (22) to reveal:
\[
Q(1 + \epsilon_p \Theta) = (S/S_R)S_P
\] (24)

Since \((S/S_R)S_P > 0 \) and \(\Theta > 1\), this, again, implies a strategy in which tickets are priced in the inelastic segment of demand.

**EMPIRICAL TEST**

Data from major league baseball are used to test the implication of an inelastic ticket price. Baseball is used to test these implications because it is a profit-oriented performance industry with a long history of published prices.

The sample consists of 516 observations encompassing twenty years of ticket prices. In testing the hypothesis that tickets are priced in the inelastic section of the demand curve, the logs of team attendance figures (\(LTEAMATT\)) are regressed against a set of independent variables, including the log of the average (weighted by the number of seats in each category) real ticket price for each team (\(LREALPRICE\)).\(^6\) The model for team attendance is:

\[
LTEAMATT = \alpha_0 + \alpha_1 LREALPRICE \\
+ \alpha_2 BOXRESERVE \\
+ \alpha_3 RESERVEVENADM \\
+ \alpha_4 TEAMQUALITY \\
+ \alpha_5 PREVTEAMQUALITY \\
+ \alpha_6 POP + \alpha_7 TWO + \alpha_8 OLD + \epsilon_1
\] (25)

\(TEAMQUALITY\) and \(PREVTEAMQUALITY\) are the winning percentages of the team in the current and previous season, and, therefore, proxy the quality of the performance.\(^7\)

\(BOXRESERVE\) and \(RESERVEVEN\) represent relative ticket prices (box seat prices/reserve seat prices and reserve prices/general admission prices).

The inclusion of these variables is extremely important in deriving an unbiased estimate of elasticity. Although the theoretical model derived earlier was for a single-price admission fee (i.e. movie theater tickets), baseball ticket prices vary and depend on the quality of the seat. If the price of box seats rises, some patrons may substitute into non-baseball goods whereas others simply substitute into lower-quality seats. The attendance variable captures the former element but not the latter, which would result in a downward bias in the elasticity estimate. By holding relative ticket prices constant, the pure impact of ticket prices upon attendance may more accurately be captured.\(^8\) The remaining independent variables represent market characteristics of each team. These variables are described in Table 1.\(^9\)

Prior research has found a heteroskedastic disturbance between attendance and population (Noll, 1974; Scully, 1989). This disturbance was discovered in this data set as well. Given the importance of deriving an interval estimate of elasticity, the regression was run using a weighted least squares estimate to obtain an unbiased estimate of the population variance. The results of the regression are shown in Table 2.

The key coefficient is the point elasticity estimate for \(LRPRICE\). The estimate (−0.568) lies in the inelastic range of demand. In terms of providing an interval estimate of elasticity, even with a generous

**Table 1. List of Variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTEAMATT</td>
<td>The log of the team’s home attendance</td>
</tr>
<tr>
<td>LREALPRICE</td>
<td>The log of the team’s average real ticket price (in 1991 dollars)</td>
</tr>
<tr>
<td>TEAMQUALITY</td>
<td>The team winning percentage in the current season × 1000</td>
</tr>
<tr>
<td>PREVTEAMQUALITY</td>
<td>The team winning percentage in the previous season × 1000</td>
</tr>
<tr>
<td>BOXRESERVE</td>
<td>The price of box seats relative to reserve seats</td>
</tr>
<tr>
<td>RESERVEVEN</td>
<td>The price of reserve seats relative to general admission (and bleacher)</td>
</tr>
<tr>
<td>POP</td>
<td>The population of the city in which the team plays (in thousands)</td>
</tr>
<tr>
<td>TWO</td>
<td>A dummy variable equal to one if there exist two major league teams within</td>
</tr>
<tr>
<td></td>
<td>the same SMSA</td>
</tr>
<tr>
<td>OLD</td>
<td>A dummy variable equal to one if the team played in an older ballpark</td>
</tr>
</tbody>
</table>

Table 2. Team Attendance Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>6.71</td>
</tr>
<tr>
<td></td>
<td>(26.08)*</td>
</tr>
<tr>
<td>LREALPRICE</td>
<td>-0.568</td>
</tr>
<tr>
<td></td>
<td>(-6.39)*</td>
</tr>
<tr>
<td>TEAMQUALITY</td>
<td>0.0026</td>
</tr>
<tr>
<td></td>
<td>(11.36)*</td>
</tr>
<tr>
<td>PREVTEAMQUALITY</td>
<td>0.0009</td>
</tr>
<tr>
<td></td>
<td>(4.20)*</td>
</tr>
<tr>
<td>BOXRESERVE</td>
<td>-0.209</td>
</tr>
<tr>
<td></td>
<td>(-2.34)*</td>
</tr>
<tr>
<td>RESERVEVEGAD לחבר</td>
<td>0.0525</td>
</tr>
<tr>
<td></td>
<td>(1.75)*</td>
</tr>
<tr>
<td>POP</td>
<td>0.0006</td>
</tr>
<tr>
<td></td>
<td>(6.91)*</td>
</tr>
<tr>
<td>TWO</td>
<td>-0.330</td>
</tr>
<tr>
<td></td>
<td>(-6.28)*</td>
</tr>
<tr>
<td>OLD</td>
<td>-0.257</td>
</tr>
<tr>
<td></td>
<td>(-4.66)*</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.977</td>
</tr>
<tr>
<td>$n$</td>
<td>516</td>
</tr>
</tbody>
</table>

$t$-statistics in parentheses.

* Significant at 0.01 level.

* Significant at 0.05 level.

* Significant at 0.10 level.

99% confidence interval, demand is inelastic (with an estimate ranging between $-0.338$ and $-0.798$).

Prior research on baseball ticket pricing echo these findings. These studies included ticket prices from 1951 to 1969 (Demmert, 1973), 1970–71 (Noll, 1974), the 1984 season (Scull, 1989), the period from 1970 to 1984 (Whitney, 1988) and also from 1982 to 1989 (Whitney, 1993). In each case the point estimate of elasticity was in the inelastic section of demand. Ironically, none of the researchers attributed any significance to the finding, and in some cases actually argued that the evidence supported a unitary pricing strategy.

Demmert described the nearness of his elasticity estimate ($-0.93$) to $-1$ as ‘encouraging’. Both Noll and Scull, whose point estimates ranged from $-0.049$ to $-0.76$, explained that the interval estimates of elasticity did not allow one to reject the hypothesis of unitary pricing. Finally, although the focus of Whitney’s studies was not on price elasticity, the empirical results reveal inelastic point estimates ($-0.188$ for National League teams and $-0.557$ for American League teams in the 1988 study and $-0.562$ for all of major league baseball in his 1993 paper). Most interestingly, in Whitney’s 1988 study, which involved the most observations (and presumably the most efficient estimates), the interval estimate of elasticity lies convincingly within the inelastic range of demand.

Another ticket-pricing study based on professional hockey was conducted by Ferguson et al. (1991). The researchers pursued the notion that ticket prices may be set in the elastic section of demand for teams that routinely sell out and in the unitary section for teams that do not; again, ignoring multiproduct pricing considerations. Interestingly, for teams which did not sell out, marginal revenue was significantly different from zero in 23 of the 39 cases. The researchers, however, discounted the evidence and referred to the results of a likelihood ratio test of a set of cross-equation restrictions as support for their hypothesis.

The theoretical implication of inelastic pricing derived in this paper serves to unify and explain previous empirical evidence. Several empirical studies on ticket pricing in major league baseball, encompassing nearly forty years of data and utilizing a variety of models, all produced inelastic point estimates. Although some of the researchers attempted to explain away their findings as being consistent with unitary elasticity pricing, this paper suggests that an inelastic ticket price is consistent with profit maximization. The notion that concession considerations would enter into the prices charged by clubs is not surprising in baseball, since during the period studied, concessions revenue made a significant contribution to the clubs’ total revenue.

CONCLUSION

The use of an inelastic pricing strategy to maximize profits for performance goods is based on two assumptions: first, the ticket-price setter must receive revenues from both tickets and concessions. If, for example, the concessionaire is an independent contractor which does not share its revenues with the ticket seller (nor pays a fee to the ticket seller for the right to sell its wares at the event), the optimal strategy would be unitary pricing. Second, the model assumes that the marginal cost of seat provision for performance events is insignificant. As the variable costs associated with seat provision become greater, the profit-maximizing price becomes more elastic.
APPENDIX: MEANS AND STANDARD DEVIATIONS

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTEAMATT</td>
<td>7.25</td>
<td>0.435</td>
</tr>
<tr>
<td>LREALPRICE</td>
<td>2.09</td>
<td>0.158</td>
</tr>
<tr>
<td>TEAMQUALITY</td>
<td>500</td>
<td>70.73</td>
</tr>
<tr>
<td>PREYTEAMQUALITY*</td>
<td>498.62</td>
<td>71.27</td>
</tr>
<tr>
<td>POP</td>
<td>4237.5</td>
<td>3257.8</td>
</tr>
<tr>
<td>TWO</td>
<td>0.320</td>
<td>0.467</td>
</tr>
<tr>
<td>OLD</td>
<td>0.054</td>
<td>0.227</td>
</tr>
<tr>
<td>BOXRESERVE</td>
<td>1.37</td>
<td>0.150</td>
</tr>
<tr>
<td>RESERVEGENADM</td>
<td>1.84</td>
<td>0.451</td>
</tr>
</tbody>
</table>

*Montreal and San Diego, because they were expansion teams in 1969 and had no prior record of winning, were assigned previous winning percentages equal to their 1969 records.

NOTES

1. Some larger cities, such as Chicago, New York, and Los Angeles field two major league teams. Even in these markets, however, fan loyalty is based largely on regional boundaries.

2. Cowen and Glazer (1991) argue that the ski-lift model is little more than an application of the theory of clubs. Ski-lift prices are analogous to membership fees and the number of ski rides per patron is parallel to the congestion issue in club theory.

3. The term 'concessions' is used in a generic sense to refer to any nonobligatory consumption goods which complements ticket-buying.

4. The use of $W(q)$ to represent the cost of the performers implies a monopsonistic environment. The comparative static implications for ticket pricing do not depend on this assumption.

5. Interestingly, Barro and Romer (1987) suggest that admission fees to ski areas will be set in the unitary section of demand absent congestion considerations. However, because the main focus of the article was on price setting in the presence of congestion and queuing at ski lifts, the implication of unitary pricing results from the omission of complementary ski lodge concessions in the model.

6. This method of averaging prices has been used in other studies of baseball ticket pricing (Noll, 1974; Demmert, 1973). Both researchers acknowledge that tickets may not be sold in the same proportion that they are available. Further, weighted averaged ticket prices do not necessarily reflect the quality of the seats, which may differ from team to team. In another baseball study, Whitney (1988) limits his study to the 15000 most expensive tickets in each stadium. The data used in this study was compiled from information supplied by the Archives at The Sporting News.

7. Team quality is, of course, a major component of the attendance demand function and was included in the empirical models used by the other baseball studies cited in this paper.

8. None of the four studies cited earlier controlled for relative ticket prices. Clearly, this may have played a role in the inelastic point estimates these studies revealed. Scully (1989) attempted to remedy this problem by dividing the gate receipts by the total attendance to obtain the average ticket price paid per patron. A simple numerical example will show that this method of averaging ticket prices could lead to biased (and even perverse) elasticity estimates. Assume that two ticket prices exist at $10 and $5, and that 10000 of each ticket type are purchased. Gate receipts total $150,000, or an average of $7.50/patron. Suppose that the price of the $10 ticket rises to $20, whereas the $5 ticket price remains unchanged. Clearly, there has been an increase in the average ticket price. However, suppose that in response to the higher price, 8000 patrons substitute into the $5 seats, while the remaining 2000 purchasers of $10 tickets do not buy tickets at all. Not only do the calculations imply a price decrease (from $7.50 to $5), but that attendance decreased in response to the decrease in price.

9. The ticket demand model does not control for either the price of concessions or the level of concessions demand. The purpose of this paper is to test the hypothesis that ticket prices will be set in the inelastic section of demand. As Eqns (15) and (24) indicate, inelastic pricing will exist as long as concession sales are greater than zero and the demand for concessions is not perfectly elastic. The precise level of concessions prices or demand are not necessary to test this implication.

10. To test the sensitivity of the elasticity estimate, several models were specified using numerous combinations of variables. Included were the use of time series and team-specific dummies. None of the alternative models produced an elasticity estimate which was outside of the inelastic range.

11. In each of these cases, the research was conducted using relatively small sample sizes, which could explain the generous limits of their confidence intervals. Also, given that ticket prices are not adjusted within a season, one- and two-season sample estimates may not be indicative of an equilibrium strategy. In contrast, the sample size used in this study is substantially larger, resulting in more efficient estimates of the population variance. Further, the data set covers a 20-year span. The estimates produced in this study, therefore, are probably more indicative of the industry’s long-run pricing strategy.

12. Although concessions revenue is a significant portion of revenue on a league-wide basis, the proportion of total revenues accounted for by concessions differ significantly between teams (for a more detailed analysis, see Quirk and Fort, 1992).

REFERENCES


