Cross-Elasticity of Demand in Multi-Product Sports & Entertainment Portfolios

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Introduction

While estimating sports demand is a common and important topic in the context of ticket sales and consumer behavior, the market power of pro sports franchises in the US makes the study of demand particularly important from the perspective of fan, player, and public sector welfare. One issue in particular that determines the level of market power among sports franchises – in addition to their favorable treatment by antitrust authorities – is the rate at which consumers substitute their leisure time and disposable income spending. In particular, if sports franchises compete with other forms of entertainment, and not just other franchises in their own league, then this reduces the power they have to charge higher prices or reduce overall output. Alternatively, if a given sports team is not substitutable with other entertainment or sports options, then substantial market power would remain.

However, there has been only limited empirical inquiry into sports substitution behaviors among fans, as highlighted by Winfree (2009) and Mills and Winfree (2016). In the few inquiries that do exist, researchers have identified important nuances related to prices, quality, cross-ownership, type of sport, and type of consumption. For example, in MLB, Winfree, McCluskey, Mittelhammer, and Fort (2004) found that the existence of a closely located rival franchise in the same league has a negative impact on attendance. Alternatively, Mills and Rosentraub (2014) and Mills, Winfree, Rosentraub, and Sorokina (2015) find that while consumers substitute between two nearby same-league teams based on both price and quality, only relative prices drive substitution behaviors if these teams are in different leagues (sports). Further, Mills, Tainsky, and Mondello (2016) actually find complementarities in quality as it relates to television viewership for same-market MLB teams: as one team increases quality, the other team in the market experiences some increase in viewership, too. Finally, Mongeon and Winfree (2013) theoretically show that owners of two sports teams in the same market would field lower quality teams, possibly reducing fan welfare. Yet more work is needed to empirically test the substitutability of other entertainment events, particularly in the cross-ownership scenario where market power is increased due to a wider range of holdings by a single firm. This research therefore uses a proprietary data set of individual consumer transactions to directly test the cross-elasticity of demand for different events within a single firm’s multi-product portfolio.

Modeling Approach and Data

Our data come from a large entertainment company in control of various sports and entertainment products offered in a large US metropolitan area through three separate venues. It contains 10 years of individual account transactions, with over 3 million total observations. This consists of every transaction for every event held at one of their three event locations, including concerts, sporting events, and other shows. Our preliminary inquiry categorizes purchases into three general commodity categories: (1) Sporting Event, (2) Concert, and (3) Family Event. Further, we address substitutability not only through changes in relative spending budgets on each type of event, but also establish a leisure time budget through data on purchase quantity.

We use the Almost Ideal Demand System (AIDS) approach introduced by Deaton and Muellbauer (1980) to model prices, and Almost Ideal Inverse Demand System (AIIDS) developed by Barten and Bettendorf (1989) to model scale, compensated, and uncompensated price or quantity elasticities related to these entertainment products. The supply for these events is fixed so that the providers and ticket retailers become price takers as reproduction of homogeneous event is nearly implausible. With this assumption, market clearing price becomes endogenous so that inverse demand analysis is reasonable as it converts to a function of quantity. Finally, the time taken to attend these events – a central characteristic of leisure – also brings about decisions over time allocation to each event, which we model in this work.
Because we have multiple years of purchases tied to specific user accounts, the data allows for identification of purchase variation across years as budget changes. Therefore, the pertinent variables include the year of purchase, an account identifier, the type of commodity, the price and quantity of the commodity, and the budget share of each commodity among total entertainment spending for each consumer. These are used in the AIDS and AIIDS estimations to evaluate shifts in spending and time (quantity) of different event types across years. The general form of both AIDS and AIIDS models are:

AIDS: \( dw_i = a_i * d\ln Q + \sum_{j}(\pi_{ij} * d\ln p_j) \)

AIIDS: \( dw_i = b_i * d\ln Q + \sum_{j}(\gamma_{ij} * d\ln q_j) \)

where \( dw_i \) is the difference of consumer budget share from time \( t \) and \( t-1 \), \( p_i \) and \( q_i \) is the price and quantity for good \( i \), \( d\ln p_j \) and \( d\ln q_j \) is the log difference of price (quantity) of good \( j \), and \( d\ln Q = \sum_j w_j d\ln q_j \) is the Divisia volume index. The parameters of interest are \( a_i / b_i \) and \( \pi_{ij} / \gamma_{ij} \) subject to an adding up condition, homogeneity condition, and symmetry condition. Using these parameters, we then can estimate the scale elasticities as well as the compensated and uncompensated elasticities. The model can be interpreted as the change in budget share of a consumer over the years \( (dw_i) \) explained by the index of variation in real income \( (d\ln Q) \) and sum of the log differences of price of other goods \( (d\ln p_j) \) or quantity of other goods \( (d\ln q_j) \). Ultimately, the combination of these parameter estimates directly tells us about the spending elasticities for each of the products relative to one another.

Results and Managerial Implications

This research is currently ongoing, with the data fully collected and cleaned. We are in the process of estimating the demand system models at this time – with much of the code for the estimation completed – and will have full results by the time of the conference.

There are clear implications, as noted earlier, from this work for understanding market power in pro sports. However, there will also be salient lessons for sport managers from our analysis. In particular, the substitution relationship estimated here could inform owners as to the level of cannibalization of consumers across the portfolio of events, and which mix of events results in the best net outcome for the firm. For example, knowing if an increased price of a basketball game will reduce revenues elsewhere in the portfolio reveals information about optimal ticket pricing to maximize profits across the entirety of the entertainment business. Managers of facilities, marketing, and ticket offices would be well served to have this information at hand when scheduling events and marketing and selling tickets to these events. We will expand upon the importance of these findings in our presentation.