Northwestern | McCORMICK SCHOOL OF ENGINEERING

JOEL SHAPIRO

Concession Pricing @ Solider Field

On the shores of beautiful Lake Michigan in downtown Chicago sits Solider Field, the home of the Chicago Bears. A storied and world-famous American football team, the Bears enjoy one of the most enthusiastic and loyal fan bases of any team in the National Football League (NFL). Their fans eagerly watch games on TV and regularly fill every one of Soldier Field's 61,500 seats.

The Bears, along with every other team in the NFL, play 16 games each season, with half at their home stadium and half at another team's stadium. Most of the tickets for the Bears 8 weekly home games are purchased as season-ticket packages, where the buyer purchases a seat for all 8 games. Approximately 95% of seats are sold as season-ticket packages. It is not uncommon for a season-ticket holder to attend some of the games and sell a single game ticket on the secondary ticket market.

The Bears, like many professional sports teams, use data analytics in two ways. The first regards team performance – they build models around how best to build a winning team and create successful in-game strategies. The second is around business decisions, such as marketing, merchandising, and other revenue-generating activities. Food and drink concessions represent one of the Bears' largest revenue streams, but precise pricing strategies have never received much scrutiny. In 2020, the Bears began to consider how they could analyze data to help inform how to set the right price for hot dogs, nachos, soft drinks, beer, and more.

At the core of pricing decisions, the Bears analytics team knew, is a concept called "price elasticity," which measures how demand changes when price is changed. For instance, if the Bears typically sell 20,000 hot dogs when priced at $5 each, and 18,000 hot dogs when priced at $6 each, then price elasticity = 0.5, as shown below.

Quantity Sold	Price
20,000	$5.00
18,000	$6.00
Decrease = 10%	*Increase = 20%*
Price elasticity of hot dogs = |-10% / 20%| = 0.5	

Here, the percentage decrease in quantity sold is less than the percentage increase in price. This suggests that the Bears would make more money by charging $6 instead of $5 for a hot dog.

The Bears' analytics team knows that calculating price elasticity requires variation in price. For instance, if they always charge $5 for a hot dog, then there would be no way to assess what would happen to demand when price is changed. Fortunately, via occasional promotions, the prices of selected food and drink did vary throughout the 2019 season, as follows:

- Food and drink items for non-season-ticket holders and those who purchased single-game tickets from season-ticket holders were always full price
- Items were always discounted by 10% for General Admission (GA) season ticket holders and by 20% for Club Level (CL) season ticket holders
- Selected items were chosen as "Item of the Week" for any given game, and discounted by 50% for all season-ticket holders. When an item was "Item of the Week," the 50% discount would be used instead of the 10% or 20% discount.

For instance, if the full price of a hot dog was $6.00, then the price for a GA season-ticket holder would be $5.40 (10% discount) and the price for a CL season-ticket holder would be $4.80 (20% discount). If hot dogs were designated as "Item of the Week," then the cost would be $3.00 for both GA and CL season-ticket holders.

In 2019, the Bears sold many different foods and drinks, but included only 7 items in their "Item of the Week" promotions. Each item was featured as "Item of the Week" from 1 to 4 times throughout the season. The 7 items, called "Promotional Items," were:
- Nachos
- Souvenir popcorn (popcorn sold in a souvenir container)
- Hog dog
- Bag of Peanuts
- Bavarian pretzel
- Bottled water
- Souvenir soda 32 oz (soda sold in a souvenir cup)

All promotions to season-ticket holders – GA, CL, or Item of the Week – were available only through a season-ticket holder mobile app and could only be redeemed by scanning a QR code at the point of sale.

The accompanying data set "ConcessionSalesData_ForClass" provides transaction-level sales data for each food and drink item – including the 7 Promotional Items – redeemed with a season-ticket holder for all 8 home games in the Bears' 2019 season. If a season-ticket holder didn't use a mobile device to redeem a discount for any reason (no access to a mobile device, wasn't aware of the promotion, etc.), then the purchase was not linked to a season-ticket holder, and therefore is not included in these data.

Use the data to answer the following questions.

Question 1. (4 points) What is the price elasticity of each the 7 Promotional Items? (3 points). Make sure to provide the model that you use to estimate elasticity, calling attention to any independent variables that you incorporate as control variables.

Question 2. (4 points) How do "Item of the Week" discounts on each of the 7 Promotional Items affect sales of the other Promotional Items? For instance, what is the causal effect of a 50% discount on hot dogs for the other 6 Promotional Items? What is the causal effect of a 50% discount on nachos on the other 6 Promotional Items? And so on…

Question 3. (4 points) How might the Bears use the insights in (1) and (2) to improve their concessions pricing strategy?

Question 4. (3 points) Briefly articulate the weaknesses of your analysis, specifically as it relates to the nature of the data and the number of observations in your analysis. What could the Bears do in the future to generate data that can be more effectively used to assess the pricing questions above?