

Springsteen on Broadway

Case Simulation

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Abstract – Bruce Springsteen performed his *Springsteen on Broadway* show from October 2017 to December 2018 in an intimate, 960-seat, theater on Broadway. An online “Verified Fan” system discouraged scalpers and kept tickets off the secondary market. This Case Simulation provides both a case study of the concert and a software simulated model of the market for tickets. Students are asked to analyze the market and optimize prices in the model.

Keywords – Agent-Based Models, AI, Artificial Intelligence, Business, Case Simulations, Case Study, Economics, Microeconomics, Market Simulation, Modeling, Ticket, Ticketing, Pricing, Price Optimization, Demand Curve, Cannibalization, Capacity Limitations, Perishable Goods

Learning Goals – Students will learn:

1. How to set the price of goods having capacity limitations,
2. How to generate a Demand Curve,
3. How to manage good-better-best prices, and
4. How to optimize revenue from a portfolio of perishable goods.

1 ABOUT CASE SIMULATIONS

1.1 Overview

Case Simulations are a combination of Case Studies and Market Simulations.

$$\textit{Case Simulation} = \textit{Case Study} + \textit{Market Simulation}$$

Case Simulations extend business and economics case studies by reproducing key market dynamics in a software simulation. Students can actively explore this simulated environment to analyze the problems presented in the case. Data analytic tools are provided alongside the simulation to answer specific questions. Student solutions can be tested in software before recommendations are made.

1.2 Market Simulation Details

The software simulation runs an Agent-Based Model (ABM) built upon Mainstream Economics. Consumer Agents make Rational Decisions based upon their Willingness To Pay (WTP) and Consumer Surplus for goods and services. Vendor Agents can follow the rules of Game Theory to maximize profitability.

The simulation runs within a Data Analytics platform called KNIME. This platform, along with the Market Simulation extension, must first be installed by students before the Market Simulation workflow can be explored and analyzed.

2 CASE STUDY

Growin' Up was one of Bruce Springsteen's first notable songs and the opening number of his Broadway show. He played 15 songs on an empty stage and closed with his famous title-track *Born to Run*.

"It's going to feel like a garage workshop", said Springsteen, "I'm going to play my songs and tell my stories." (Flanagan, 2017)

2.1 Background

15-year-old Bruce Springsteen started playing guitar in 1964 after he saw the Beatles' appear on the Ed Sullivan Show (Statham, 2013).

Greetings from Asbury Park, N.J. came 8 years later and included the song *Growin' Up*. It was Springsteen's debut studio album cut with his E Street Band and released through Columbia Records in 1972. Around this time Springsteen also acquired his nickname "The Boss". Springsteen's future wife, Patti Scialfa, was to join the E Street Band later in 1984 (Brett, 2009).

Springsteen's career as a singer, songwriter, and musician spanned five decades. He has sold more than 135 million records and is one of the world's best-selling music artists (RIAA, 2013). Springsteen's 2016 autobiography, *Born to Run*, was named after his iconic 1975 album and song.

2.2 Broadway Concert

Springsteen on Broadway kicked off October 3, 2017 at the Walter Kerr Theatre in New York City.

The 68-year-old Springsteen performed his 15 songs over two hours every performance. Most of the show he played solo with his acoustic guitars, harmonica, and piano. Scialfa sang backing vocals on two of the songs.

Between songs, Springsteen would reminisce and recall stories from his book, *Born to Run*. As *Variety* magazine described it, the concert was a kind of live autobiography (Aswad, 2017).

According to Springsteen himself:

"I wanted to do some shows that were as personal and as intimate as possible. I chose Broadway for this project because it has the beautiful old theaters which seemed like the right setting for what I have in mind. In fact, with one or two exceptions, the 960 seats of the Walter Kerr Theatre is probably the smallest venue I've played in the last 40 years. My show is just me, the guitar, the piano and the words and music. Some of the show is spoken, some of it is sung. It loosely follows the arc of my life and my work. All of it together is in pursuit of my constant goal to provide an entertaining evening and to communicate something of value." (Sisario, 2017)

Springsteen performed five shows a week: Tuesday through Saturday. "I've never worked five days a week until right now", he quipped (Willman, 2018).

The concert was an immediate hit. Springsteen's first five concerts were all sell-out performances that grossed \$2.33 million (about \$466,000 per night). Only two Broadway shows did better: *Hamilton* and *Hello, Dolly!* (Flanagan, 2017).

2.3 Scalpers

Tickets went on sale for between \$75 and \$850 face value. But with such a small venue hosting such a big star, the concert was always going to cause a stampede. All scheduled tickets, as well as tickets for the first extension, were sold out almost immediately (Marks, 2017).

The online "Verified Fan" system employed by Ticketmaster helped to discourage scalpers and ticket-buying bots. The system was designed to check the purchase history of buyers and confirm their social media activity. Verified and pre-registered fans were then contacted randomly and invited to purchase up to two tickets. According to Ticketmaster, 90% of the tickets sold through Verified Fan were kept off secondary market resale sites like StubHub, TicketIQ, and Seat-Geek (Bonazzo, 2017).

"The beautiful thing about Springsteen is that if we had not done Verified Fan, 100 per cent of the tickets would have gone to secondary market sites," said David Marcus, Ticketmaster's Executive Vice President and Head of Music. "There

would have been no chance for consumers to get tickets, because the bots would have overwhelmed (the system)" (Postmedia Network Inc., 2018).

But fans quickly noticed the \$75 face-value tickets selling for \$1,400. And premium tickets selling for as much as \$17,000 per pair on StubHub (Marks, 2017).

Springsteen had seen this before.

In the lead-up to Springsteen's 2009 concerts at Giants Stadium in New Jersey, secondary market ticket sellers had already started advertising steeply marked-up tickets before they had even gone on sale (McGlone, 2009). This led Congress to propose the BOSS Act¹ to help eliminate fraudulent behavior.

Then tickets for Springsteen's 2016 *The River Tour* that had sold out within minutes remained available for sale on secondary markets at inflated prices. This helped spur Congress to pass the BOTS Act².

The secondary market for tickets is estimated to be about US\$15 billion per year. "Ticketing is still a rigged system," said New York Attorney General Eric Schneiderman (Keller, Novy-Williams, Voris, & Burton, 2017).

But many economists believe that scalpers can benefit both the buyer and the musician. Buyers benefit by having tickets available when they want them. And musicians benefit by selling tickets far in advance of concerts and having scalpers take on inventory risk. Economists argue that musicians can discourage scalping more effectively by (a) increasing the price of tickets, and (b) increasing the number of concerts (Perry, 2016).

2.4 Concert Extensions

The *Springsteen on Broadway* concert was originally scheduled to run from October 2017 for four months. But the show was extended twice to both satisfy demand and placate fans. It ultimately ran for 14 months, and closed December 15, 2018.

¹ Better Oversight of Secondary Sales and Accountability in Concert Ticketing (BOSS Act)

² Better Online Ticket Sales Act (BOTS Act) of 2016

Netflix released its film version of *Springsteen on Broadway* on December 16, 2018 – the day after the concert closed.

3 DISCUSSION QUESTIONS

These questions can be prepared by students after reading the case and before an instructor-led class discussion.

1. Does it make sense that premium tickets are ten times more expensive than economy tickets in such a small theatre?
2. Why do artists dislike their tickets being sold on the secondary market? Are artists economically rational?
3. Is ticketing a “rigged system” as was described by New York’s Attorney General?
4. Do systems like Verified Fan solve the problem of scalpers? Do you see any flaws with the system?
5. Should musicians adopt dynamic pricing strategies like those employed by the airline industry?
6. Fans were upset that Springsteen did not announce the first extension of tickets even earlier, accusing the musician of creating an artificial shortage when he always knew there would be more tickets. Is this a fair criticism?
7. How much would you pay for tickets to an intimate show by your favorite performer?
8. If you knew Netflix was going to release the film version the day after the concerts finished would you still pay for the privilege of going?

4 SIMULATION QUESTIONS

A Market Simulation has been prepared that mimics the market for concert tickets in 2017. The simulation is an Agent-Based Model (ABM) comprising of many concertgoing customer agents interested in *Springsteen on Broadway* tickets. Some adjustments to the input parameters have been made to simplify the analysis.

The model covers a single week. Concerts are held on the following evenings:

- Tuesday
- Wednesday
- Thursday
- Friday
- Saturday

Four seating sections are available at the Walter Kerr Theatre (in order of price):

- Luxury
- Orchestra
- Mezzanine
- Balcony

Customer agents can choose between the four seating sections at each of the five concerts. The customers' Willingness To Pay (WTP) for each of these 20 choices has already been determined. Customers can buy a maximum of one ticket each.

Using the Market Simulation and the data analytics tools provided, answer the following questions. Some of this analysis can be performed in a spreadsheet but most needs to be performed in the simulated environment. Your instructor may demonstrate how to get started.

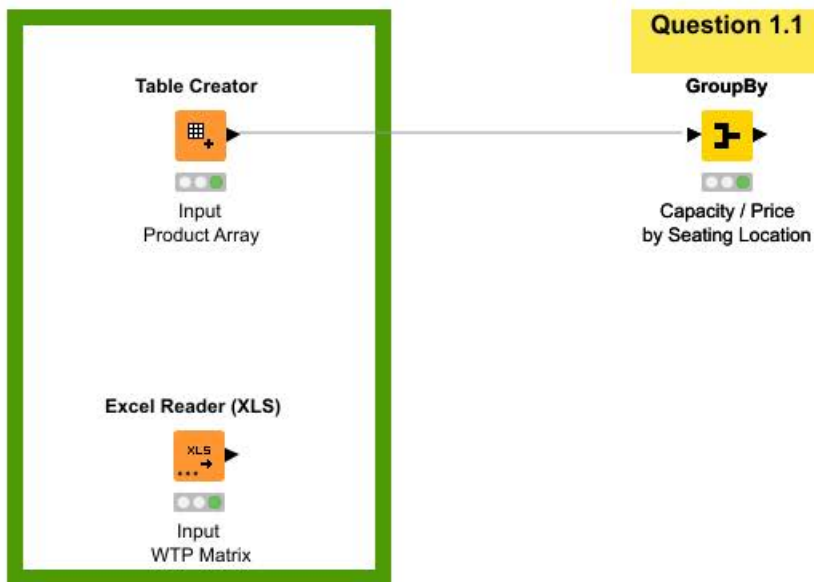
Create a spreadsheet to collect your answers.

Education (ED-211) - Springsteen on Broadway

Bruce Springsteen performed his 'Springsteen on Broadway' show from October 2017 to December 2018 in an intimate, 960-seat, theater on Broadway. This Case Simulation provides both case study of the concert and a software simulated model of the market for tickets. Students are asked to analyze the market and optimize prices in the model.

Simulation Input Data

This is the input data used by the Market Simulation. The section seating capacity and original prices have been set. The Willingness To Pay (WTP) of each ticket by each customer has already been calculated.



Section 1: Exploring the Data

This section requires you to conduct basic statistical analysis of the data used by the market simulation.

Question 1.1



Hints on New Sections

You can copy-and-paste the input data block down to a new part of the simulation to start the next section of analysis.

Hints on Running the Simulation

You will typically need to connect both the "Product Array" and the "WTP Matrix" to any simulation node. Change this input data by first making a copy or, even better, by manipulating this data using the nodes provided.

Hints on Looping the Simulation

The 'Loop Start' and 'Loop End' nodes can automate the changing of input data and run the model multiple times. Results are collected by the Loop End node.

Section 2: Running the Simulation

This section requires you to run the original Market Simulation and analyze the tickets sold in each section on each day.

Section 3: Demand Curve

In this section, you need to change the price of the Wednesday Orchestra ticket multiple times to generate a Demand Curve.

Section 4: Maximize Weekend Revenue (Advanced)

Fans understand that weekend ticket prices can be more expensive than weekday prices. In this section, you need to change the price of the Weekend to maximize Total Theatre Revenue.

4.1 Exploring the Data

This section requires you to conduct basic statistical analysis of the data used by the market simulation.

For this section, you may conduct your analysis in the spreadsheet you created to collect your answers. But note this will not always be possible as you will need to modify and run the simulation to generate results.

1. Find the Input Product Array table in the Market Simulation. What is the capacity of each section? What is the price of a ticket in each section? Do ticket prices vary by day of the week? Fill in the following table.

Section	Capacity	Price
Luxury		
Orchestra		
Mezzanine		
Balcony		

2. Find the Input WTP Matrix table in the Market Simulation. Verify the number of customers included in the model? Verify the number of tickets (called “products” in the simulation) customers can choose between?

How many Customers in the WTP Matrix?	
How many Products in the WTP Matrix?	

- Look more closely at the Input WTP Matrix and note the zero (0) values some of the customers have for some of the tickets. This indicates that the customer could not go to the concert on that day regardless of the ticket price. Those tickets are not within the customer's "consideration set".

For the first five customers, count the number of days each customer is available to go to a concert.

Customer	# Days Considering
C00001	
C00002	
C00003	
C00004	
C00005	

- Using the first row of the Input WTP Matrix, rank the top five ticket preferences for the first customer (C0001) by their Willingness To Pay. Remember, Willingness To Pay does *not* take into account price.

Preference of C0001	Ticket Day / Seat Section
First	
Second	
Third	
Fourth	
Fifth	

5. Using the Input WTP Matrix, find the minimum, maximum, and average Willingness To Pay customers have for the Thursday tickets listed in the table below.

Hint: First exclude customers who are not considering going on Thursday with the Row Filter node. The Statistics node can then be helpful.

Section	Min WTP	Max WTP	Average WTP
Luxury			
Orchestra			
Mezzanine			
Balcony			

6. Using the results from the question above, calculate the Average Consumer Surplus for Thursday tickets for each section and fill in the table below. Based upon this calculation alone, which section do most customers prefer to buy?

Hint: Consumer Surplus is the difference between WTP and Price.

Section	Average WTP	Price	Consumer Surplus
Luxury			
Orchestra			
Mezzanine			
Balcony			

7. Using the Input WTP Matrix, generate histograms for the Thursday Balcony tickets and the Thursday Luxury tickets showing the range of the customers' Willingness To Pay. Describe, in words, how the two histograms compare?

Hint: The Histogram Chart (JFreeChart) node can generate histograms. Or you can generate the histograms in Excel.

8. Suppose all but one of the tickets have already been sold-out for the week's concerts, and all customers in the simulation are still looking for a ticket. The last remaining ticket is a Luxury ticket for the Saturday night performance, and a scalper is selling it.

What is the maximum price the scalper could get from selling the ticket (to the nearest dollar)? You may assume all customers are in contact with the scalper.

4.2 Running the Simulation

This section requires you to run the original Market Simulation and analyze the tickets sold in each section on each day.

Connect the Input Product Array and the Input WTP Matrix to a “Simulate Market” node and run it using the green arrowed button in the toolbar. Find the “Output Product Array” and answer the following questions.

1. How many customers in the simulation bought tickets on each day in each section? The Quantity column tracks number of customers. Fill in the following table and plot the results in a 3D bar chart or in a heatmap.

Section	Tue	Wed	Thu	Fri	Sat
Luxury					
Orchestra					
Mezzanine					
Balcony					

2. How much Revenue did each section generate each day? Fill in the following table and plot the results in a 3D bar chart or in a heatmap.

Section	Tue	Wed	Thu	Fri	Sat
Luxury					
Orchestra					
Mezzanine					
Balcony					

- Sum the Quantity of tickets sold and Revenue generated each day across all sections. Fill in the following table and plot the results in a line chart. Which day(s) brings in the most Customers and generates the most Revenue?

Hint: The GroupBy node can be used to sum the Quantity and Revenue across all sections.

Section	Tue	Wed	Thu	Fri	Sat
Quantity					
Revenue					

- Suppose Madonna launches her *Madonna on Broadway* concert the same week and the first half of Bruce Springsteen's fans attend that concert instead. What happens to the Quantity of tickets sold and Revenue generated by the *Springsteen on Broadway* concert? Fill in the following table and plot the results in a line chart.

Hint: The Row Filter node can filter out the top half of Springsteen's fans.

Section	Tue	Wed	Thu	Fri	Sat
Quantity					
Revenue					

4.3 Demand Curve

In this section, you need to change the price of the Wednesday Orchestra ticket multiple times to generate a Demand Curve.

1. Change the price of *just* the Wednesday Orchestra ticket in increments of \$50 according to the table below. Run the Simulate Market node at each step and make a note of the Quantity sold and Revenue generated. You only need to track these metrics for the Wednesday Orchestra section itself, although you may also calculate the theatre totals if you wish.

Hint: Manually change the price of the ticket in the Input Product Array Table Creator node. Run the Simulate Market node and note the results.

Wednesday Orchestra	Quantity	Revenue
\$400		
\$450		
\$500		
\$550		
\$600		
\$650		

2. Create a Demand Curve by plotting these values in a chart in your Excel answers spreadsheet. At which price is revenue maximized?

3. Drag in the Demand Curve node to your market simulation to calculate these values much quicker. At what price is Revenue for the Wednesday Orchestra section maximized? How much additional Revenue is generated by this ticket when priced at its Revenue Maximizing Price? Based upon this result alone, would you recommend raising or lowering the price of the Wednesday Orchestra ticket?

Demand Curve node dialog box instructions:

- Double-click to open the node's dialog box
- Select the Wednesday Orchestra ticket as the Focus Product
- Select "Focus Product Only" as the Demand Curve Product Set
- Check the option "Override Price-Cost Gap Width with Fixed Price Percentage"
- Set "Gap Width Fixed Percentage of Price" to 2.0
- In the Market Size tab, select "Set to total number of Customers in the WTP Matrix"

After you run the Demand Curve node you will find results in the Output Demand Curve table. Look at just those result rows in which the Scenario column is set to "Product" (recall tickets are known as "Products" in the Market Simulation). Hint: use the Row Filter node to filter Scenario by Product.

4. Continue using the Demand Curve node output you generated, but now look at just those result rows in which the Scenario column is set to "Market". Pay special attention to the Quantity and Revenue values when filtering Scenario by Market. Why are these values so much larger than the Quantity and Revenue values when filtering Scenario by Product?

What is the Revenue Maximizing Price when filtering Scenario by Market? Would you raise or lower the price of the Wednesday Orchestra ticket based upon this result?

Complete the following sentence:

To maximize the Revenue generated by just the Wednesday Orchestra tickets, the theatre should raise / lower the price of the ticket to \$_____. But to maximize the Total Revenue generated by the theatre, the price of Wednesday Orchestra tickets should be raised / lowered to \$_____.

- Repeat the exercise above to determine the price of each Wednesday section that maximizes Total Theatre Revenue. Test each section independently one-at-a-time. Fill in the following table.

Hint: Find the Output Price Sensitivity Array output from the Demand Curve node. Filter by “Change Method” equals “After Max Market”.

Wednesday Section	Original Section Price	Revenue Maximizing Price	Original Theatre Revenue	Maximized Theatre Revenue	Additional Theatre Revenue
Luxury					
Orchestra					
Mezzanine					
Balcony					
Total Expected Additional Revenue					

- As shown in the table above, sum the Additional Theatre Revenue to calculate the Total Additional Revenue the theatre might expect by changing the price of each Wednesday section to its Revenue-Maximizing Price.
- Simultaneously set the price of all Wednesday section tickets to their Revenue Maximizing Prices calculated above. Re-run the Market Simulation. What is the total additional Revenue that was generated by the theatre? Is this the result you expected when adding individual results? Explain.

4.4 Maximize Weekend Revenue (advanced)

Fans understand that weekend ticket prices can be more expensive than weekday prices. In this section, you need to maximize Total Theatre Revenue by changing the price of the weekend tickets. Friday and Saturday tickets are “weekend tickets”.

1. Change the prices of all Friday and Saturday tickets at the same time by the same percentage according to the table below (leave the price of Tuesday, Wednesday, and Thursday tickets unchanged). Sum up the total Quantity and total Revenue for the theatre across all sections and performance days (exclude the ‘No Sale’ customers). What percentage price increase of weekend tickets would maximize Total Theatre Revenue?

Weekend Ticket Price Increase	Total Theatre Quantity	Total Theatre Revenue
+0%		
+10%		
+20%		
+30%		
+40%		
+50%		
+60%		
+70%		
+80%		
+90%		
+100%		

4.5 Maximize Total Theatre Revenue (expert)

Assume Bruce Springsteen wants to maximize the total Revenue the theatre generates over the week. Assume he is not concerned about the reaction of disgruntled fans.

1. Describe, in words, how you might go about changing the prices of the tickets for each section on each day to maximize the total week's revenue. All 20 tickets could now have different prices.
2. Try changing individual ticket prices by trial-and-error or any way you wish to increase the week's total revenue. Boasting rights will be awarded to the student or team that can generate the most revenue.

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