Pay no attention to the alternatives behind the curtain

or, Demand Forecasting with Missing Data

Jeffrey Newman
MNL

- Us Coach
- Us Business
- Us First
What if they have Kryptonite?
It is like a choice-based sample, except the sampling rate on **Them** is zero.
Talluri & van Ryzin Revenue Management

timeline
Talluri & van Ryzin Revenue Management

timeline
Talluri & van Ryzin Log Likelihood

\[
\log L = \sum_{i \in W^+} \left[ \log \lambda + V_i - \log \left( \sum_{j \in C} \exp V_j + 1 \right) \right] \\
+ |W^-| \alpha \left( \log \lambda - \log \left( \sum_{j \in C} \exp V_j + 1 \right) \right) \\
+ |W^-| \left( 1 - \alpha \right) \log \left[ 1 - \lambda \right]
\]

Expectation for \( \alpha \Leftrightarrow \text{Maximization for } \beta, \lambda \)
### Talluri & van Ryzin, Test Data

<table>
<thead>
<tr>
<th>Case Number</th>
<th>Alternative Availability</th>
<th>Chosen</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Alt A</td>
<td>Alt B</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Prices: 199, 249, 347
Talluri & van Ryzin, All Over the Map

![Graph](image-url)
What to do?

- Problem: there is no information available to tell the difference between their customers and a hole in the wall
- Solution: add some information!
- Aggregate market share data is typically publicly available
Instead of E-M, M-E

1) **Maximization** of our utility parameters
2) Holding those fixed, **Expectation** of their utility constant and arrival rate based on overall market share
NL

Coach

Business

First

Us Coach

Us Business

Us First
NL

Coach

Business

First

Us
Coach

Us
Business

Us
First
To Do

• Connect the GEV sampling adjustment to...
• An aggregate representation of choices in a manner that is not the same as the nesting, and...
• Incorporate the dynamic programming framework for pricing strategy to...
• Maximize revenue.
• Simple!