WILLINGNESS TO PAY AND COMPETITIVE REVENUE MANAGEMENT

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Traditional RM Systems Are Struggling Under Fare Simplification

- **Simplified fare structures characterized by**
  - One-way fares with little or no product differentiation, priced at different fare levels
  - Existing RM systems employed to control number of seats sold at each fare level

- **But RM systems were developed for restricted fares**
  - Assumed independent fare class demands, because restrictions kept full-fare passengers from buying lower fares
  - Time series forecasting models used to predict future demand based on historical bookings in each fare class
  - Given independent demand forecasts, top-down protection for highest classes, extra seats made available to lowest class
Revenue Impacts of Fare Simplification with Traditional RM Models

- Fully Restricted: -0.5%
- Remove AP: -16.8%
- Remove Sat Night Min Stay: -29.6%
- Remove All Restr, Keep AP: -45%
- Remove All Restr and AP: -45%
Traditional RM Models “Spiral Down” without Product Differentiation

- Fully Restricted: 81.6
- Remove AP: 87.8
- Remove Sat Night Min Stay: 79.8
- Remove All Restr, Keep AP: 82.7
- Remove All Restr and AP: 88.1

Legend:
- FC 6
- FC 5
- FC 4
- FC 3
- FC 2
- FC 1
Existing Airline RM Systems Need to be Modified for Changing Fare Structures

- Without modification, these RM systems will not maximize revenues in less restricted fare structures
  - Unless demand forecasts are adjusted to reflect potential sell-up, high-fare demand will be consistently under-forecast
  - Optimizer then under-protects, allowing more “spiral down”

- Current RM system limitations are negatively affecting airline revenues
  - Existing systems, left unadjusted, generate high load factors but do not increase yields
  - Many legacy carriers are using “rule-based” RM practices

- RM forecasting models must be changed to reflect passenger willingness to pay (WTP)
Forecasting by Willingness to Pay

- With undifferentiated fares, forecasting must focus on demand by willingness to pay higher fares
  - Approach is to “transform” all historical bookings at different fares to maximum demand potential at lowest fare
- Total demand potential at lowest fare converted to demand forecasts by fare level for future flights
  - Based on estimates of sell-up potential/WTP
- But, most simplified fare structures still retain some product differentiation
  - Lowest fares can have more several cancel/change restrictions
  - Higher fares can offer full flexibility and additional amenities
Hybrid Forecasting For Partially Differentiated Fare Structures

• Generate separate forecasts for price ("priceable") and product ("yieldable") oriented demand
  - A passenger is *price-oriented* if the next lower class from the one booked is closed
  - A passenger is *product-oriented* if the next lower class from the one booked was open.

• Combine standard forecasts and WTP forecasts for input to RM optimizers
  - For product-oriented demand, bookings are treated as a historical data for the given class, and standard time series forecasting applied.
  - For price-oriented demand, forecasts by WTP based on expected sell-up behavior
PODS Simulations in Network D

- **Simplified Fare Structure**
  - 6 fare classes
  - Compressed fare ratio of 4.1
- **2 competing hub airlines**
  - 40 Spoke Cities
  - 252 legs
  - 482 OD markets

<table>
<thead>
<tr>
<th>Class</th>
<th>AP</th>
<th>Min Stay</th>
<th>Chg Fee</th>
<th>Non Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
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<td>3</td>
<td>7</td>
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<td>14</td>
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<td>5</td>
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<tr>
<td>6</td>
<td>21</td>
<td>0</td>
<td>1</td>
<td>1</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Class</th>
<th>Average Fare</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>412.85</td>
</tr>
<tr>
<td>2</td>
<td>293.34</td>
</tr>
<tr>
<td>3</td>
<td>179.01</td>
</tr>
<tr>
<td>4</td>
<td>153.03</td>
</tr>
<tr>
<td>5</td>
<td>127.05</td>
</tr>
<tr>
<td>6</td>
<td>101.06</td>
</tr>
</tbody>
</table>
PODS “Network D”

Traffic Flows
Baseline Results: Standard RM Models

- Standard pickup (moving average) forecaster, booking curve unconstraining and EMSRb optimizer
- Revenue is $1,124,782 ; Yield is $0.1061
- Load factor is 86.45%
Spiral Down is Evident in Standard Forecasts

**Forecast + Bookings by Fare Class**

*Very High Initial Forecasts in Classes 5 + 6*
Airline 1 Implements Hybrid Forecasting

<table>
<thead>
<tr>
<th></th>
<th>Airline 1</th>
<th>(\Delta) from Trad RM</th>
<th>Airline 2</th>
<th>(\Delta) from Trad RM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
<td>$1,163,408</td>
<td>+ 3.4%</td>
<td>$1,118,299</td>
<td>- 0.2%</td>
</tr>
<tr>
<td>Yield</td>
<td>$0.1107</td>
<td>+ $0.005</td>
<td>$0.1016</td>
<td>- $0.001</td>
</tr>
<tr>
<td>Loads</td>
<td>85.70%</td>
<td>- 0.75</td>
<td>86.40%</td>
<td>+ 0.26</td>
</tr>
</tbody>
</table>

Loads by Fare Class

![Bar chart showing loads by fare class for Airline 1 and Airline 2, with Hybrid and Standard categories.]
Both Competitors Use Hybrid Forecasting

<table>
<thead>
<tr>
<th></th>
<th>Airline 1</th>
<th>Δ from Trad RM</th>
<th>Airline 2</th>
<th>Δ from Trad RM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
<td>$1,158,167</td>
<td>+ 2.97%</td>
<td>$1,152,222</td>
<td>+ 3.03%</td>
</tr>
<tr>
<td>Yield</td>
<td>$0.1098</td>
<td>+ $0.004</td>
<td>$0.1055</td>
<td>+ $0.004</td>
</tr>
<tr>
<td>Loads</td>
<td>85.95%</td>
<td>- 0.5</td>
<td>85.72%</td>
<td>- 0.68</td>
</tr>
</tbody>
</table>

Loads by Fare Class

- Hybrid
- Standard
WTP Approach Brings Forecasts Back into Line

Forecast + Bookings by Fare Class

Higher Forecasts, Classes 1-3
Distorted Forecasts Affect RM Performance

- Spiral-down leads to high forecasts in lower classes
  - And, in turn, forecasts that are too low in higher classes
- In EMSR-based leg RM, at least the lowest class demand is rejected when demand is high
  - Not revenue maximizing, but some benefit from booking limits
- Recent PODS simulations illustrate impacts of distorted forecasts on O+D method performance:
  - Mismatch between independent path/class demands assumed by network optimizer and reality of passenger sell-up
  - Network optimizers over-protect for forecast low-class connecting traffic, leading to distorted bid prices or displacement costs
Impacts on O+D Revenue Gains Under Simplified Fare Structure

- Revenue performance of O+D methods is affected:
  - Standard forecasting assumes path/class independence
  - Incorrect forecasts fed into network optimizers (LP, ProBP)
  - Network optimization methods more affected than Heuristic BP

![Revenue Gain over EMSRb Graph]

- DAVN: 0.74%
- PRO BP: 0.43%
- H BP: 1.93%
All RM Methods Benefit From Hybrid Forecasting

- Use of Hybrid Forecasting with WTP component improves RM revenue gains by 2-4%
- O+D RM Methods once again outperform EMSRb leg controls by 1% or more

Revenue Gain over EMSRb

<table>
<thead>
<tr>
<th>Method</th>
<th>Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMSRb</td>
<td>2.6%</td>
</tr>
<tr>
<td>DAVN</td>
<td>3.3%</td>
</tr>
<tr>
<td>ProBP</td>
<td>2.9%</td>
</tr>
<tr>
<td>H BP</td>
<td>1.7%</td>
</tr>
</tbody>
</table>

0.74% 0.43% 1.93%
Simulations in Larger Network R
4 Competitors with 4 Hubs

• All methods benefit from Hybrid Forecasting
  ▪ ProBP again is most affected by simplified fare structure, but benefits most from use of Hybrid Forecasts based on WTP

<table>
<thead>
<tr>
<th></th>
<th>EMSRb</th>
<th>DAVN</th>
<th>ProBP</th>
<th>H BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue Gain over EMSRb (%)</td>
<td>1.3%</td>
<td>1.51%</td>
<td>2.3%</td>
<td>1.9%</td>
</tr>
</tbody>
</table>

- EMSRb: 1.3%
- DAVN: 0.8%
- ProBP: 0.65%
- H BP: 0.44%
Existing RM Forecasts Are Inadequate for Simplified Fare Structures

- Existing RM systems need to be modified
  - Mismatch between RM model assumptions and fare structures

- Price/product hybrid forecasting increases revenues
  - Compared to use of standard RM forecasting methods
  - Gains come from higher forecasts in upper/middle classes, increasing protection and helping to reduce “spiral down”

- Modified forecasters require estimates of passenger WTP by time to departure for each flight
  - Approach is to forecast maximum demand potential at lowest fare, and convert into “partitioned” forecasts for each fare class

- But, WTP forecasting is much more difficult…
Standard RM Forecasts Assume Independent Demands by Class

Demand observable in each DCP in any fare class

• Product-oriented demand observed for any open class by DCP
Forecasts of Demand to Come by Class Used as Inputs by Optimizer

- Demand to come by class assumed to be independent of what classes are open or closed.
Price-Oriented Demand for Undifferentiated Fares

- On a single flight departure, bookings in each class observed only when lower class was closed down.
Sample of Price-Oriented Demand over Multiple Departures

- With information about class closures and observed bookings, we can estimate WTP and sell-up
- But we can’t estimate what we’ve never seen!
Factors Affecting WTP Estimates

• **Time to departure**
  - Business travelers with higher WTP book closer to departure date

• **Peak vs. off-peak periods**
  - Higher demand periods tend to have higher WTP

• **Market characteristics**
  - Limited competition and low capacity (relative to demand) means a higher WTP among consumers

• **RM seat availability – your own and your competitors’**
  - Weak RM controls on previous flights mean historical bookings don’t reflect higher WTP of consumers
  - High availability of low-fare seats on competitor makes it difficult (impossible) to observe high-fare bookings
Willingness to Pay Relative to Lowest Fare Changes over the Booking Process
WTP Estimates are Critical to Effective RM under Simplified Fares

- Nothing simple about RM models required by these simplified fare structures
  - Traditional RM methods do not maximize revenues
  - Without forecasting modifications, even O+D control gains are affected

- New approaches to “hybrid” forecasting of price- vs. product-oriented demand show good potential
  - Significant revenue gains over standard forecasting methods

- Recent PODS research shows potential for conditional WTP estimates:
  - Requires separate estimation of WTP for each scenario of class closure, for own airline and potentially competitor(s)