The Effect of airport parking fees on the tourist’s airport / airline choice behavior

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Common work with:
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Agenda

- Introduction
- Literature Review in Airport/ Airline Choice Behavior
- Choice Experiment and Data
- Model Specification and Results
- Conclusions
Introduction

• 2 major reasons for the Analysis of Airline/ Airport Choices
  • Airport Competition
  • Airport Regulation

• Main Approach: Substitution between travel time to the airport and cost of flying
Main Approach

For individual $t$: \[ U_{it} > U_{jt} \Rightarrow i \succ j, \forall j \in J. \]

Probabilistic model: \[ U_{it} = V_{it} + \epsilon_{it} \]

Assuming iid and extrem valued distributed derives the well known MNL choice probabilities

\[ P(i) = \frac{e^{V_i}}{\sum_j e^{V_j}} \]
Introduction

Additional modeling approaches:

• Nested Logit: Grouping alternatives

• Mixed Logit: a flexible parametric form; allows for flexible substitution patterns; relaxes the assumption of independently distributed error terms:

  Two different specifications of mixed logit

a) Random coefficient model

\[ p_{i,t} = \int \left( \frac{e^{V_{i,t}}}{\sum_i e^{V_{i,t}}} \right) f(\beta | \omega) \, d\beta \]

b) Error component model

Both are equivalent (Train, 2009)
Two Findings:
- Mainly: MNL and NL Specifications
- No consideration of parking charges

Main results
- Main variables: access time, flight cost, flight frequency, departure time, direct flight, inertia
- Business travelers more time sensitive
- Leisure travelers more cost sensitive
Choice Experiment and Data

- Stated choice experiment
- Flying for touristic reasons
- Multiairport area: Berlin/ Leipzig / Dresden
- 600 observations
- Sociodemogr. Data
- Distance to the airport: Zip Code
- Orthogonal Design
- All other attributes affecting choices: Identical

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flight cost</td>
<td>210-500 Euro</td>
</tr>
<tr>
<td>Parking cost</td>
<td>25-115 Euro</td>
</tr>
<tr>
<td>Direct flight</td>
<td>Yes, No</td>
</tr>
<tr>
<td>Mile bonus</td>
<td>200-4000 Miles</td>
</tr>
<tr>
<td>Parking period</td>
<td>7 or 14 days</td>
</tr>
</tbody>
</table>
Model Specifications

- random coefficients model:
  \[ U_{ni} = V_{ni}^* + \varepsilon_{ni} = \beta' x_{ni} + \varepsilon_{ni} \]

- Deterministic part:
  \[ V_{ni}^* = ASC_i + \beta_{RANDOM Distance} * Distance_{ni} + \beta_{Cost} * Cost + \beta_{Parking} * Parking_{ni} + \beta_{Direct flight} * Direct flight_{ni} + \beta_{Miles} * Miles_{ni} + \beta_{Duration} * Duration_{ni} + \beta_{i,Age} * Age_n + \beta_{i,Sex} * Sex_n + \beta_{i,Income} * Income_n + \beta_{i,Occupation} * Occupation_n + \beta_{i,Education} * Education_n \]

- Test of normal- and Lognormal distribution
Model Specifications

- Error component model (similar to panel data models in regression analysis)
  One additional error component per airport alternative
  \[ U_{nid} = V_{nid} + \varepsilon_{nid} + E_{Cni} \]

- Deterministic part:
  \[ V_{nid} = ASC_i + \beta_{Distance} * Distance_{nid} + \beta_{Cost} * Cost_{nid} + \beta_{Parking} * Parking_{nid} + \beta_{Direct\ flight} * Direct\ flight_{nid} + \beta_{Miles} * Miles_{nid} + \beta_{Duration} * Duration_{nid} + \beta_{i,\ Age} * Age_{nd} + \beta_{i,\ Sex} * Sex_{nd} + \beta_{i,\ Income} * Income_{nd} + \beta_{i,\ Occupation} * Occupation_{nd} + \beta_{Education} * Education_{nd} \]

- Additional error component:
  \[ E_{Cni} = \sigma_{ni} * Random\ variable_{ni} \]
Results

- **Random Coefficients Model – selected results**

  - Normal and Lognormal distributions lead to very similar results
  
  - $\beta_{Distanz\_Random} \sim N(-0.0209, 0.0114^2)$
  
  - $\ln(\beta)_{Distanz\_Random} \sim N(-0.0209, 0.0109^2)$
  
  - 96% of the values with negative sign
## Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parameter</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Null Log-Likelihood</td>
<td>-659.167</td>
<td>-659.167</td>
</tr>
<tr>
<td>Final Log-Likelihood</td>
<td>-389.205</td>
<td>-371.426</td>
</tr>
<tr>
<td>LR Test</td>
<td>539.924</td>
<td>575.484</td>
</tr>
<tr>
<td>Pseudo-R²</td>
<td>0.410</td>
<td>0.437</td>
</tr>
</tbody>
</table>

### Variable

<table>
<thead>
<tr>
<th>Variable</th>
<th>Random Coefficient</th>
<th>Error Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flight cost</td>
<td>-0.0312***</td>
<td>-0.0352***</td>
</tr>
<tr>
<td>Direct flight</td>
<td>2.64***</td>
<td>2.79***</td>
</tr>
<tr>
<td>Parking fees</td>
<td>-0.0322***</td>
<td>-0.0349***</td>
</tr>
<tr>
<td>Distance to airport</td>
<td>-0.0228***</td>
<td>-0.0241***</td>
</tr>
<tr>
<td>Distance_standard dev.</td>
<td>0.0110***</td>
<td></td>
</tr>
<tr>
<td>Error Component Dresden</td>
<td></td>
<td>0.858***</td>
</tr>
<tr>
<td>Error Component Berlin</td>
<td></td>
<td>1.90***</td>
</tr>
</tbody>
</table>
## Results

<table>
<thead>
<tr>
<th></th>
<th>Random Coefficient</th>
<th>Error Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>VTTS</td>
<td>73.00 Euro/h</td>
<td>68 Euro/h</td>
</tr>
<tr>
<td>WTP for a direct flight</td>
<td>84.62 Euro</td>
<td>79.26 Euro</td>
</tr>
</tbody>
</table>

Elasticities: 

\[ E_{X_{ikn}}^{P_{in}} = -\beta_{ik} * X_{ikn} * (1 - P_{in}) \]

Example for Alternative Dresden/Air Berlin

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance</td>
<td>-1.06</td>
<td>-1.10</td>
</tr>
<tr>
<td>Flight cost</td>
<td>-6.06</td>
<td>-8.41</td>
</tr>
<tr>
<td>Parking fees</td>
<td>-1.46</td>
<td>-1.58</td>
</tr>
<tr>
<td>Direct flight (Marginal Effect)</td>
<td>-1.769</td>
<td>-1.874</td>
</tr>
</tbody>
</table>
Conclusions

- **Summary**

  - Decision relevant alternative attributes:
    - distance ( ), flight cost ( ),
    - parking fees( ), direct flight (+)
  - Heterogeneity in preferences
  - Error Component Model performs best
  - Holiday travelers are strongly cost sensitive

Parts of these results are confirmed in literature (in particular Hess/Polak, 2009)
Conclusions

Additional dimensions

Airline Revenue Management should take into account

a) The individual valuation of Point-to-point vs. via connections

b) VTTS, in particular in multiairport areas

Management of parking spaces at airports should take into account the parking price elasticity
Thank you for attention