



# ***USING DISCRETE CHOICE MODELS TO TEST THE IMPACT OF ENVIRONMENTAL AIRPORT CHARGES***

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“Airports and the Environment – How to  
balance economic and environmental  
concerns”  
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- Significance of environmental aspects
- Also in air transport
  - emission trading
  - airport charges (Noise, Emissions)
  - further regulations

But:

Do environmental related airport charges have  
the desired effects?

## Brueckner/ Girvin (2007): Noise Abatement

- Noise Taxes equivalent to cumulative Noise Caps
- Relevance of Fares, Frequencies and Aircraft Size

## Brueckner/ Zhang (2009): Emission Charges lead to:

- Higher Fares
- Lower Frequency
- Use of Enhanced environmentally friendly Aircrafts
- Higher Load Factors

## Changes of Choice Probability for a certain Aircraft Type by a certain Carrier

### –Airline Characteristics

- Aircraft Fleet, Destinations served, Passengers carried, Frequency

### –Aircraft Characteristics

- Size, Weight, Capacity, Range

Carriers maximize (short to medium run) Profits by using a certain Aircraft Type

$$\pi = R - C = \sum_k \beta_{jk} z_{njc}$$

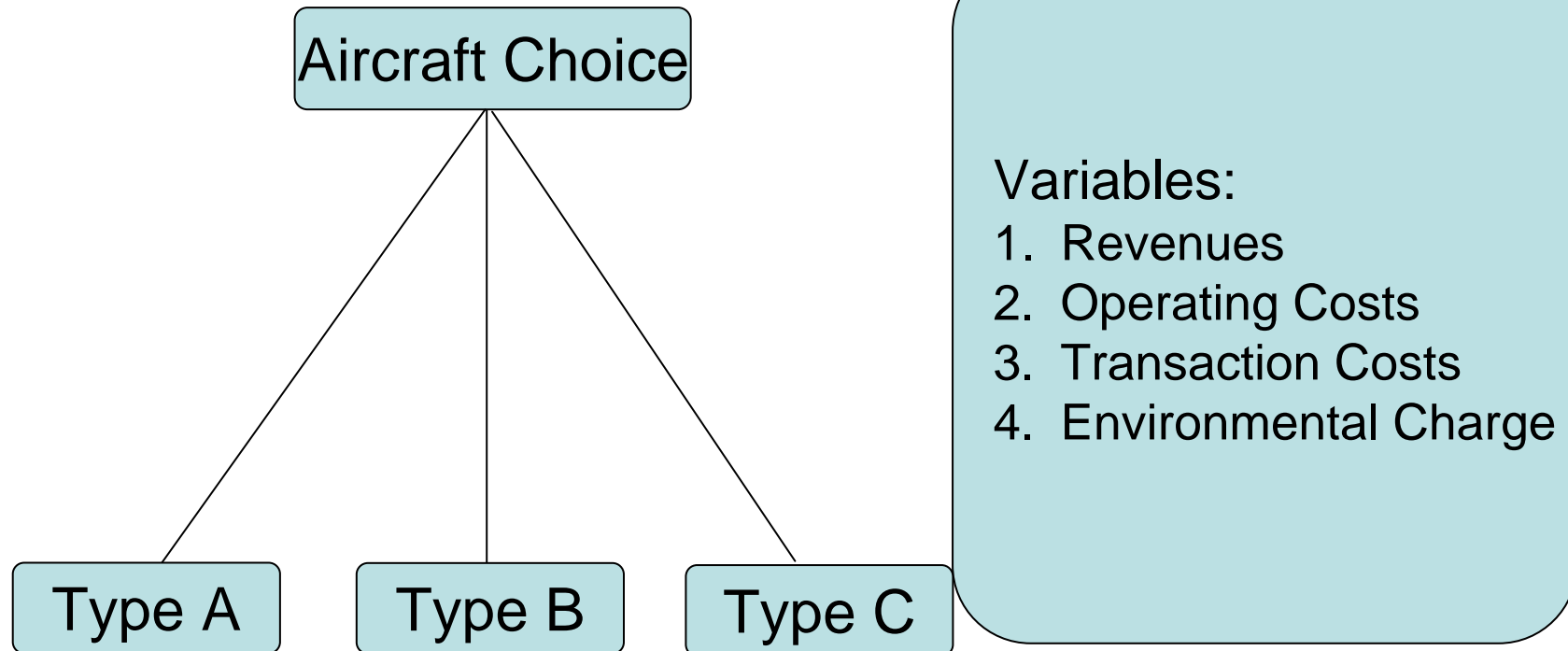


- Revenues
  - Number of Passengers per Ton MTOW
- Costs
  - Operating Costs (Distance x Weight)
  - Environmental Charge per Passenger
  - Rescheduling Costs (Transaction Costs: Network Size X Aircraft Weight)
- Choice Probability for Carrier n to choose Aircraft Type i:

$$P_{ni} = \frac{e^{\pi_{ni}}}{\sum_j e^{\pi_{nj}}}$$

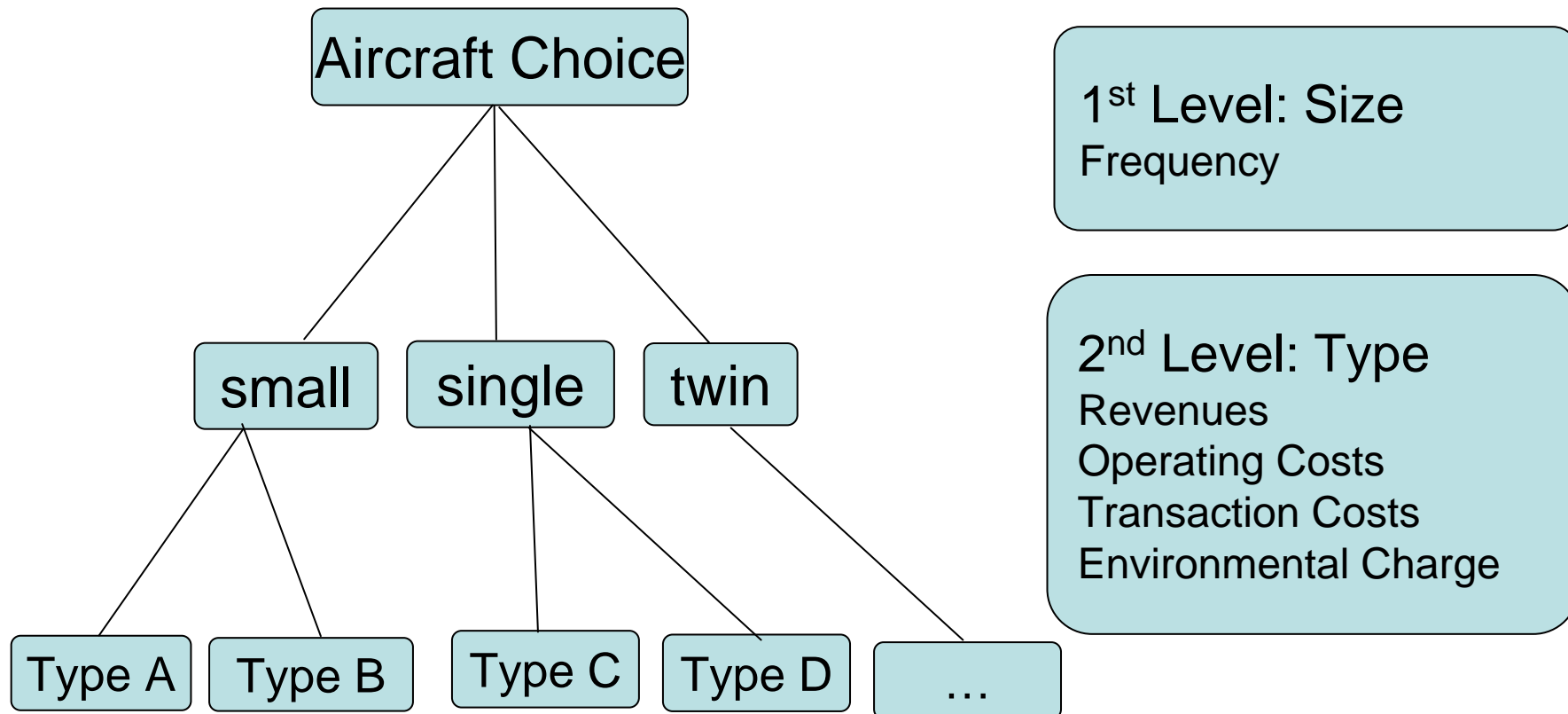


- Choice Structure: single MNL





- Choice Structure: Nested Logit



- Airport Zurich
  - Sample: 90,000 take-offs and landings
    - Consideration of Pairing of Flights
    - Clearing of private Jets, etc.
    - Identification of Carrier from Flight Schedules
  - Final Sample: 8,600 take-offs
  - Totally 27 Alternatives (Aircraft Types)
  - Fixing of the largest Alternative at zero (Boeing 777)

- **Results: Single MNL**

<b>Variable</b>	<b>Parameter</b>	<b>( t-value)</b>
ASC B 747 – 400*	-4,340**	(-9.01)
Revenues	-3,640**	(-42.46)
Operating Costs	0.008**	(25.65)
Transaction Costs	-0.0005**	(-4.59)
Noise Charge	-0.030	(-0.51)
Init. Log Likelihood		-20,749.249
Final Log Likelihood		-10,170.645
R-Square (Adj.)		0.508

\* Representative for all Aircraft Types in the Sample

\*\* Significance at the 95% confidence level

- Results: Nested Logit

Variable	Parameter	( t-value)
ASC F100*	-0.647	(-0.72)
<b>Aircraft Size related Variables</b>		
Frequency	-0.001**	(-13.02)
<b>Aircraft Type related Variables</b>		
Revenues	-3,480**	(-39.92)
Operating Costs	0.007**	(12.77)
Transaction Costs	-0.001**	(-14.87)
Noise Charge	-0.140	(0.00)
Init. Log Likelihood		-20,749.249
Final Log Likelihood		-10,562.511
R-Square (Adj.)		0.489

\* Representative for all Aircraft Types in the Sample

\*\* Significance at the 95% confidence level

- No Effect of Noise Charges to Aircraft Choice Probability

Leads to political economic considerations

- Diametrically opposed positions of involved parties
  - Airports
  - Citizens
  - Air Carriers
  - Regulators/ Politicians
- Political Equilibrium depending on the balance of the political power



***THANK YOU FOR YOUR ATTENTION!***

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