Environmental Aspects of Aviation Charges

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Overview

1. Introduction

2. Short theoretical background

3. Legal background

4. Orientation of noise charges

5. Future developments
Short theoretical background
Marginal Social Cost and Marginal-Cost Pricing

- At q*, marginal social cost exceeds the price paid by consumers. Output is too high. Market price takes into account only part of the full cost of producing the good.
Social / external cost of noise at airports

- Bigger problem at night than at daytime
- Indicator: real estate / housing prices → internalization?
- Prices for windows, ... → internalization is done!
- Price for quality of life?
Internalizing Externalities

- A **tax** per unit equal to $MDC$ is imposed on the firm. The firm will weigh the tax, and thus the damage costs, in its decisions. Instead of the tax any other kind of **surcharge**.
Noise emission measurement – Calculation of potential internalization

- Noise emissions for a given airport is a function of:
  - Number of people exposed to aircraft noise
  - Number of properties affected by the aircraft noise
  - Number of scheduled flights from and to an airport and
  - Type of Aircraft

- Intention: Raising funds for noise protection measures and
- act as an incentive for airlines to use modern and less noisy aircraft.
Noise awareness and medical research

Changes over the years:

Aviation noise decreases – noise awareness increases!
  → inverse reaction

High awareness of aircraft noise in the population
  → not only in the neighborhood of airports

Noise awareness and prices for houses / real estates

In noise related medical research often a problem of the sample

No help of medical research if it’s better to have
  - less movements with bigger / noisier aircrafts
  - more movements with smaller / less noisy aircrafts
Legal background: Noise emission measurement

- ICAO Annex Chapter 16 regulates noise standards for aircraft:
  - Chapter 1 and 2 define AC to be banned from active service
  - Chapter 3 covers AC licensed between 1978 and 2006
  - Chapter 4 encompasses AC licensed after 2006

- EU Commission directive 2202/C 103 E/16 from 2002 defines noise charge as a levy by the airport:
  - 1. **Fixed charges**: *compensation* for noise emitted by an AC
  - 2. **Variable charges**: amount should provide an *incentive* to switch to less noisy AC, the more noise an aircraft emits, the higher the charge

Cost orientation of charges
Proposal of noise charges by the EU COM

- The European Commission promotes a formula for calculating airplanes noise charges:
  - Fixed term being used by the airports to provide compensation
  - Variable term designed to urge airlines to switch to less noisy AC

Promoted Calculation of noise charge by EC:

\[ C = Ca \cdot 10^{[(La - Ta)/10]} + Cd \cdot 10^{[(Ld - Td)/10]} \]

- \( Ca/Cd \) = unit noise charge for arrival / departure
- \( La \) = certified noise level at approach
- \( Ld \) = certified noise level at flyover and lateral
- \( Ta \) = threshold at arrivals corresponding to the category of a relatively quiet aircraft for this airport
- \( Td \) = idem for departure
- \( Ca \) and / or \( Cd \) can be 0

- The total noise charge is calculated for arrival as well as for departure.
Orientation of noise charges
Political Concepts for Traffic-Noise-Reduction
Noise-abatement-measures and Effected Spheres

- Noise-related measures
  - noise surcharges
  - noise budget restrictions
  - aircraft related noise-level-limitations

- Operational measures
  - curfews
  - operating quotas
  - frequency capping
  - aircraft size steering
  - airport cooperation for noise reduction
  - administrative traffic-steering
  - modal-split-steering

- Preliminary procedures and measures for decision, implementation and enforcement of noise-reduction measures
  - Mediation
  - Incentives for providers
  - Individual prosecution of noise-violations

- Measures directed to increase the noise-acceptance and to reduce the exposure to noise
  - Incentives for noise-exposed population
  - real-estate- and land-use-policy

Affected Spheres:
Ecology  Traffic  Economy
Impact of Noise Charges - Airport View

- Revenues
- Competitive position
- Airport model
  - Hub
  - Freight percentage
  - LCC
- Establishment of a noise measuring system
Impact of Noise Charges - Airline View

- Switching cost
  - between different aircraft types
  - between airports
- Reallocation of cost
- Possible reactions
- Airline model
- Airline flexibility
  - Rate of fleet change
  - New fees are faster than new aircraft
Choice of airports

• Only 7 German airports have noise oriented classes
• The others: certification oriented according ICAO, than MTOW
• Since 2006 ICAO chapter 4
  – The big majority already now
  – All new certified a/c have to fulfill it
  – Nearly no incentive for airlines to switch
• German Bonusliste
  – Introduced before chapter 4 ICAO
  – Introduced to differentiate ch. 3
  – Taken i.a. for night curfews
Differenz, Lärmgrenzwerte zu zertifizierten Lärmpegeln

**Voraussetzung:**
- mind. 2 dB an der Summe zweier Meßpunkte,
- keine negativen margins an einem Meßpunkt

(Kumulativ: Start, Seitenlinie, Landung), [ EPNdB]
Example: fees and charges

B 747-400; bonuslist aircraft; MTOW 395 t; max. 390 seats; with 280 passengers on board; intercont. traffic; airport FRA

until the end of 2000 no night-supplement in FRA!
No noise fee implementation on German Airports for the 7 airports

<table>
<thead>
<tr>
<th>ICAO Chapters</th>
<th>Airport Noise Categories</th>
<th>Separate Noise Fee</th>
<th>Daytime Distinction</th>
<th>Other Noise Fee</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRA</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>2008</td>
<td></td>
</tr>
<tr>
<td>HAM</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>2008</td>
<td></td>
</tr>
<tr>
<td>HAJ</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>separate noise fee only at night (2008)</td>
<td></td>
</tr>
<tr>
<td>SXF</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>2007 Daytime distinction only from cat 5 up</td>
<td></td>
</tr>
<tr>
<td>TXL</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>2007</td>
<td></td>
</tr>
<tr>
<td>DUS</td>
<td>X</td>
<td>(X)</td>
<td>X</td>
<td>2008 Daytime distinction only for non chapter 3 aircraft</td>
<td></td>
</tr>
<tr>
<td>MUC</td>
<td>X</td>
<td></td>
<td>X</td>
<td>2006</td>
<td></td>
</tr>
<tr>
<td>CGN</td>
<td>X</td>
<td></td>
<td>X</td>
<td>2008</td>
<td></td>
</tr>
<tr>
<td>STR</td>
<td>X</td>
<td></td>
<td></td>
<td>2007</td>
<td></td>
</tr>
</tbody>
</table>
The Role of Noise Fees in Relation to Total Landing Fees

Proportion of noise fee in relation to total landing fee (day) in %

- B737-700
- A320
- B777-200LR
- A340-500

Proportion of noise fee in relation to total landing fee (night) in %

- B737-700
- A320
- B777-200LR
- A340-500
Noise Fees at German Airports - Comparison

Cost and savings in relation to aircraft type

Deviation of noise charges in comparison to B747-400 (day)

Deviation of noise charges in comparison to B747-400 (night)
Noise Fees at German Airports - Comparison

Cost and savings in relation to aircraft type

**Deviation of noise charges in comparison to B737-800 (day)**

- FRA
- MUC
- TKL
- HAM

**Deviation of noise charges in comparison to B737-800 (night)**

- FRA
- MUC
- TKL
- HAM

- 320-200
- 757-300
Noise charges in Europe, short comparison

- Noise charges for the A380 and the B747 vary quite considerably between airports due to different formulas for calculation and different variables being used.

- MAD, OSL and LIS no noise charge system in force.

- Two different types of calculation are used as basis of calculation:
  - MTOW ICAO Annex 16: CDG, LHR and CIA
  - Combination of different aircraft noise levels (APNL, TONL, SLNL): ARN, FRA, AMS and HEL
Noise emission measurement – Calculation

- ICAO Annex 16 Chapter 4 provides a list of noise emissions of different aircraft in relation to their Maximum take-off weight (MTOW).

Example Airbus 380-800 and Boeing 747-400:

<table>
<thead>
<tr>
<th>Type of Aircraft</th>
<th>MTOW in t</th>
<th>Number of Engines</th>
<th>Noise level according to ICAO-Annex 16 in EPNdB (Effective Perceived Noise Level)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Take-off</td>
</tr>
<tr>
<td>A380-800</td>
<td>560</td>
<td>4</td>
<td>93.7</td>
</tr>
<tr>
<td>B747-400</td>
<td>386</td>
<td>4</td>
<td>99.0</td>
</tr>
</tbody>
</table>
# Noise charges in depth – Final Results

- MTOW ICAO Annex 16:

<table>
<thead>
<tr>
<th>Airport</th>
<th>A380 in €</th>
<th>B747 in €</th>
<th>Basis of Calculation</th>
<th>Appraisal</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDG (daytime)</td>
<td>69.90</td>
<td>68.30</td>
<td>MTOW ICAO</td>
<td>+</td>
</tr>
<tr>
<td>CIA</td>
<td>47.95</td>
<td>32.43</td>
<td>MTOW</td>
<td>-</td>
</tr>
<tr>
<td>LHR</td>
<td>688.43</td>
<td>688.43</td>
<td>MTOW ICAO (mod.)</td>
<td>-</td>
</tr>
</tbody>
</table>
Noise charges in depth – Final Results

- Combination of different aircraft noise levels during take-off and landing leads to a more sophisticated noise charging scheme:

<table>
<thead>
<tr>
<th>Airport</th>
<th>A380 in €</th>
<th>B747 in €</th>
<th>Basis of Calculation</th>
<th>Appraisal</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARN</td>
<td>38.51</td>
<td>64.75</td>
<td>APNL, TONL, SLNL</td>
<td>+</td>
</tr>
<tr>
<td>FRA (daytime)</td>
<td>75.00</td>
<td>270.00</td>
<td>APNL, TONL, SLNL</td>
<td>+</td>
</tr>
<tr>
<td>HEL</td>
<td>49.92</td>
<td>167.87</td>
<td>TONL, SLNL</td>
<td>+</td>
</tr>
<tr>
<td>AMS (daytime)</td>
<td>198.42</td>
<td>559.11</td>
<td>APNL, TONL, SLNL and MTOW</td>
<td>++</td>
</tr>
</tbody>
</table>
Future developments on noise charges I

- Further research needed
  - If an equilibrium of the stakeholders is possible
  - If there can be a solution
    - If it’s better to have less but louder flights
    - Or if it’s better to have more movements
  - But this relevant only with enough capacity
- Orientation towards certified noise level (as with the EU COM) is not effective
  - Big difference for one aircraft according weight
Future developments on noise charges II

• In FRA (and others) an average over the year
  – Is it fair for different kinds of airlines / flights?

• Optimization:
  – Is it optimal to calculate dB(A) per flight?
    • Influence of weather, DFS, technical reasons
  – Proposal:
    • (Further) differentiation landing / starting fee
    • yearly average per airline
    • Per flight calculation including the actual weight

• Effectiveness control is needed!
  – Any differences between the airports in noise development?
  – Controlling of strategies should be “normal”
  – Noise forecasts are required for new investment – are they in any way strategy related?
    • Reasons for changes for changes of strategies though no results
    • Reasons for result without a change of strategy
Future developments beyond noise charges

- Since about November 2006 emissions became more important than noise – at least in general
- In the surrounding of an airport noise remains more important
- Air quality at the airport is still better than in city areas
- Air pollution is more a problem of high altitudes
- However first airports started to introduce an emission oriented surcharge on the landing fee
- Orientation of the fee on NOx, not on CO₂
- The introduction is intended to be cost neutral
- Forerunners FRA and MUC, CGN following
Thank you for your attention!

Time for questions and discussion.