Noise surcharges at German airports and their effects

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Noise surcharges
– their effectiveness and efficiency
– some German and European evidence
Overview

1. Introduction
2. Short theoretical background
3. Legal background
4. Orientation of noise charges
5. Future developments
Some definitions

- (Sur-)Charges
  price for a service, mostly administratively regulated

- Noise
  loud and unpleasant sound, not absolute but depends on perception

- Effectiveness
  ability to bring about the result intended

- Efficiency
  state or quality of being able to perform duties well
## Effectiveness and efficiency

<table>
<thead>
<tr>
<th>Efficiency</th>
<th>Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concerns Cost Saving on Time, Budget or Efforts</td>
<td>Concerns Quality of output</td>
</tr>
<tr>
<td>Skillfulness in avoiding wasted factors</td>
<td>Quality to bring about an effect</td>
</tr>
<tr>
<td>The ‘means’</td>
<td>The ‘ends’</td>
</tr>
<tr>
<td>Measures ratio between input and output</td>
<td>Measures the output and its impact</td>
</tr>
</tbody>
</table>

![Diagram showing the relationship between effectiveness and efficiency with categories such as Wish-list dreamer, Thinking performer, Lifetime liability, and Automated bureaucrat.](image-url)
Short theoretical background – stakeholder oriented

- External cost
- Incentives for a/l
- Communication oriented
- Airline: price elasticity
- Society: cost recovery
- Population: complaints reaction
Social / external cost of noise at airports

- Bigger problem at night than at daytime
- Indicator: real estate / housing prices → internalization?
  → different directions of development
- Prices for windows, ...
  → internalization is done!
- Price for quality of life?
- If these cost are calculated who gets the money?
- What about direct compensation?
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

- External costs 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.
Limits and alternative to external cost calculation

• Limits to the calculation of external costs
  – Calculation of external cost with high subjective influence
  – Compensation of costs is limited
  – Is internalization ineffective?

• Alternative: concentrating on incentives
  – For those being affected by noise
  – For those being responsible for the noise
Incentive based charges

- Incentive for the airlines to reduce noise
- Charge has to be high enough → airline has to react
- Airline has to have choice
  - Either within the same a/c size
  - Or with a change of frequency:
    - 10 x A 320 = 1500 seats
    - 15 x EMB 195 = 1500 seats
    - 7 x B 757 = 1470 seats

- Airline has to reduce flights (esp. at night)
Reduction of flights
Elasticity of demand high enough

2008: charges 8%
→ Noise charges < 2%
→ But: profit-margin also < 2%
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

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
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
  - airport cooperation for noise reduction
  - administrative traffic-steering
  - modal-split-steering
  - aircraft size 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 – Restrictions shall be applied individually

#### Where do airports differ?
- Traffic composition consisting of:
  - Total traffic volume
  - Passenger traffic
  - Cargo traffic
  - Hub- or non-hub-traffic
- Amount of affected people
- Distance to next airport
- Noise measuring system
- Bilateral air service contracts in place

#### How to fine-tune restrictions?
- Global or partial
- With timely effectiveness
- Based on aircraft noise
- Combination of different restrictions possible
- Amount of revenues

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GAP Charges Workshop 23-01-09   H. Ehmer
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
Criteria for effectiveness and efficiency

- Decrease of...
  - Maximum noise levels of single events
  - Continuous noise level (Leq)
  - Noise at certain (critical) times

- Allocative efficiency: internalization of external cost according polluter principle – wealth transfer
- Pareto-efficiency: if the wealth of one stakeholder increases without decreasing the one of other stakeholders
- Administrative intervention (direct regulation):
  - Movement limitation, curfews, quotas, min. aircraft size; limitation of esp. noisy aircraft
- Setting of incentives (indirect regulation):
  - Noise charge, noise quota
## Effectiveness of charges

### Noise charge

<table>
<thead>
<tr>
<th>Effect towards noise</th>
<th>Effect towards stakeholders</th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ No noise effects as yet&lt;sup&gt;1&lt;/sup&gt;</td>
<td>➢ Internalisation of external cost&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>➢ Obvious economic tool for incentivising&lt;sup&gt;2&lt;/sup&gt; and long term fleet optimisation</td>
<td>➢ Did not lead to reduction in movements&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>➢ Individualised treatment of each noise impact possible</td>
<td>➢ Partially leads to technical upgrades and fleet renewal&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>➢ Increase in ticket prices and possibly reduction of service quality&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Restriction not designed well<sup>2</sup>. Incentivising potential unused as yet.<sup>2</sup>

1) Source: Questionnaire
2) Source: Literature
# 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></td>
<td>X</td>
<td></td>
<td>2008</td>
</tr>
<tr>
<td>HAM</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>2008</td>
</tr>
<tr>
<td>HAJ</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>separate noise fee only at night (2008)</td>
</tr>
<tr>
<td>SXF</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>2007 Daytime distinction only from cat 5 up</td>
</tr>
<tr>
<td>TXL</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>2007</td>
</tr>
<tr>
<td>DUS</td>
<td>X</td>
<td>(X)</td>
<td></td>
<td>X</td>
<td>2008 Daytime distinction only for non chapter 3 aircraft</td>
</tr>
<tr>
<td>MUC</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>2006</td>
</tr>
<tr>
<td>CGN</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>2008</td>
</tr>
<tr>
<td>STR</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>2007</td>
</tr>
</tbody>
</table>
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!
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 of aircraft

Cost and savings in relation to aircraft type – related to 747-400

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

- FRA
- MUC
- SKF
- HAM

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

- FRA
- MUC
- SKF
- HAM

330-300
340-600
Noise Fees at German Airports - Comparison of aircraft

Cost and savings in relation to aircraft type – related to 737-800
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 – some 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 – some 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>
Noise charges are often inefficiently established

### Charges in FRA\(^1\)

<table>
<thead>
<tr>
<th>Category</th>
<th>Daytime</th>
<th>Nighttime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise</td>
<td>265</td>
<td>895</td>
</tr>
<tr>
<td>Variable charges</td>
<td>1098</td>
<td>1098</td>
</tr>
<tr>
<td>Security</td>
<td>746</td>
<td>746</td>
</tr>
<tr>
<td>Pax &amp; cargo handling</td>
<td>9072</td>
<td>9072</td>
</tr>
</tbody>
</table>

### Noise classes in AMS\(^2\)

![Graph showing noise classes in AMS](image)

#### Incentive of charges too week to push a fleet adaptation

1. B747-400 mit 396T MTOM, FRA-LAX, departure day at 14:00 CET, departure night at 04:00 CET.
2. EPNdB decrease of Chapter 3: MCC3= -0; A= -5; B= -9; C= < -18

#### Noise classes too wide spread to set right incentives
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 is better
    - to have less but louder flights
    - or to have more movements
  - Relevant only with enough capacity (at night)
- Orientation towards **certified noise** level (as with the EU COM) is **not efficient**
  - Big difference for one single aircraft according weight
    - A 320 FRA – PAR 50% SLF; A 320 FRA – LPA 85% SLF
  - Alternative: more differentiated calculation
  - Example: FRA (and others) an average over the year
    - Is it fair for different kinds of airlines / flights?
    - Weight indirectly included via variable charges
Future developments on noise charges II

- **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 (FRA)
    - Per flight calculation including the actual weight

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

- Since about November 2006 (Stern report) 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

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