

# 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



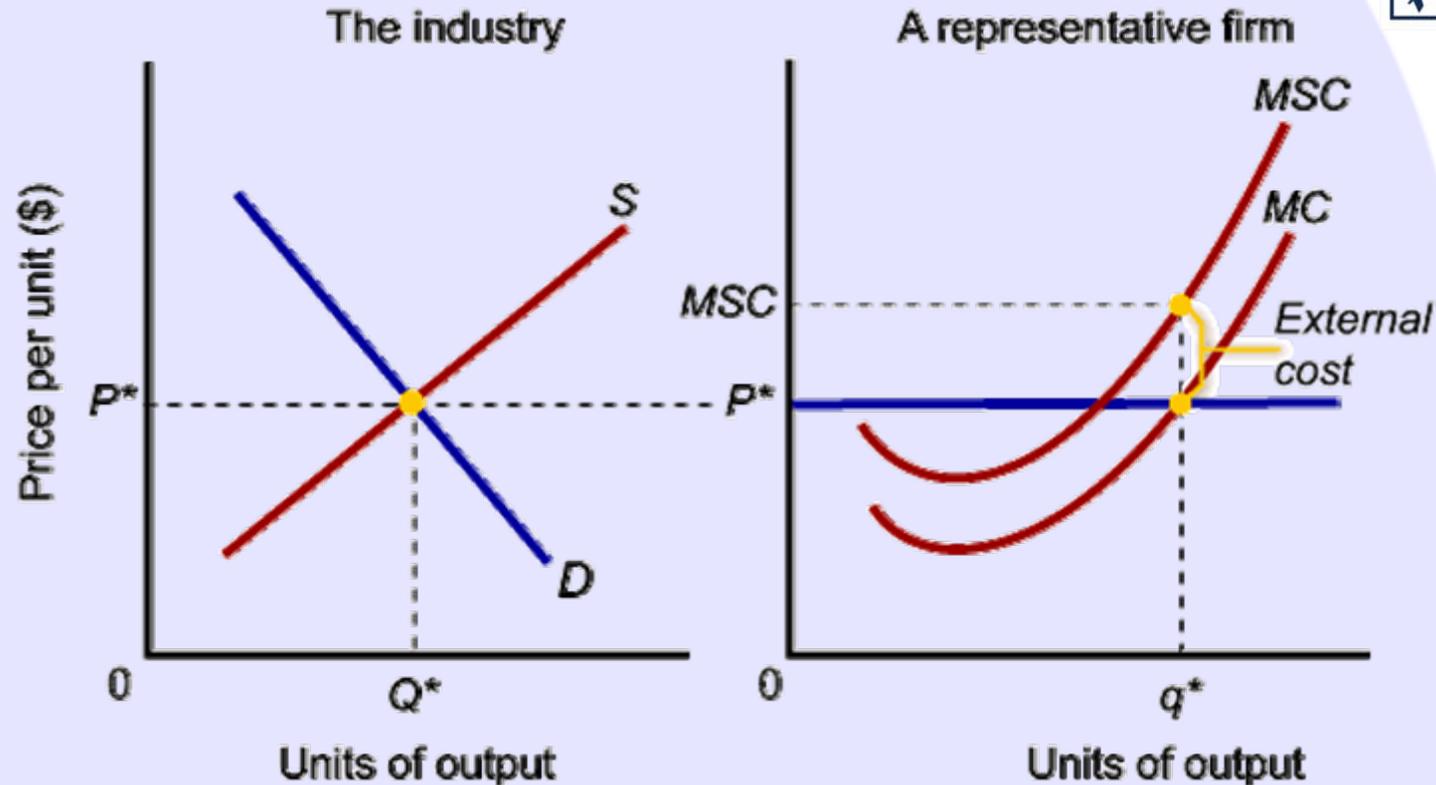
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# Marginal Social Cost and Marginal-Cost Pricing

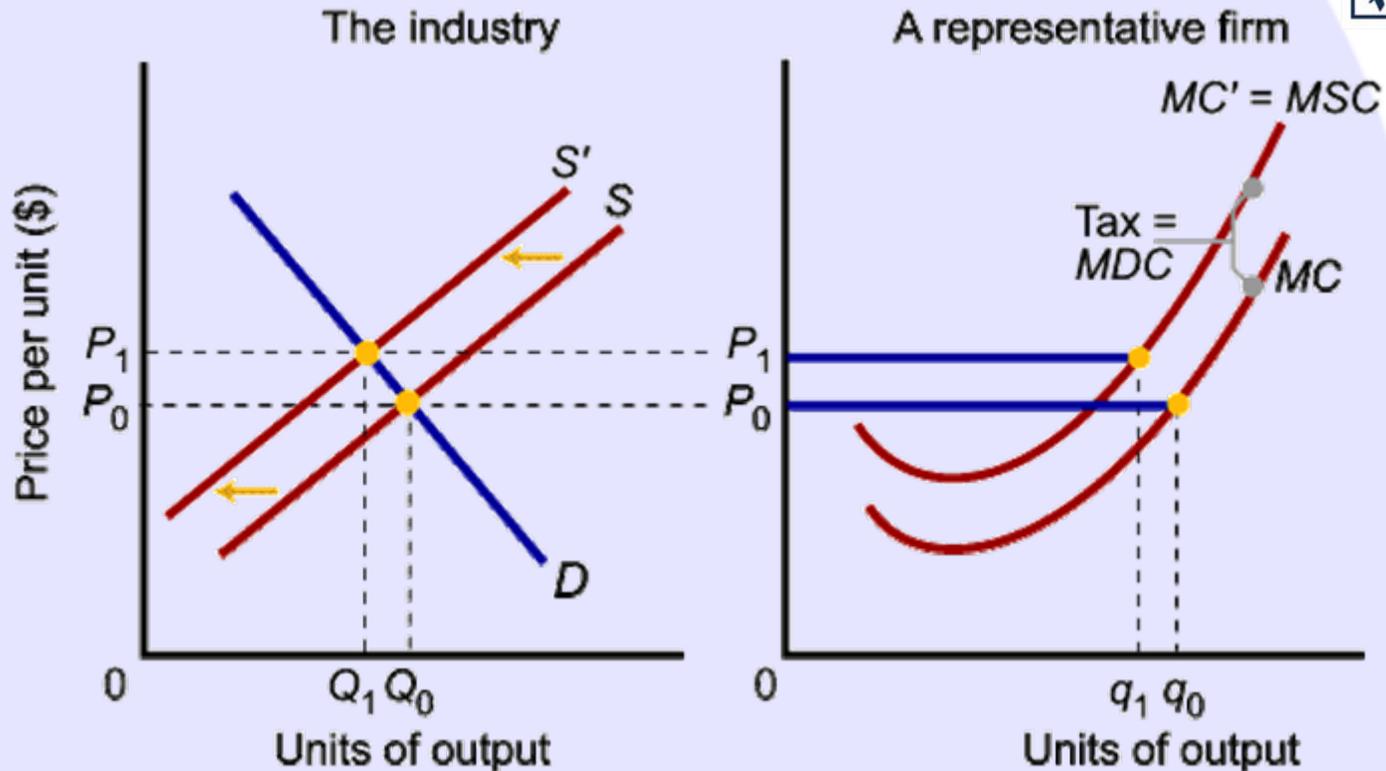


- At  $q^*$ , marginal social cost exceeds the price paid by consumers. Output is too high. Market price takes into account only part of the full cost of producing the good.

# Social / external cost of noise at airports

- Bigger problem at night than at day time
- 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

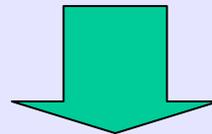
No help of medical research if it's better to have

- 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:

$$C = C_a \cdot 10^{[(L_a - T_a)/10]} + C_d \cdot 10^{[(L_d - T_d)/10]}$$

$C_a/C_d$  = unit noise charge for arrival / departure

$L_a$  = certified noise level at approach

$L_d$  = certified noise level at flyover and lateral

$T_a$  = threshold at arrivals corresponding to the category of a relatively quiet aircraft for this airport

$T_d$  = idem for departure

$C_a$  and / or  $C_d$  can be 0

- The total noise charge is calculated for arrival as well as for departure.

# Orientation of noise charges



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# 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

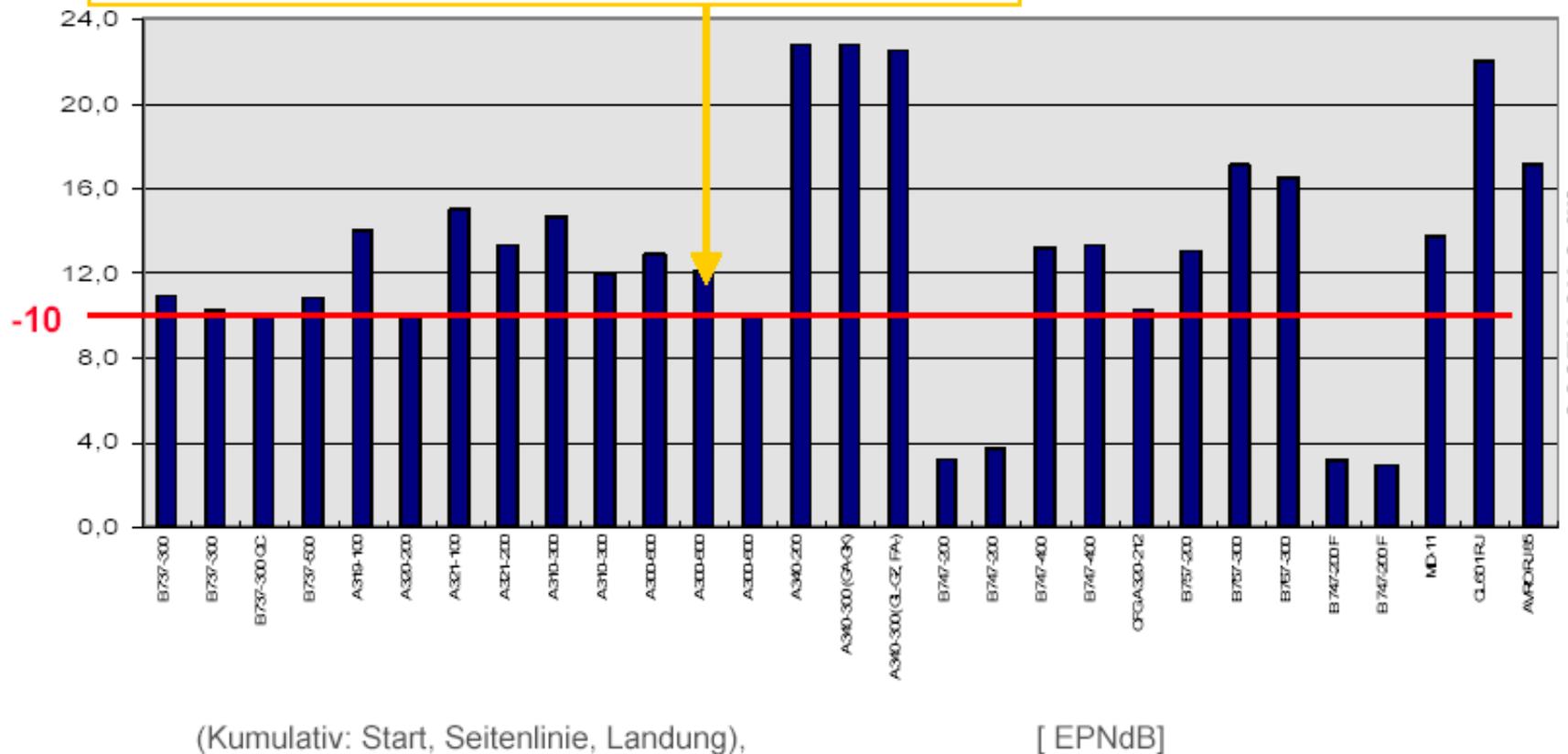
- Only 7 German airports have noise oriented classes
- The others: certification oriented according ICAO, than MTOW
- Since 2006 ICAO chapter 4
  - The big majority already now
  - All new certified a/c have to fulfill it
  - Nearly no incentive for airlines to switch
- German Bonusliste
  - Introduced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

# Internationale Lärm-Zertifizierungswerte

## Beispiel: Lufthansa Konzernflotte

Differenz, Lärmgrenzwerte zu zertifizierten Lärmpegeln

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

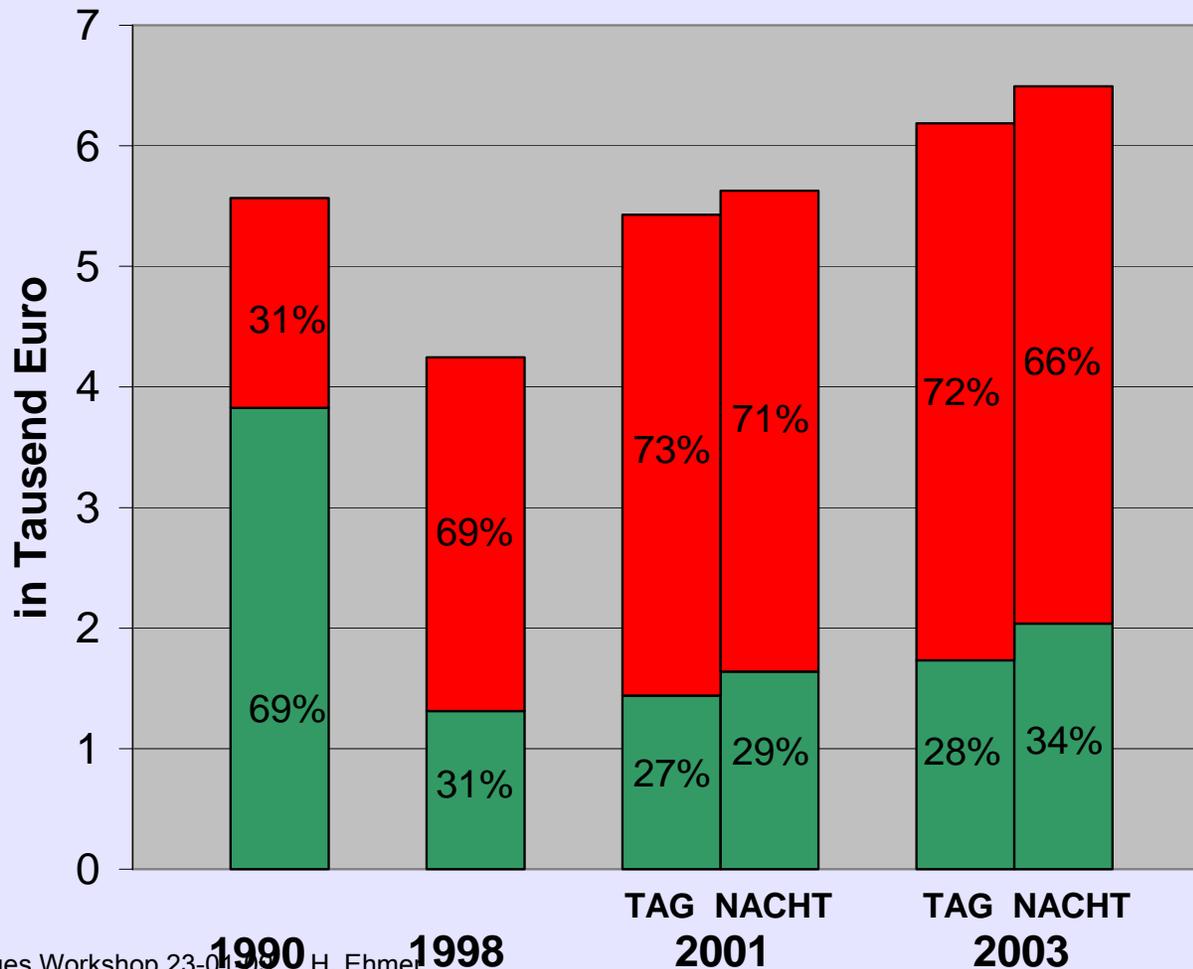


Grenzwert Chapter IV  
- ab 01.01.2006 -

# 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**!



■ Passagiergebühr

■ Gewichtsabhängige  
Gebühr (MTOW)<sup>1)</sup>

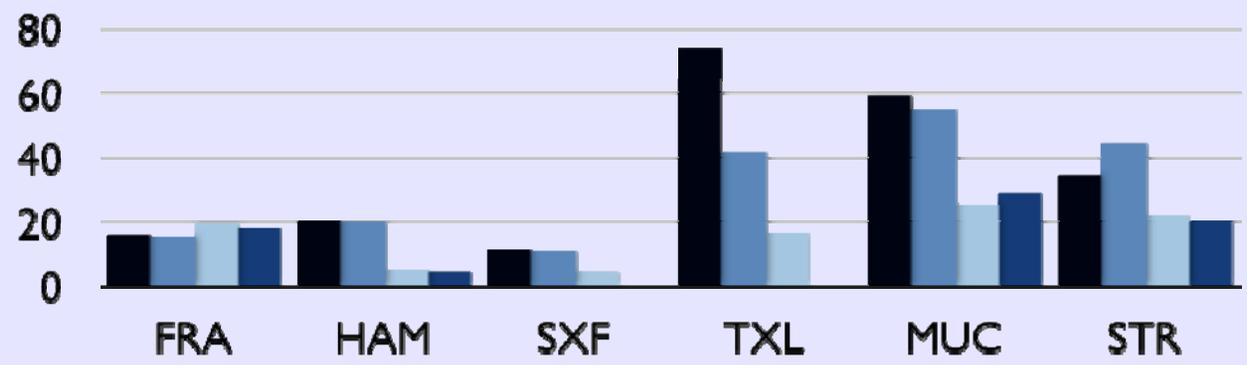
<sup>1)</sup> ab 2001  
inkl. Lärmzuschlag  
ab 2002 zusätzlich Schall-  
schutz- und Lärmzuschläge

# Noise Fee Implementation on German Airports for the 7 airports

	ICAO Chapters	Airport Noise Categories	Separate Noise Fee	Daytime Distinction	Other Noise Fee	Remarks
FRA		X		X		2008
HAM		X		X		2008
HAJ	X		X	X		separate noise fee only at night (2008)
SXF		X		X		2007 Daytime distinction only from cat 5 up
TXL		X		X		2007
DUS	X			(X)	X	2008 Daytime distinction only for non chapter 3 aircraft
MUC		X				2006
CGN	X			X		2008
STR		X				2007

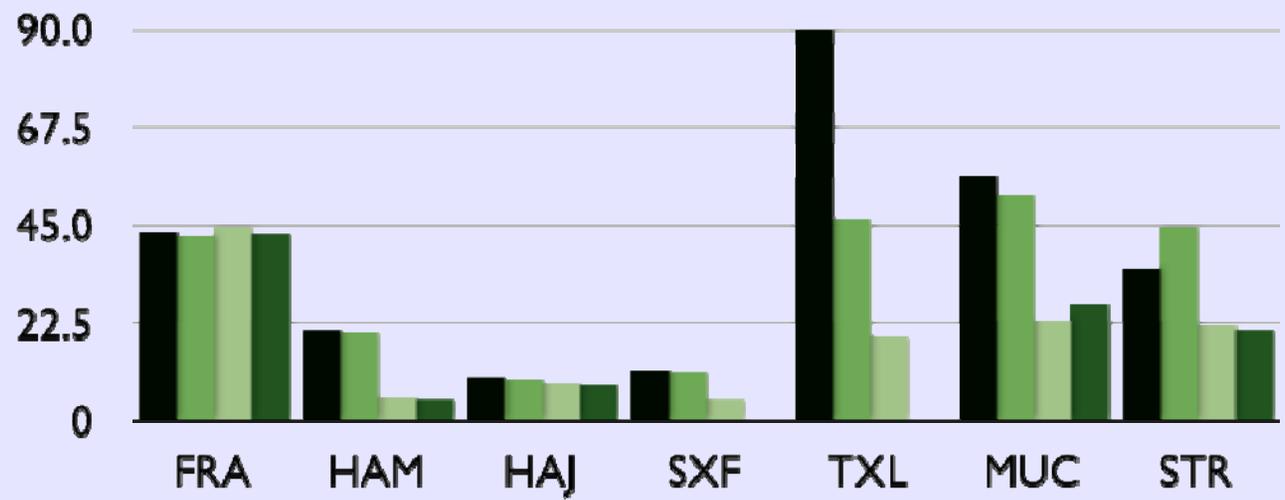
# The Role of Noise Fees in Relation to Total Landing Fees

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 %

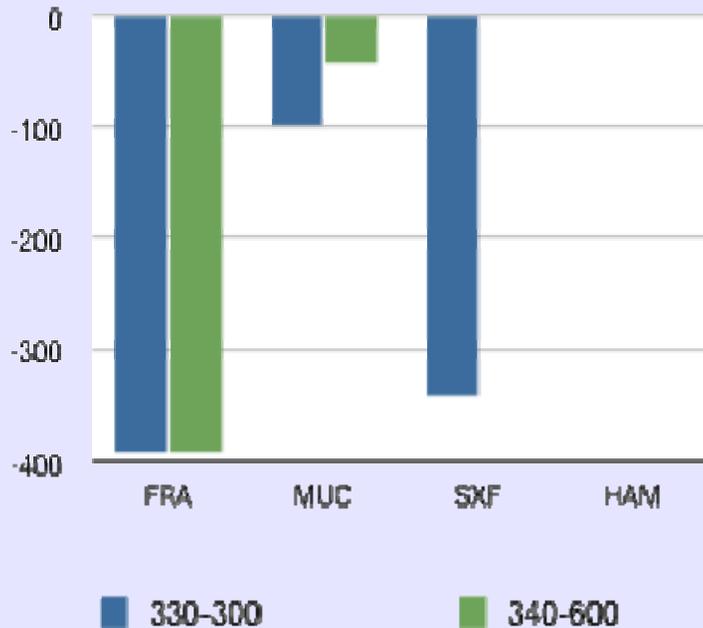


- B737-700
- A320
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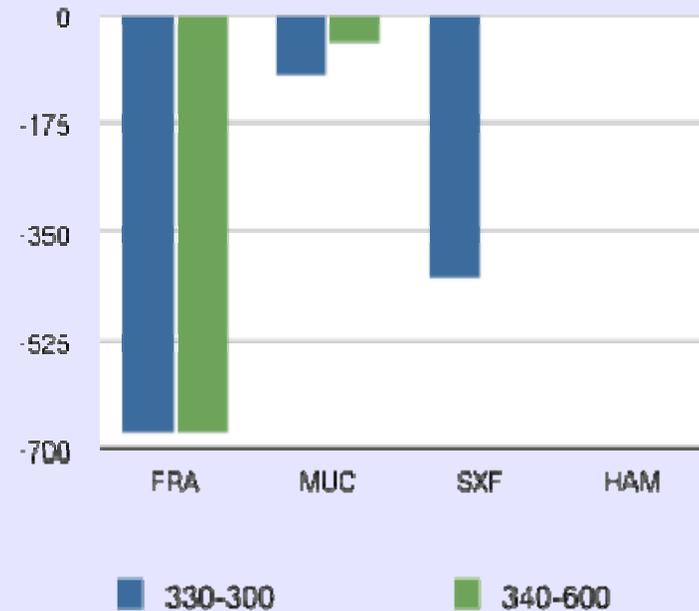
# Noise Fees at German Airports - Comparison

## 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)

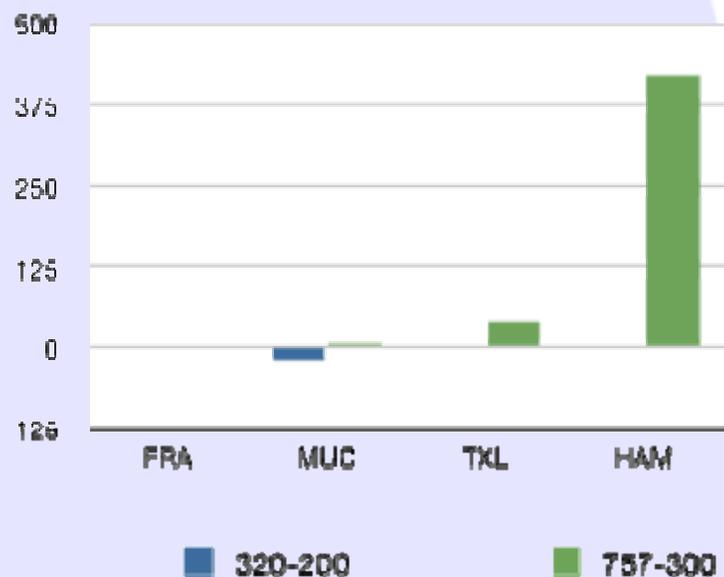
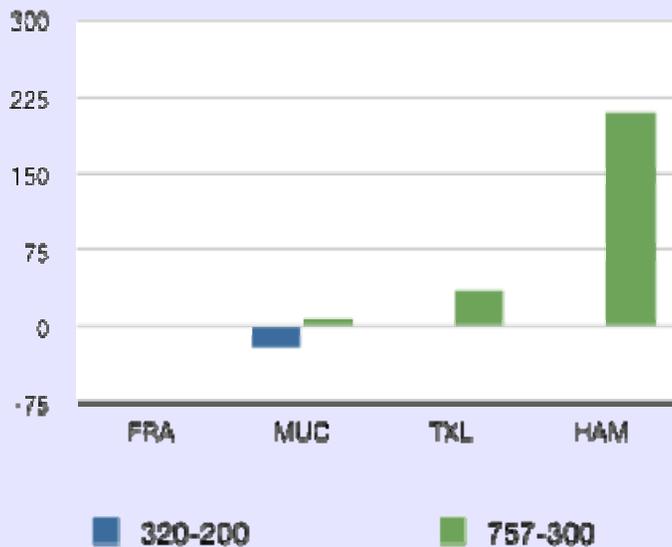


# Noise Fees at German Airports - Comparison

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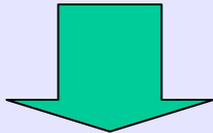
Deviation of noise charges in comparison to B737-800 (day)

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

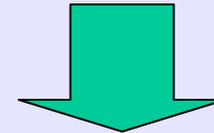


# Noise charges in Europe, short comparison

- 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:

Type of Aircraft	MTOW in t	Number of Engines	Noise level according to ICAO-Annex 16 in EPNdB (Effective Perceived Noise Level)		
			Take-off	Sideline	Approach
A380-800	560	4	93.7	95.3	97.9
B747-400	386	4	99.0	98.3	100.3





# Noise charges in depth – Final Results

- MTOW ICAO Annex 16:

Airport	A380 in €	B747 in €	Basis of Calculation	Appraisal
CDG (daytime)	69.90	68.30	MTOW ICAO	+
CIA	47.95	32.43	MTOW	-
LHR	688.43	688.43	MTOW ICAO (mod.)	-



# 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:

Airport	A380 in €	B747 in €	Basis of Calculation	Appraisal
ARN	38.51	64.75	APNL, TONL, SLNL	+
FRA (daytime)	75.00	270.00	APNL, TONL, SLNL	+
HEL	49.92	167.87	TONL, SLNL	+
AMS (daytime)	198.42	559.11	APNL, TONL, SLNL and MTOW	++

# Future developments on noise charges I

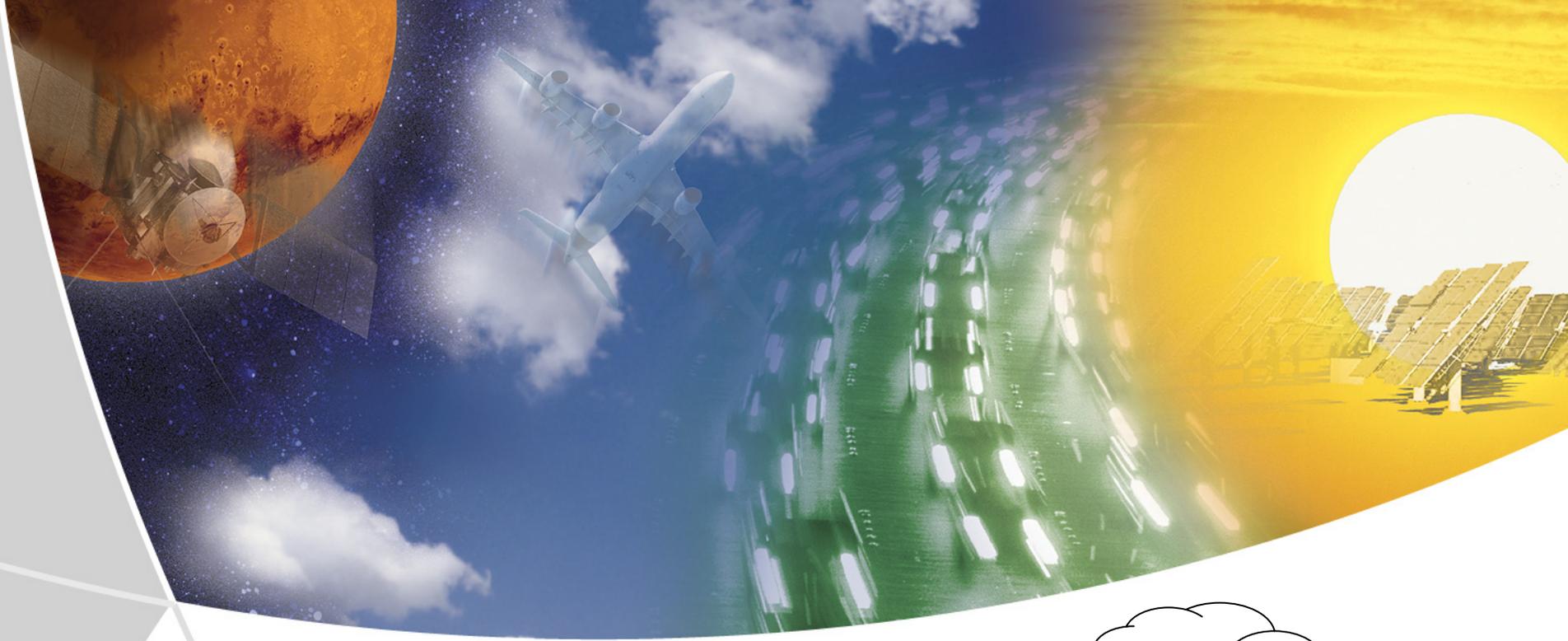
- Further research needed
  - If an equilibrium of the stakeholders is possible
  - If there can be a solution
    - If it's better to have less but louder flights
    - Or if it's better to have more movements
  - But this relevant only with enough capacity
- Orientation towards certified noise level (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 strategie

# 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 NO<sub>x</sub>, not on CO<sub>2</sub>
- The introduction is intended to be cost neutral
- Forerunners FRA and MUC, CGN following



Thank you for your attention!

Time for questions and discussion.

