

Environmental restrictions and the efficiency of airports - the case of slot restrictions at Dusseldorf Airport -

5th Conference INFRADAY – GARS

TU Berlin 07 October 06

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Thesis:

- The performance of airports is harmed by environmental measures
- Environmental issues are one reason that the performance of German airports is worth than elsewhere in the world
- Main questions:
 - How do environmental instruments influence the efficiency of airports
 - In general?
 - In concrete?
 - How efficient are these instruments
 - in their actual use?
 - in their potential?



Content

- Preliminary thoughts
 - What do the airports do?
 - Why do the airports do what they do?
 - What is the result of what they do?
- One example calculated
 - The case of Dusseldorf Airport
 - First step: slot restrictions at the airport
 - Second step: night restrictions (in preparation)



What do the airports do?

- Analysis of the environmental reports of the airports
 - Not all airports publish an environmental report
- Analysis of the internet performance
 - Not only sources of the airport itself but
 - Environmental groups are present there too
- The measures the airports have implemented
 - Nearly all have different kinds of noise surcharges
 - Most airports have other instruments too
 - Often changes



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



Environmental reports of the airports

- Extent and completeness of topics
- Extent and completeness of information
- Comparability of information
- Static or dynamic?
- How many years are included?
- Instruments implemented at the airports:
 - Instrument explained
 - The instrument's efficiency
- Indication of any efficiency for the airport
- Comparison of rational and emotional information
-



Analysis of the internet performance

- **Environmental reports**
- Other internet resources of the airport
 - General information material
 - Special measurements
 - Economic **impact studies**
- Resources by other institutions
 - Institutions of the owners
 - Information by the economy
 - Publications by special interest groups mainly **environmentalists**



Why do the airports do what they do?

- Environmental awareness increased in the population
- Increasing number of complaints about aviation noise (nearly nothing about emissions)
- The airport gets the complaints
 - but the airlines produce the noise
 - but they bring the main revenues to the airport
- Conflict of goals !!

Awareness → complaints → reaction AP
→ reaction AL → less complaints

How far are the last two dependant of each other?

Do the airports really want this?



What is the result of what they do?

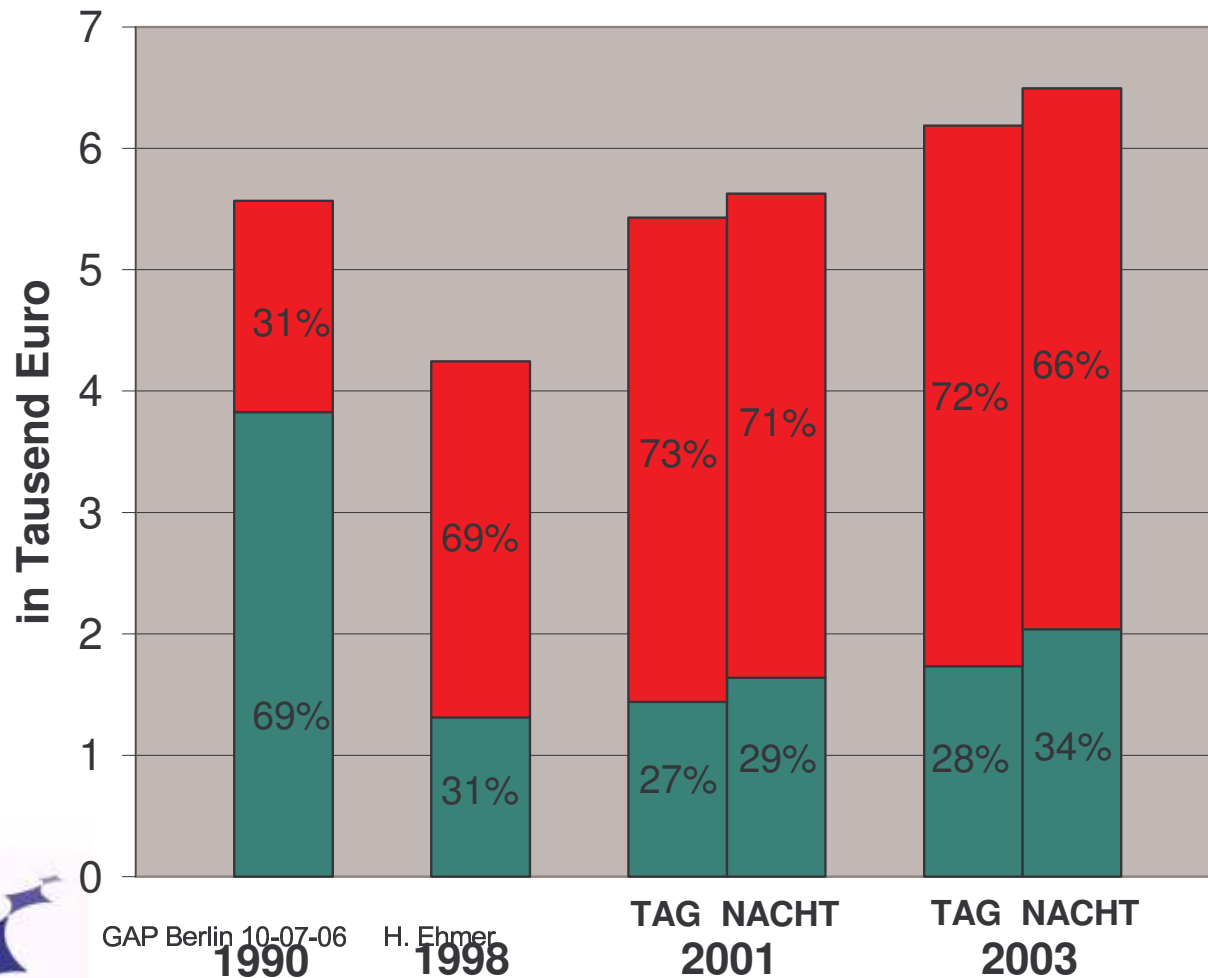
- Now the calculations have to start!
- Some preliminary results:
 - The airports have done and do a lot
 - In most cases a combination of instruments
 - Though the complaints continue, even increase
 - Awareness dependant of overall economic development:
high unemployment → less complaints



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)¹⁾

¹⁾ ab 2001 inkl. Lärmzuschlag
ab 2002 zusätzlich Schallschutz- und Lärmzuschläge



GAP Berlin 10-07-06
1990

H. Ehmer
1998

TAG NACHT
2001

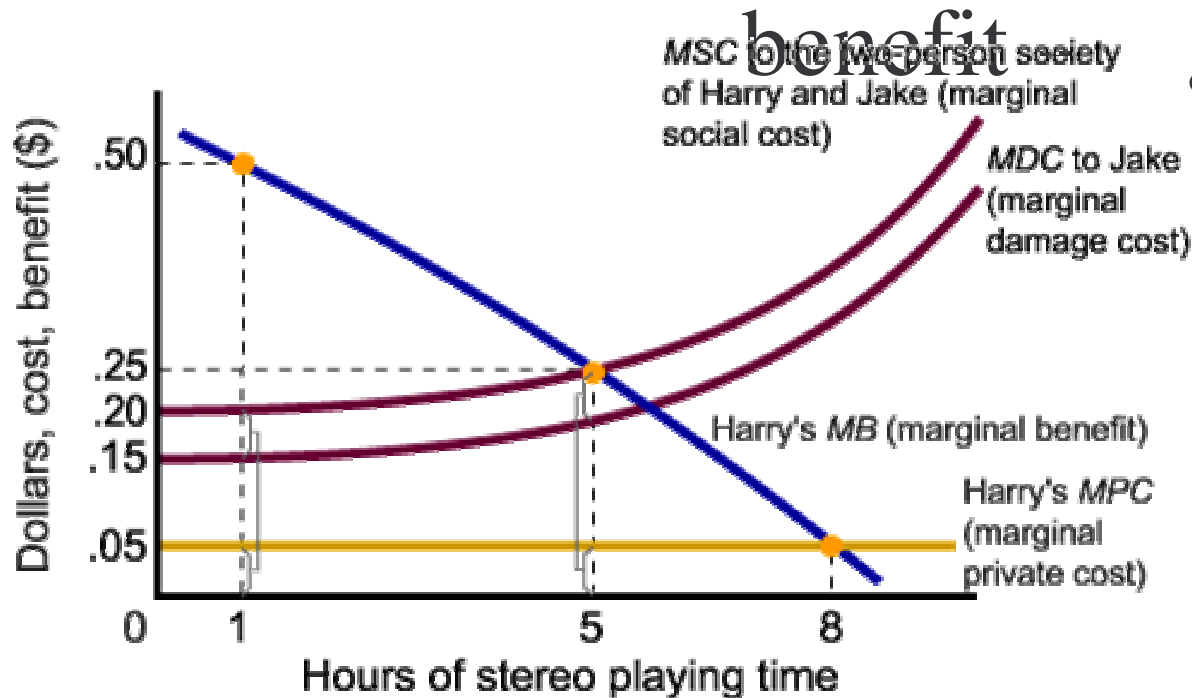
TAG NACHT
2003

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PRIVATE CHOICES AND EXTERNAL Effects

– marginal social cost and marginal



- *Marginal social cost (MSC)* is the total cost to society of playing an additional hour of music.

- Playing the stereo beyond more than five hours is inefficient because the benefits to Harry are less than the social cost for every hour above five.

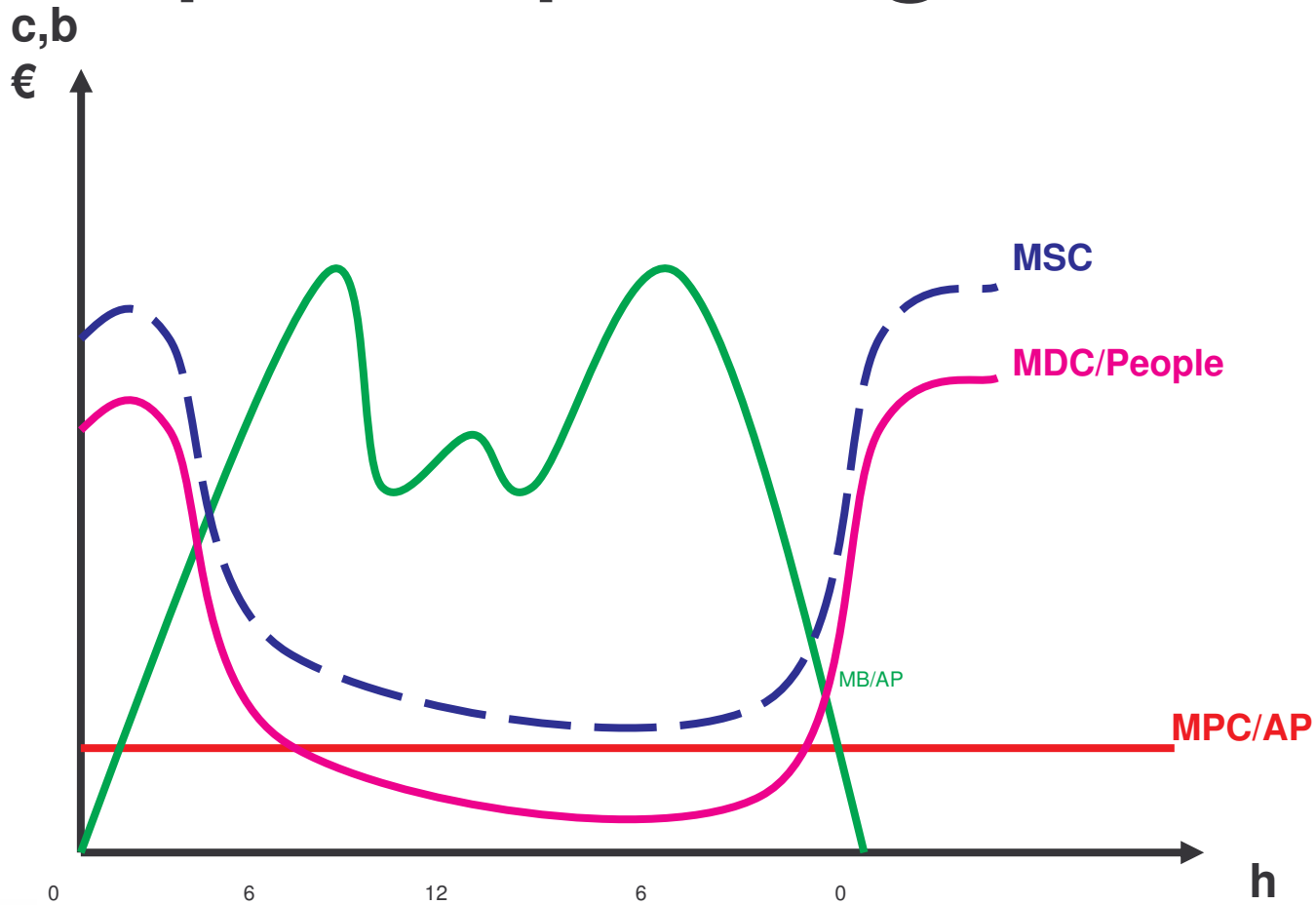


Airport opening hours

- Find the optimal opening hours of an airport
- MPC/AP – Marginal Private Cost Airport, stable over the day
- MB/AP – Marginal Benefit of the Airport, depending on paid flight movements
- MDC/People – Marginal Damage Cost of the people living near to the airport
- MSC – Marginal Social Cost = MPC + MDC
- Optimal Opening Hours: the time when the MSC-curve crosses the MB-curve



Airport opening hours II



Slot restrictions at airports

- Is it possible to apply this to slots too?
- Medical research cannot give an answer if more “silent” movements or less “noisy” movements are better
- Slot restrictions do not reduce noise – in contrast noise probably increases
- What about the efficiency of the airport?
Calculation for the case of Dusseldorf



Contents

- Administrative Capacity Limitations
- Duesseldorf International
- Location and Catchments
- The General Problem
- The Angerland Agreement
- Traffic Development
- Lost Passenger Potential
- Lost Take-off and Landing Charges
- Lost Passenger Charges
- Permanent Operation at Capacity Level
- Consequences of operation at Capacity Level



Administrative Capacity Limitations

- They **limit** the utilization of the **available technical capacity** of airports
- They should help to *reduce the negative effects* of noise nuisance at the airport
- Two categories of measures:
 - direct *focus on noise* reduction
→ noise budget or contingent
 - *focus on reducing a/c movements* to lower the noise level
→ movement contingent



Duesseldorf International

- Germany's third biggest airport (15.5 mio. passengers)
- Principal airport for *NRW* (60% of total existing passenger traffic operated through Duesseldorf)
- Germany's first *partly-privatized* airport
 - 50% City of Duesseldorf
 - 30% Hochtief GmbH
 - 20% Aer Rianta
- 75 *airlines* from 36 countries
- 170 *destinations* in 45 countries



Location and Catchments

- Location in the heart of Germany's major industrial zone (*Rhine-Ruhr Region*)
- 18.0 mio. inhabitants living within a 100 km radius
- 3rd largest *catchment area* in Europe (after London and Paris)
- 7th largest *catchment area* worldwide in terms of Gross Domestic Product
- All major European cities within 2 hours flying range

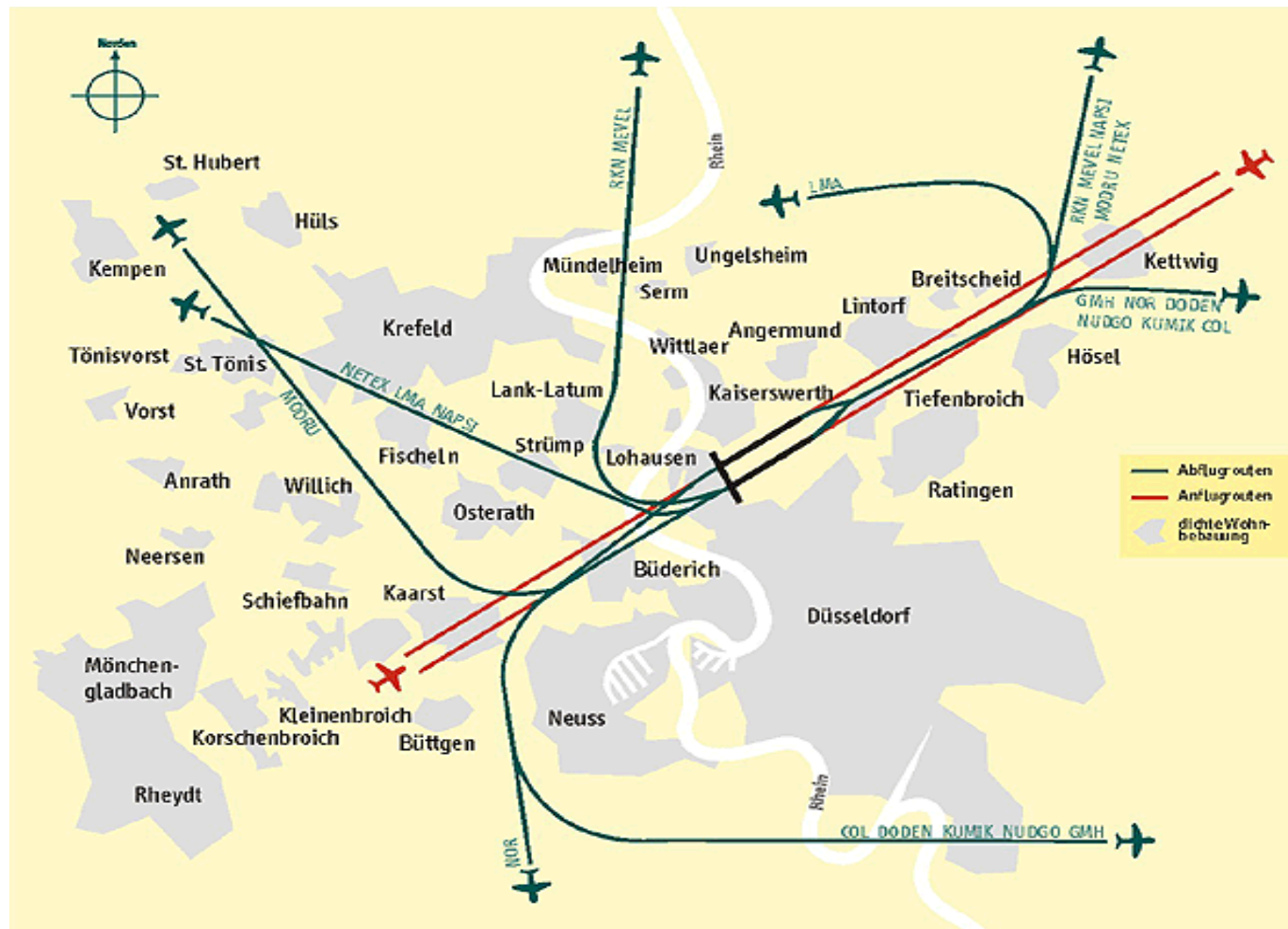


The General Problem

- Close proximity to the inner city of Duesseldorf
- Airport's grounds bordering residential areas
- Most of take-off and landing routes run across residential areas
- Severe noise annoyance of the surrounding population



The General Problem (cont.)



The Angerland Agreement

- Negotiated and drafted in 1965
- Restricted length of runways at Duesseldorf
 - Primary runway: 3000 meters
 - Parallel Runway: 2700 meters
- Night curfew (23:00 pm – 6:00 am)
- Regulatory operating licenses (movement contingent) based on primary runway capacity
- Future expansion and capacity constraints



The Angerland Agreement (cont.)

Restrictions on the runway system

- Usage of only the *primary runway capacity*
- *Insufficient length* for operating non-stop inter-continental flights (e.g. Japan, Korea) in economically feasible way
- Only 500 meters *interspace* between primary and parallel runway – no independent operation possible
- Parallel runway function of a sidestep runway only (Ausweichsbahn)



The Angerland Agreement (cont.)

Night curfew

- Complete shut-down of airport operations between 23:00 pm and 6:00 am
- Only aircraft landings permitted between 22:00 pm and 23:00 pm
- No take-offs in this time frame



The Angerland Agreement (cont.)

Regulatory operating licenses

- Stringent *movement contingents* throughout the years
- Prevent efficient utilization of *primary runway* capacity
- Example: Operating license from Sept. 2000 (valid from 2001 until 2005) theoretically allowed 122.176 movements for the six busiest months of each year (May-October)
- Theoretical *technical capacity* of primary runway at Duesseldorf Airport: 143.888 movements (46 per hour)
- Unused (idle) capacity: 21.712 slots for the six busiest months of each year.



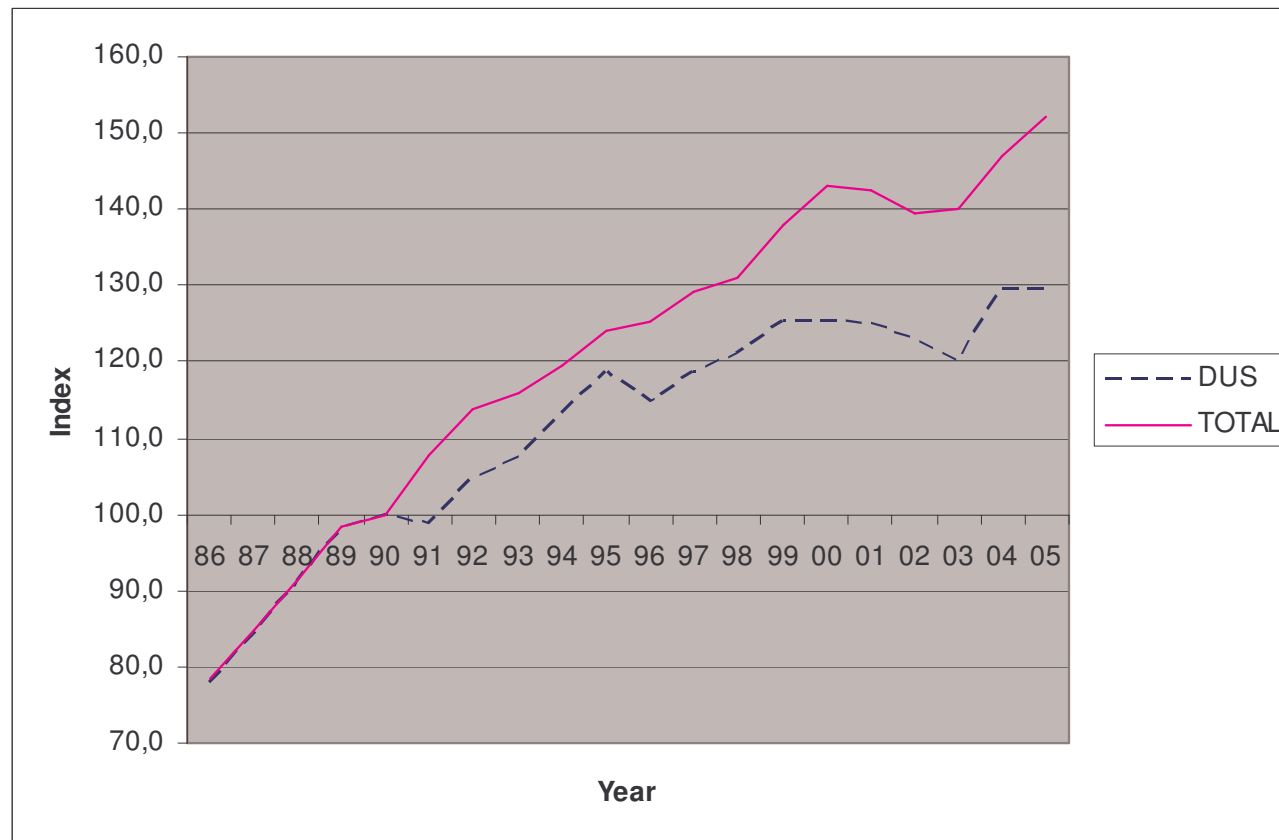
Operating License (September 2000)

Time	Slots (hour)	Hours (day)	Slots (day)	6 busiest months
6:00 - 21:00	38	15	570	104.880
21:00 - 22:00	35	1	35	6.440
22:00 - 23:00	25	1	25	4.600
6:00 - 23:00 (Additional)	2	17	34	6.256
Total			664	122.176



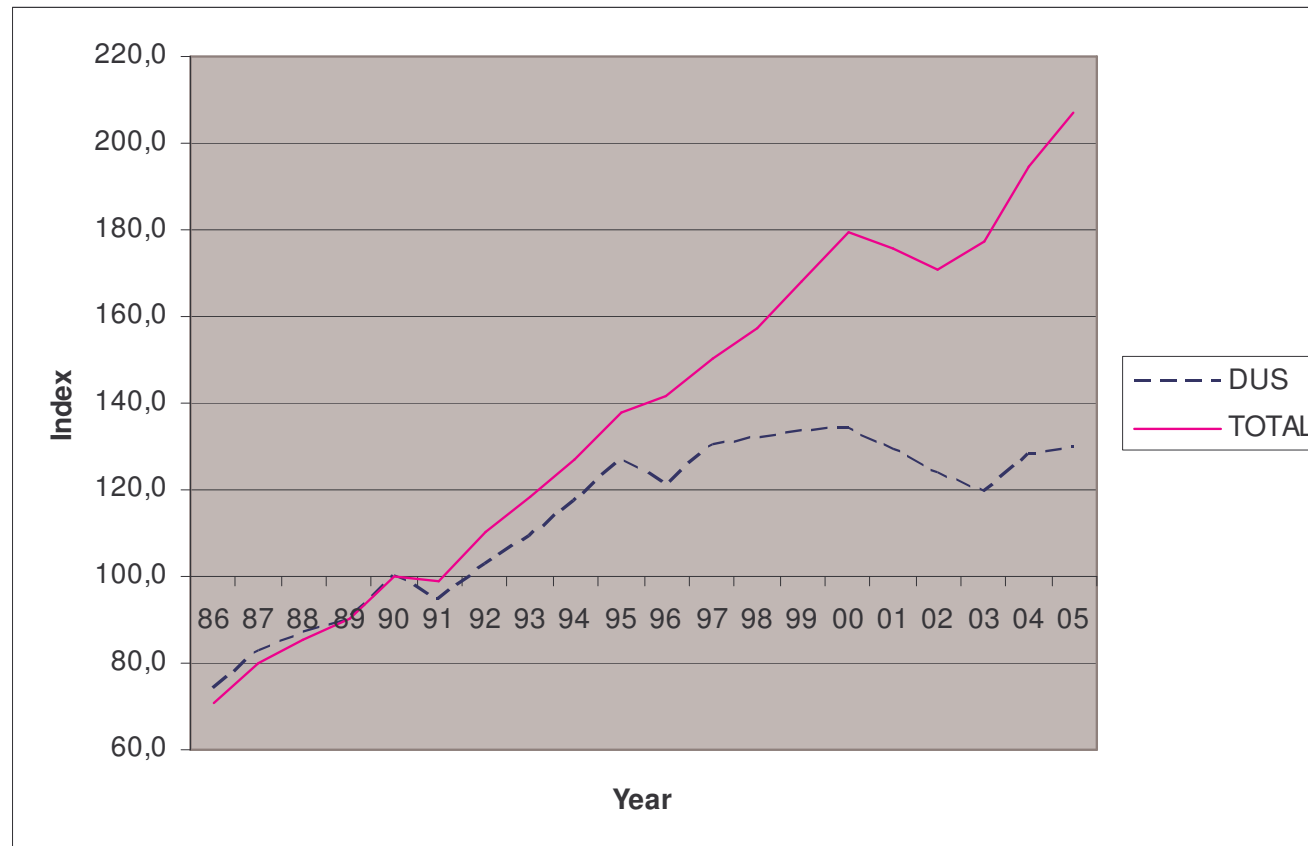
Traffic Development

Development of aircraft movements (1986 – 2005)



Traffic Development (cont.)

Development of passenger traffic (1986 – 2005)



Traffic Development (cont.)

- Due to the restrictions, Duesseldorf significantly lost market share in German aviation market

Movements	2005	2000	1995	1990
German Airports	2.227.816	2.097.052	1.818.621	1.465.149
Duesseldorf	200.621	194.021	184.021	155.029
Market share Dusseldorf	9,0%	9,3%	10,1%	10,6%

Passengers (mio.)	2005	2000	1995	1990
German Airports	165,4	143,6	110,4	80,0
Dusseldorf	15,5	16,0	15,1	11,9
Market share Duesseldorf	9,4%	11,2%	13,7%	14,9%



Lost Passenger Potential

- Results from the number of turned down slot requests
- Over the last 12 years, a total of 18.764.949 potential passengers was lost
- An average of 1.563.746 passengers for the six busiest months of each year



Lost Passenger Potential (cont.)

Year	Slots				Turned down (%)	Pax/ movement	Lost pax potential
	requested	allocated	Ops License	turned down			
1995	111.814	101.204	n.a	10.610	9,5	91	802.896
1996	125.408	97.618	n.a	27.790	22,1	89	2.103.130
1997	125.748	104.037	105.000	21.711	17,3	92	1.700.345
1998	119.913	105.504	105.000	14.409	12,0	92	1.128.431
1999	127.080	104.989	105.000	22.091	17,4	90	1.691.280
2000	122.137	106.144	95.600	15.993	13,1	90	1.238.424
2001	143.814	110.686	122.176	33.128	23,0	87	2.565.376
2002	122.845	114.305	122.176	8.540	7,1	85	668.600
2003	124.398	115.725	122.176	8.673	7,0	84	728.532
2004	138.507	117.151	122.176	21.356	15,4	82	1.815.260
2005	132.811	114.522	122.176	18.289	13,7	83	1.554.565
2006	155.088	122.522	131.744	32.566	20,9	83	2.768.110



Lost Take-Off and Landing Charges

- Result from the turned down slot requests
- Each landing and take-off operation of aircraft at DUS is subject to charges
- Landing and take-off charges are assessed as a fixed monetary amount based on MTOW of the aircraft (no reduction for LCC)



Lost Take-Off and Landing Charges (cont.)

- Potentially lost charges are calculated for the six busiest months (May–October) of the current year 2006
- Assumptions:
 - only Boeing 737-300 (avg. MTOW: 57 tons) and Airbus 320 (avg. MTOW: 75 tons)
 - Share: 60% A320 and 40% B737-300
 - All turned down aircraft are included in the "Bonuslist", resulting in a basic charge of EUR 122.00 per movement
 - total parking time of aircraft is less than 3 hours
 - no security charges



Lost Take-Off and Landing Charges (cont.)

Charging structure for each Boeing and Airbus

Aircraft type	Basic charge	Variable charge per ton	MTOW/ aircraft	Total variable charge (t)	Total charge/ aircraft
Boeing 737-300	EUR 122,00	EUR 1,05	57 tons	EUR 59,85	EUR 181,85
Airbus 320	EUR 122,00	EUR 1,05	75 tons	EUR 78,75	EUR 200,75

Potentially lost take-off and landing charges

Aircraft type	Share	Turned down	Total charge per a/c	Lost potential
B 737-300	40%	13.026	EUR 181,85	EUR 2.368.778
A 320	60%	19.540	EUR 200,75	EUR 3.922.655
Total	100%	32.566		EUR 6.291.433



Lost Passenger Charges

- All commercially operated departures are imposed with passenger charges
- Charge depends on the number of passengers aboard the aircraft
- For summer flight schedule 2006, the passenger charge per person depends on the geographical location of the subsequent landing of the a/c from Duesseldorf:
 - Destination is within Germany EUR 10.18
 - Destination is within EU EUR 11.67
 - Destination is outside EU EUR 11.77



Lost Passenger Charges (cont.)

- Potentially lost charges are calculated for the six busiest months (May–October) of the current year 2006
- Potentially lost passenger charges result from the lost passenger potential
- Only departures are imposed with passenger charges
- Assumptions about share of pax per destination (based on 2005):
 - Within German borders 23.0%
 - Within EU, but outside Germany 48.0%
 - Outside the EU 29.0%



Lost Passenger Charges (cont.)

Destination	Share	Lost passenger potential	Charge per pax	Lost pax charges
within Germany	23.0%	318.333	EUR 10,18	EUR 3.240.630
within EU	48.0%	664.346	EUR 11,67	EUR 7.752.918
outside EU	29.0%	401.376	EUR 11,77	EUR 4.724.196
Total	100.0%	1.384.055		EUR 15.717.744

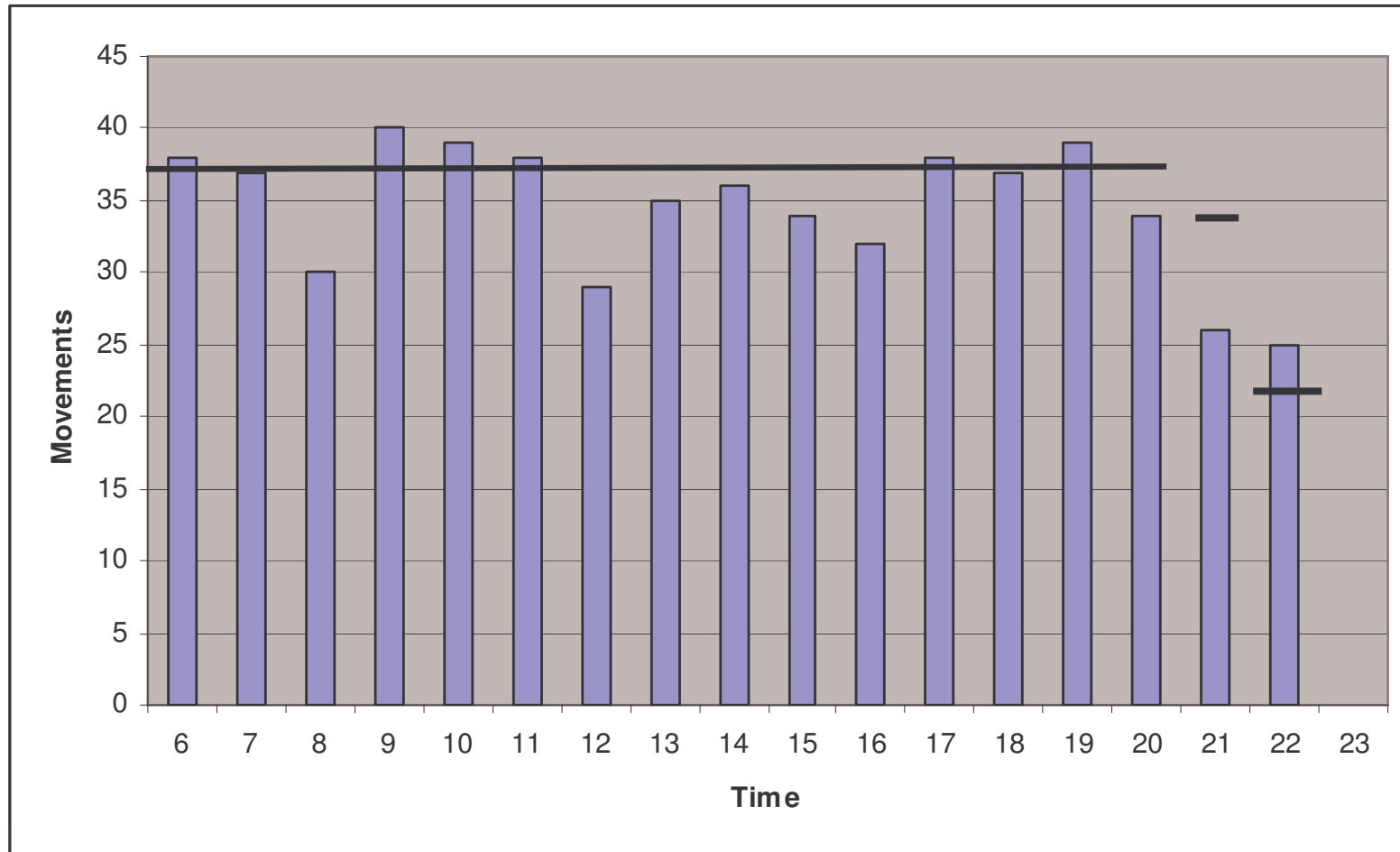


Permanent Operation at Capacity Level

- Average weekly aircraft movements for the six busiest months in 2005:
 - Four heavily congested *peak times*
 - slight “overcapacity” during certain hours caused by aircraft rotation and less congested weekends



Permanent Operation at Capacity Level (cont.)



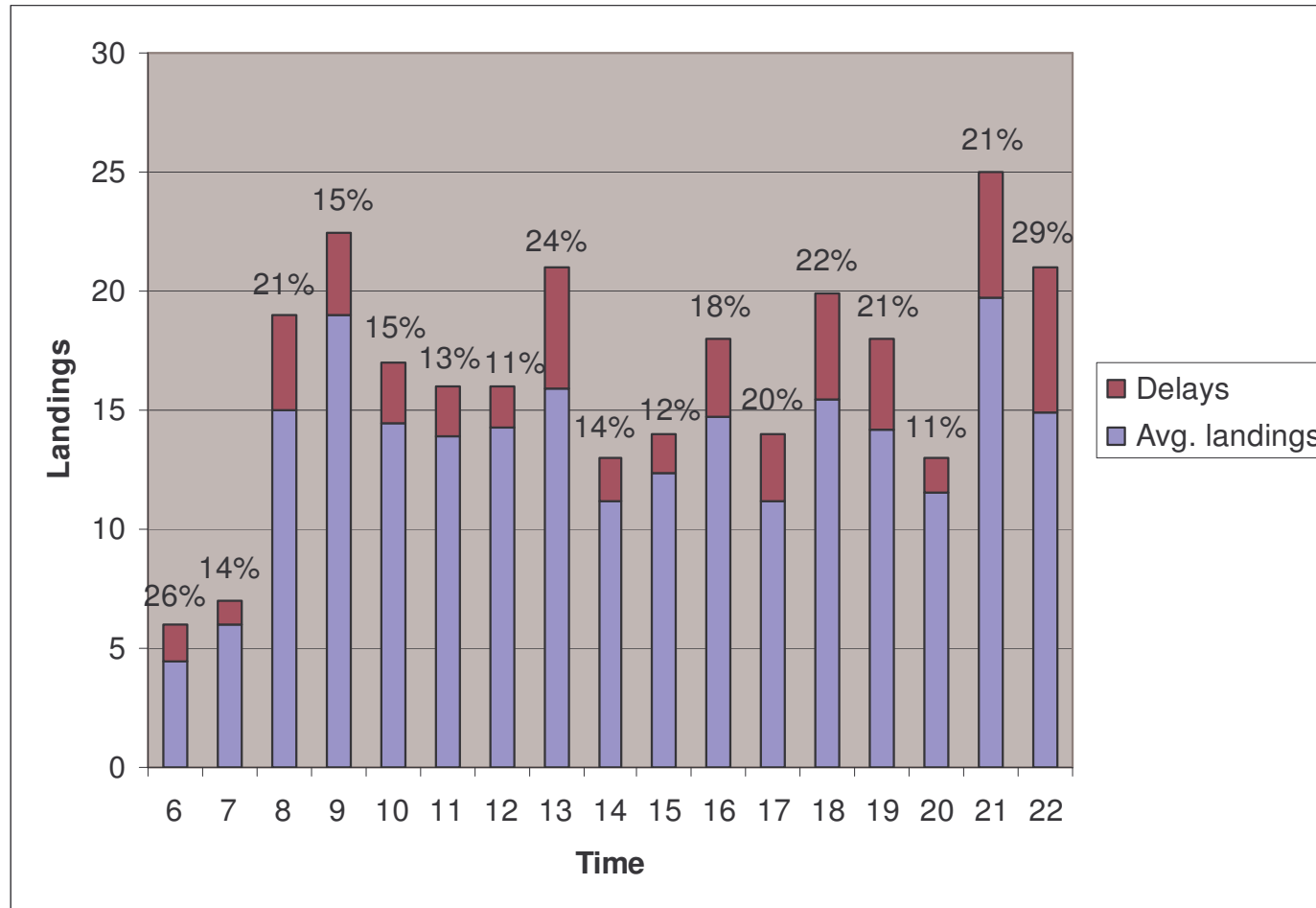
Consequences of Operation at Capacity Level

Delays in landings at Duesseldorf Airport (June 2005)

- Average of 18% of all landings was delayed during the sample period June 2005
- Average time of delay was 42 minutes
- Highest share of delays during the sensitive night-time period between 22:00 pm and 23:00 pm with a share of 29%



Consequences of Operation at Capacity Level (cont.)



**Thank you for
your attention!**

Any question?

