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Demand Management

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Demand Management

- Objective
  - Review the characteristics, advantages and disadvantages of alternative approaches to demand management
- Topics
  - Motivation for Demand Management
  - International Practices
  - Description of Fundamental Approaches
  - Examples
  - Lessons Regarding Policies

Reference: Chapter 12

Objective and Application of Demand Mgt.

Help maintain efficient operations at congested airports by:

- reducing total demand and/or
- shifting demand from peak to off-peak periods

"Access control"

Application involves:

- use of non-capital alternatives
- mitigation in the short and medium terms
- peak-period problems

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Basic Precept

- Capacity expansion should be the fundamental means for accommodating growth of demand
- Demand management should be considered only when capacity expansion
  - becomes unreasonably expensive; or
  - is faced by insurmountable political, social or environmental barriers
- In such cases, the forms of demand management that should be considered are the ones that will interfere the least with a deregulated and competitive market

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The "Do Nothing" Alternative

- Allow unlimited access to airport; as delay grows, more and more aircraft operators will decide not to schedule flights; an equilibrium will eventually be reached
- Problems:
  - Encourages users with the lowest value of time to use the airport
  - The equilibrium level of delay (and of demand) will be higher (possibly much higher) than it would have been if each operation had to pay for the marginal delay costs it imposes on others

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Demand Management Approaches

- Administrative [Slot Allocation]
  - "Schedule Coordination"
  - Lotteries
- Economic
  - Congestion pricing (peak-period pricing, marginal cost pricing, etc.)
  - Minimum landing fees
- Hybrid
  - Slots plus peak period pricing
  - Slot auctions
  - Buy-and-sell of slots

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Administrative Approaches

- Based on the notion of a ***"slot"*** (= a time interval available for scheduling an arrival or departure)
- Each airport has a declared number of slots per hour; this number is determined by the capacity of the most restricting element of airport
- Potential allocation criteria:
  - Historical precedent
  - Stimulating competition ("new entrants")
  - Access to new markets
  - Regular vs. occasional service
  - Size of market to be served

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IATA Schedule Coordination Process

- Level 1 ("non-coordinated")
- Level 2 ("schedules facilitated") *(~ 75 airports)*
- Level 3 ("fully coordinated")
  - ~ 140 international airports (practically all busiest ones outside US)
  - Coordinator appointed by appropriate authority, usually assisted by a coordination committee
  - IATA Schedule Coordination Conferences (SCC); in June and November for subsequent season
  - Attended by 300 air carriers, airport reps, airport coordinators, etc.

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IATA Schedule Coordination Process [2]

- Air carriers must submit slot requests 27 days before SCC
- During SCC and post -SCC, coordinators resolve conflicts, finalize schedules
- ***Historical precedent is primary criterion***
- Carriers may exchange slots
- Use-it-or-lose-it clause (80% use required)
- New entrants obtain up to 50% of "free" slots
- ***Several restrictive clauses re. "new entrants"***
- Other allocation criteria: size and type of market, length of period of operation, curfews, etc.

Note: Declared capacities determined at local level

Slot Availability at LHR

ARRIVALS							
HOUR	Mon	Tue	Wed	Thu	Fri	Sat	Sun
0600	0	0	0	0	0	1	0
0700	0	0	0	0	0	0	1
0800	0	0	0	0	0	0	3
0900	0	0	0	0	0	0	0
1000	0	0	0	0	0	0	0
1100	0	0	0	0	0	1	1
1200	0	0	0	0	0	0	1
1300	0	0	0	0	0	1	1
1400	2	1	2	0	3	0	4
1500	0	1	1	0	0	0	0
1600	0	0	0	0	0	0	0
1700	0	0	0	1	0	0	0
1800	0	0	0	0	0	0	0
1900	0	0	0	0	0	2	0
2000	0	0	0	0	0	3	0
2100	0	0	0	0	0	15	1
2200	4	3	1	2	2	12	3

DEPARTURES							
HOUR	Mon	Tue	Wed	Thu	Fri	Sat	Sun
0600	0	0	0	0	0	3	12
0700	0	0	0	0	0	0	9
0800	0	0	0	0	0	0	0
0900	0	0	0	0	0	0	0
1000	0	0	0	0	0	0	0
1100	0	0	0	0	0	0	0
1200	0	0	0	0	0	0	0
1300	0	0	0	0	0	0	0
1400	0	0	0	0	0	0	0
1500	0	0	0	0	0	0	0
1600	0	0	0	0	0	0	0
1700	0	0	0	0	0	0	0
1800	0	0	0	0	0	0	0
1900	0	0	0	0	0	0	0
2000	0	0	0	0	0	4	0
2100	8	1	1	0	0	12	0
2200	0	2	2	1	0	5	0

Source: Manager, Slot Coordination, Airport Coordination UK for Summer, 2001

Slot limits at selected international airports

Airports	Limit of Scheduled Movements Per Interval (2001)							
	1 day	3 hrs	1 hr	30 min	15 min	10 min	5 min	
London Heathrow			79-85[1]					As long as average delay < 10 min
Tokyo/Narita	367[4]		26-32[1]					Daily limit is a noise constraint
Frankfurt/Main			78	43		16		
Seoul/Incheon			37[2]					
Sydney			80[3]		21		8	
Osaka/Kansai		81	30					

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Schedule Coordination Committees: Experience in USA

- Met biannually from 1969 to allocate slots at 4 "High Density Rule" (HDR) airports (JFK, LGA, ORD, DCA)
- Dept. of Transportation and of Justice observers
- Private negotiations between airlines or exchanges of slots not allowed
- Unanimous approval of schedules required
- Process criticized as anti-competitive
- Impasse in deregulation era; abandoned in 1985
- Buying-and-selling of slots at HDR airports since 1985
- Adjustments were made at LGA and ORD in early 2000s
- HDR expired on January 1, 2007, with exception of DCA; in absence of solution, HDR has essentially been extended at LGA, ORD; DOT/FAA looking for long-term alternatives

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Congestion Pricing: A Key Observation

- The marginal congestion cost associated with an airport user has 2 components:
  - Cost of delay to that user (***internal*** cost)
  - Cost of additional delay to all other users (***external*** cost)
    - At congested airports, this second component can be very large -- often much more than $1000 *per aircraft movement*

❑ *Congestion pricing aims at increasing the efficiency of resource utilization by forcing users to "internalize external costs" by paying a congestion toll*

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Fundamental Principle

❑ ***Optimal use of a congested transportation facility cannot be achieved unless each additional (marginal) user pays for the delay costs that (s)he imposes on all other users*** (Vickrey, 1967; Carlin + Park, 1970)

❑ Application to airports is complicated by difficult technical and sociopolitical issues

❑ No "pure" application exists to date

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Congestion pricing: observations

- Estimating the marginal delay cost that each additional operation causes to all other movements at an airport is central to congestion pricing
- At non-hub airports with many operators holding a limited share of airport activity, marginal delay cost is not internalized
- Current landing (and take-off) fees at US airports bear little relationship to true external costs

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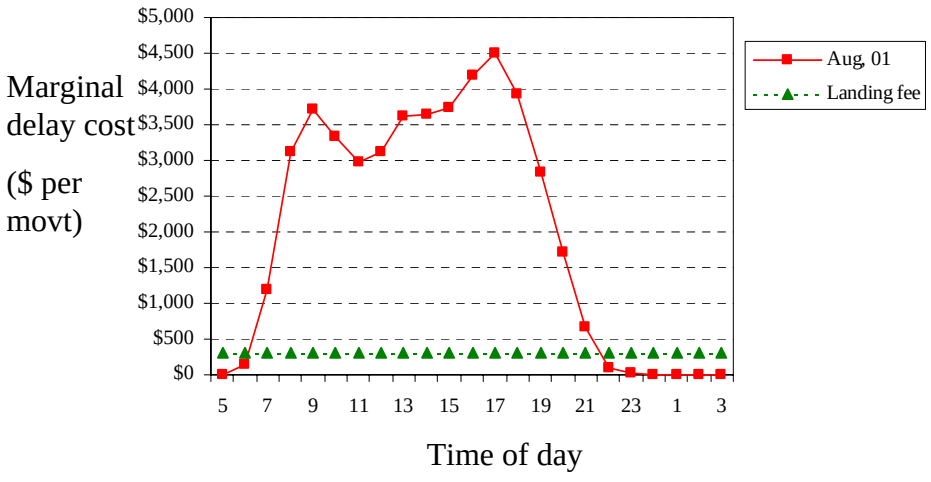
LGA: Marginal external delay cost per additional movement vs. average landing fee per movement



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Possible Forms of Congestion Pricing

Due to the many practical difficulties, the realistic possibilities for application of congestion pricing seem limited to charging *during peak periods*:

- A surcharge in addition to the weight-based landing fee
- A flat fee independent of aircraft weight (or variation thereof)
- A multiplier applied to the weight-based landing fee
- A landing fee equal to the larger of a specified minimum charge and of the weight-based landing fee

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Slots plus Congestion Pricing: Landing Fees, BAA (2005)

	Heathrow		Gatwick		Stansted	
Aircraft weight (tons)	Peak	Off-peak	Peak	Off-peak	Peak	Off-peak
MTOW ≤ 16	£ 590	£ 250	£ 385	£ 110	£ 95	£ 85
16<MTOW≤ 50	£ 590	£ 250	£ 385	£ 110	£ 142	£ 105
50 < MTOW	£ 590	£ 425	£385	£ 125	£ 231	£ 131
For MTOW > 250	£ 590	£ 425	£385	£ 125	£ 400	£ 400

Apply to domestic and international flights

Note: "Peak" varies by airport (e.g., Heathrow peak: 07:00-9:59 and 17:00-18:59 GMT, April 1-Oct. 31)

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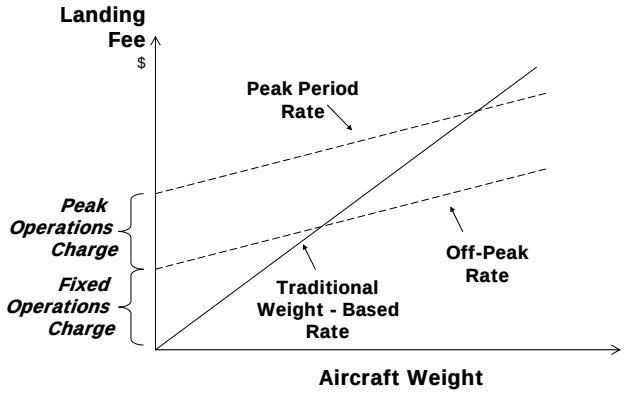
Boston (1993): Proposed Landing Fee vs. Traditional Weight-Based Fee



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Congestion Pricing: LGA (NEXTOR Game, 11/04)

Source: NEXTOR presentation, TRB, 2005.

Revenue neutral fee: $275

Beginning of Hour	Base Schedule	Round 1	Round 1 Schedule	Round 2	Round 2 Schedule
0430		$275	1	$275	1
0530	27	$275	42	$275	42
0630	75	$600	67	$600	67
0730	93	$800	66	$800	76
0830	94	$800	87	$1,000	73
0930	90	$800	71	$1,000	67
1030	84	$600	97	$1,000	96
1130	84	$600	92	$1,000	71
1230	97	$800	61	$800	81
1330	86	$800	63	$800	80
1430	84	$600	85	$1,000	71
1530	83	$600	101	$1,000	101
1630	85	$800	62	$1,200	54
1730	89	$800	86	$1,200	82
1830	92	$800	94	$1,200	81
1930	91	$800	73	$800	85
2030	81	$600	80	$600	79
2130	58	$600	36	$600	39
2230	25	$275	38	$275	38
2330	10	$275	8	$275	8
All Other	0	$275	0	$275	0
Total Operations	**1,428**		**1,310**		**1,292**

Fees are in-lieu of existing departure fees

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Auctions

- A much-discussed hybrid approach for which there is no practical experience to date
- Possible Scenario:
  - Carriers submit sealed bids for any number of slots
  - All slots are auctioned simultaneously

❑ BUT: How to do this and address all the complexities remains an open question!

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Complexity of Slot Auctions

- Value an airline derives from a slot depends on what other slots it obtains
  - Landings and takeoffs
  - Alternative times for a given flight
- Network effects are also important
  - A slot at a given time at airport A may be useless without a corresponding slot at B

❑ Hence, there is a *huge* number of combinations that each carrier may be interested in at *each* airport.
  - How does one prepare such bids and how does the auction administrator select the best bids?

- A follow-up market is also clearly needed to adjust auctioned slot allocations

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Buying-and-Selling of Slots

- A hybrid approach: slots plus a market
- Slots are, temporarily or permanently, the property of current holders
  - May be sold, leased, borrowed against, etc.
- Eligibility to acquire slots may be restricted
- *Key question: Ownership terms and acquisition method at the start.*
- Duration and terms of ownership are important in determining value of slots
- May be disincentive for capacity expansion

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Two Important Lessons

- Public policy objectives ("fairness", continuity, opportunity for new entrants, access for all operators, access for small communities) dictate use of hybrid demand management systems that combine administrative measures and market-based approaches
- The demand management systems that may eventually be implemented will have complex rules

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Example: Proposed Approach for LGA (for 1/1/07)

- FAA Notice of Proposed Rule Making, NPRM-LGA-8-29-06
- Combination of:
  - "Operating authorization" (= slots) for 75 scheduled movts per hour based on historic usage, plus 6 "reservations" for g.a.; allocation specified for 15-min intervals
  - Operating authorizations have varying expiration dates
  - Encourage larger aircraft; "size target" set annually
  - Airlines not meeting size target lose authorizations
  - Exemptions for flights to small communities
  - Secondary market available
- FAA to request authorization for possible future implementation of market-based approaches (congestion pricing or auctions)
- Dec 2006: FAA essentially extended *status quo*

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General observations on demand management

- Responsiveness to local characteristics is essential
- Most appropriate environment for application of market-based demand management approaches:
  - (True) Demand seriously exceeds capacity
  - Non-homogeneous traffic
  - Many airlines; no dominant ones
  - Mostly non-connecting traffic
  - Significant peaking of demand profile

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Conclusions

1. “Do nothing” policies lead to inefficient use of scarce resources at congested airports and invite excessive demand
2. No demand management approach is perfect
3. Schedule coordination is widely practiced outside the United States, with increasingly sophisticated rules; it can be effective at mildly congested airports, but may seriously distort market and reduce competition at airports with serious excess demand
4. Economic and hybrid approaches would seem more viable in the long run

Conclusions [2]

5. Marginal delay costs per operation at peak traffic hours can be very large
6. Applying congestion pricing to airports is difficult in practice and its effectiveness has not been demonstrated
7. Auctioning of airport slots is largely unexplored; many practical complications exist
8. Future may bring increased use of hybrid demand management systems combining use of slots, peak-period pricing, buy-and-sell and possibly other approaches