

SLOT VALUATIONS UNDER ALTERNATIVE INSTITUTIONAL ARRANGEMENTS

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Slot Valuations Under Alternative Institutional Arrangements

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→ What is a slot worth?

- Alternative valuation purposes
 - Operational value
 - Asset value
 - Estimates of "efficient" prices
 - Auctions
 - Congesting Pricing
- Present focus is on operational value of each flight at slot-controlled airports
 - Effect of Institutional Arrangements
 - Administrative allocation – assigned slots, weight-based fees
 - Congestion pricing – no slots, time-d-day fees
 - Auctions – slots with bidding

Slot Valuations Under Alternative Institutional Arrangements (Continued)

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→ Outline of Presentation

- History of Slots in the US
- Conventional Slot Valuations Based on Lease Values
- Alternative Method Based on Operational Network Opportunity Values

History of Slots in the U.S.

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→ HDR (1968)

- DCA, ORD, JFK, LGA, EWR (later exempted)
- Air Carrier, Commuter (jet<56 seats or prop<75 seats), Other
- LGA slots specified as takeoffs or landings; others can be used as either
- Scheduling Committees
 - Participating airlines decided how to allocate slots

	DCA	ORD	JFK	LGA
Air Carrier Slots	37	120	63-80	48
Commuter Slots	11	25	10-15	14
Other Slots	12	10	0-2	6
Total	60	155	73-97	68

Notes: ORD slots restricted to 105-40-10 at certain peak times
JFK slots apply only from 1500-1959

History of Slots in the U.S. (Continued)

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→ Buy-Sell Rule (1986)

- Slots grandfathered to incumbents
- Created secondary market for buyers and sellers
- Minimum usage requirement – initially 65% over 2 months, later 80%

→ Slot Exemptions (Mid-1990s)

- 3 types of exemptions
 - New international flights
 - New entrant in "extraordinary" circumstances
 - Essential air service (EAS) to small communities
- Cannot buy/sell exemptions
- 1997-98 – 30 new entrant exemptions approved at LGA, 53 at ORD

History of Slots in the U.S. (Continued)

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→ Air 21 (April 2000)

- Slot controls to be eliminated at ORD by July 2002; JFK and LGA by Jan 2007
- Slot controls to remain in effect at DCA
- Additional Exemptions
 - LGA – service by new entrants and for flights using aircraft 70 seats from "small" or "non-hub" airports
 - DCA – 12 exemptions for flights within 1250-mile perimeter rule, 12 exemptions for flights beyond perimeter rule

History of Slots in the U.S. (Continued)

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- LGA since Air 21
 - Over 600 exemption requests filed, over 300 additional flights operating by September 2000
 - Huge increase in delays
 - Moratorium in September 2000 on additional flights
 - January 2002 – Air 21 exemptions limited to 159 per day, reallocated via slot lottery for flights between 7am and 10pm
 - 75 commercial + 6 non-commercial flights per hour
 - 1500-mile perimeter rule remains in effect (except DEN)
 - December 2004 – 1,090 average daily scheduled operations
 - Largest slot holders – US Airways, Delta, American

History of Slots in the U.S. (Continued)

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- ORD since Air 21
 - HDR eliminated in June 2002
 - Muted impact initially due to 9-11
 - Over-scheduling by end of 2003 (100+ additional daily operations)
 - January 2004 – FAA-negotiated 5% reduction by AA and UA; vacated slots filled quickly by Northwest and Independence Air
 - June 2004 – Additional 2.5% reduction
 - December 2004 – 2,543 average daily scheduled operations

History of Slots in the U.S. (Continued)

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- JFK since Air 21
 - Large decline following 9-11
 - Slow recovery, significant capacity added in 2004 by Delta and Jet Blue – service now back to 2000 levels
 - December 2004 – 823 average daily scheduled operations
 - Largest slot holders – American, Delta

History of Slots in the U.S. (Continued)

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- DCA since Air 21
 - 24 additional slot exemptions issued to 8 different carriers (mainly LCCs)
 - GA flights prohibited since 9/11
 - December 2004 – 737 average daily scheduled operations
 - Largest slot holders – US Airways, Delta

Nature of Slot Transactions

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- Few outright sales
- Slots treated as quasi-permanent assets
- Strategic behavior by incumbents based on potential network opportunity costs and knowledge of who current and potential competitors are—hoarding and babysitting
- Value of slots higher as a package than individually—incumbents want full package value of each slot, but potential buyers may not be willing to pay full package value for a single slot

Distress Sales

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Loss Carrier Code	Loss Carrier Name	Gain Carrier Code	Gain Carrier Name	Slots	Year	NOTE
0042	FIRST SECURITY BANK NATIONAL (IN TRUST)	TWA	TWA AIRLINES, LLC (TWA INC. (IN TRUST))	32	2001	
TWA	TWA AIRLINES, LLC (TWA INC. (IN TRUST))	JAL	AMERICAN AIRLINES	28	2001	
TWA	TWA AIRLINES, LLC (TWA INC. (IN TRUST))	JAL	AMERICAN AIRLINES	14	2002	Bank of TWA to AA
TWA	TWA AIRLINES, LLC (TWA INC. (IN TRUST))	EGP	MIR EAGLE HOLDING CORP. (FORMERLY AMR EAGLE INC.)	10	2002	
ASH	MESA AIR (d.b.a. LIBERTY) (OP. FLA GOLF)	ALD	ALLEGHENY COMMUTER	1	2001	
CHD	CHALTAOUDA	ALD	ALLEGHENY COMMUTER	1	2001	Trade within US Air Company group
0040	MITSUBISHI BANK LIMITED	TWA	NORTHWEST AIRLINES	14	2001	
NWA	NORTHWEST AIRLINES	001	PENSION BENEFIT GUARANTY CORPORATION	14	2001	TWA Changes
ACA	AIR CANADA	000	WELLS FARGO BANK NORTHWEST, S.A.	14	2001	
0001	FAA (TEMPORARY HOLDER)	00M	DOMAIR AIRLINES	1	2002	
0001	FAA (TEMPORARY HOLDER)	00A	US AIRWAYS	1	2004	Slot Purchase from FAA
00AL	AMERICAN AIRLINES	001	FAA (TEMPORARY HOLDER)	1	2001	
00AL	AMERICAN AIRLINES	001	FAA (TEMPORARY HOLDER)	1	2001	Slot Purchase by FAA
00AA	US AIRWAYS	001	FAA (TEMPORARY HOLDER)	2	2004	
USA	US AIRWAYS	EGP	MIR EAGLE HOLDING CORP. (FORMERLY AMR EAGLE INC.)	5	2002	
ALD	ALLEGHENY COMMUTER	EGP	MIR EAGLE HOLDING CORP. (FORMERLY AMR EAGLE INC.)	10	2003	Annual Slot Sales / Transfer
USA	US AIRWAYS	EGP	MIR EAGLE HOLDING CORP. (FORMERLY AMR EAGLE INC.)	1	2004	

Slot Consolidation Over Time

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Percentage of Domestic Air Carriers Slots held by Major Airlines at U.S. High Density Airports

Airport	Holding Entities	1986	1991	1996	1999
Chicago O'Hare	American and United	66	83	87	84
New York JFK	Shawmut Bank, American and Delta	43	60	75	84
LaGuardia	American, Delta and US Airways	27	43	64	70
Washington National	American, Delta and US Airways	25	43	59	65

Source: GAO (1999)

- Note: Shawmut Bank was holder of TWA's slots.

Swaps and Leasing

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- Swaps
 - Fairly commonplace for scheduling and logistic reasons
- Leasing
 - More attractive than sales; holder retains control
 - Short-term agreements with early termination clauses
 - Leasing to new entrants is rare (seen as lower-cost direct competitors in larger point-to-point markets)

Factors Affecting Slot Valuations Under Current Administrative Regimes

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- Airport-specific features
 - Perimeter rules—reduces slot values
 - Exemptions—reduces slot values
 - Availability of related infrastructure—gates, hold rooms, baggage facilities (at LGA, gate capacity far outstrips runway capacity, so not a major issue)
- Other Considerations
 - Slots can be withdrawn at any time by FAA/DOT (carriers have no legal ownership)—but holders typically value them as if they were the owners
 - Air carrier vs. commuter slots
 - Time-of-day valuations
 - "Other" slots (for GA, military, etc) have no market value—allocated on a first-come, first-serve basis; cannot be traded, sold or leased; not required during VFR conditions

Valuation Studies

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- Many valuation studies have been done for air carriers seeking loans or loan guarantees from ATSB
 - Limited evidence from slot sales
 - 12 transactions between 1990 and 1997 at DCA—average slot sold at about \$1,000,000 U.S.
 - US Airways proposed sale of 119 air carrier slots and 103 commuter slots at DCA to DC Air for \$141 million—implied values of \$950,000 per air carrier slot, \$300,000 per commuter slot
 - Income approach—project future income stream created when slots are leased to another airline on a long-term basis
 - Caveat—valuation studies are being used to reflect asset-backing for loans; incentive to overstate values

Typical Slot Valuations Based on Long-Term Lease Rates

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- Typical Slot Valuations Using Income Approach at LGA and DCA

	LGA			DCA		
	0600-1430	1430-1930	1930-2130	0700-1400	1400-1900	1900-2100
Monthly Lease Rate	\$10,000	\$20,000	\$5,000	\$17,000	\$25,000	\$17,000
Implied Daily Slot Value	\$333	\$667	\$167	\$567	\$833	\$567
Term (months)	24	24	24	53	53	53
Total Lease Payments	\$240,000	\$480,000	\$120,000	\$901,000	\$1,325,000	\$901,000
NPV @5%	\$227,939	\$455,878	\$113,969	\$806,949	\$1,186,690	\$806,949
NPV @15%	\$206,242	\$412,485	\$103,121	\$655,952	\$964,635	\$655,952

Factors Influencing Observed Lease Rates

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- Strategic and competitive issues
- Financial weakness of large buyers and/or large sellers
- Liquidation issues
- Increasing effect of LCC entry over time (thru exemptions)
- Wedge between observed lease rates and marginal profit opportunities

Alternative Method Based on Operational Network Opportunity Values

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- Slot Valuations Based on Marginal Profitability Contribution
 - Bottoms-Up Flight Profitability Analysis
 - Profitability estimates should reflect marginal **NETWORK OPPORTUNITY** values
 - Network—Flight profitability estimates account for network impacts (effects in multiple origin-destination markets for any given segment flight)
 - Opportunity—Flight profitability estimates reflect network contribution of flight (i.e., network value with and without flight), not just on-board revenues vs. costs
 - Caveat—net marginal contribution to carrier does NOT equate to socially efficient prices due to congestion externalities
 - Own delay vs. others' delay
 - Passenger delay

Analysis Structure

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- Current Administrative Regime
 - Select slot-controlled airport, baseline schedule and fees
 - Value marginal network contribution of each flight offer (including own-delay effects)
 - For each carrier, compute O-D revenues and segment costs (including own delay) for all flights to and from given airport
 - Remove flight from schedule
 - Re-allocate traffic
 - Re-compute carrier revenues and costs
 - Difference between network revenues with and without flight = network contribution of flight for baseline schedule
- Alternative Institutional Arrangement
 - Impose demand management scheme (e.g., congestion pricing)
 - Estimate carrier responses (flight cancellations or moves)
 - Re-value network contribution of each flight offer

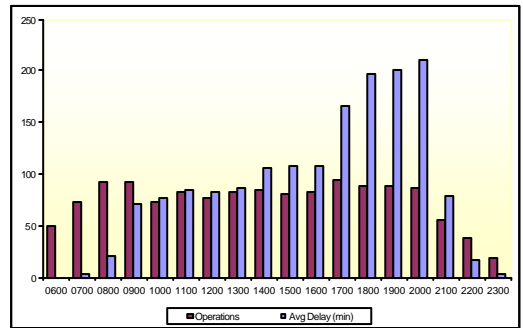
Application to LGA

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- NEXTOR consortium—strategic simulations of congestion pricing and auctions
- Representative day for Baseline—15 November 2000 (Air 21 before restrictions)
- Very high demand (1350 ops) and high delays (avg. 100 minutes per flight)
- Caveats
 - Air 21 land rush—estimated market sizes and fares may not fully reflect increased supply of air services
 - Primarily local demand

LGA Operations and Estimated Delay Following Air 21

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Network Revenue and Segment Cost Modeling Details

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- Revenues
 - Identify all O-D markets with at least one service offer touching LGA
 - Use QSI model (flight offers, equipment, service type, time of day) to estimate market shares
 - Combine with market sizes and fares to estimate network revenues for each segment flight arriving or departing LGA
- Costs
 - Carrier- and equipment-specific block-hour cost data used to estimate segment operating costs
 - Own delay costs estimated via delay model that computes minutes of delay as a function of total hourly flights at airport

Sample O-D Markets Served on a Single Flight Segment

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Flight Offers in O-D Markets Served by US Airways #3639 LGA-PVD								
MKTPAIR	US	AA	CO	DL	NW	UA	WN	Grand Total
BHM-PVD	10			1	8	2		24
BUF-PVD	6	3	3	3				15
BWI-PVD	22	2	2				14	40
CHO-PVD	6					4		10
CHS-PVD	11			2		4		17
CLT-PVD	28		3					31
DCA-PVD	15	3	3	5				26
GRR-PVD	4		3		5			12
ISS-PVD	13	3	2	2		4		24
JSP-PVD	3	3	2	1		4		13
JAD-PVD	8		2			4		14
JTH-PVD	5							5
JAX-PVD	12		1	5			3	21
LGA-PVD	7	6		5				18
PIT-PVD	26	3	2			4		35
RDU-PVD	14	2	2	2		4	4	28
RIC-PVD	14	2	2	3		4		25
ROC-PVD	7	5	3	3				18
SDF-PVD	11	3	2	3	4	4		24
TPA-PVD	17	1	3	6		2		29
Grand Total	241	33	37	47	10	38	33	439

Carrier Opportunity Cost

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- Individual flight profitability based on opportunity cost to carrier
 - Net Revenue Contribution = sum of O-D revenues across all carrier flights with and without individual flight
 - Without flight, passengers are re-allocated to remaining flight offers in each O-D market based on QSI, subject to equipment capacity constraints
 - Airport delays are reduced to remaining flights
- Primary Profitability Drivers
 - Time-of-day Delay
 - Flights later in the day subject to more accumulated delay
 - Do carriers really internalize delay costs???
 - Equipment Type

Average Daily Slot Valuations by Time of Day at LGA Under Air 21 Based on Network Profitability

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Equipment Type	Time-of-Day		
	0600-1430	1430-1930	1930-2130
Props	\$14	---	---
Regional Jets	\$364	\$233	\$111
Standard Narrowbodies	\$4,520	\$3,924	\$3,366
Average	\$2,721	\$2,442	\$2,027

Modeling Carrier Responses to Imposition of Congestion Prices

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- Assume time-of-day congestion prices are imposed in lieu of weight-based fees
- Congestion fee acts as an increase in segment costs
- Compute revised network contribution
- Assume least profitable pair of flights (one arrival and one departure) is cancelled (or moved)
- Re-allocate passengers and re-compute delays
- Continue canceling pairs of flights until all remaining flights make minimum acceptable network contribution (> -10% margin)

Congestion Fees

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Congestion Fee Scenario at LGA Under Air 21	
0000	\$275
0100	\$275
0200	\$275
0300	\$275
0400	\$275
0500	\$275
0600	\$275
0700	\$1,200
0800	\$1,200
0900	\$1,200
1000	\$1,200
1100	\$1,400
1200	\$1,200
1300	\$1,400
1400	\$1,400
1500	\$1,400
1600	\$1,400
1700	\$1,800
1800	\$1,800
1900	\$1,800
2000	\$1,800
2100	\$1,200
2200	\$275
2300	\$275

Cancellations Under Congestion Fee Scenario at LGA

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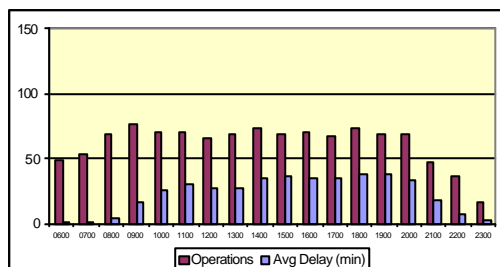
Equipment Type	Time-of-Day				Total
	0600-1430	1430-1930	1930-2130	Other	
Props	73 of 124 (59%)	48 of 79 (61%)	15 of 26 (58%)	0 of 3 (0%)	136 of 232 (59%)
Regional Jets	13 of 152 (9%)	17 of 89 (19%)	9 of 46 (20%)	1 of 5 (20%)	40 of 292 (14%)
Standard Narrowbodies	20 of 386 (5%)	19 of 263 (7%)	7 of 98 (7%)	2 of 67 (3%)	48 of 814 (6%)
TOTAL	106 of 662 (16%)	84 of 431 (19%)	31 of 170 (18%)	3 of 75 (4%)	224 of 1338 (17%)

- Additional 44 flights moved one hour ahead or back

LGA Operations and Delay After Imposition of Congestion Pricing

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- Scheduled Demand Reduced from 1350 to 1126 Operations; Avg Delay Reduced from 100 minutes to 25 minutes



Average Daily Slot Valuations by Time of Day at LGA Under Congestion Fee Scenario

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Equipment Type	Time-of-Day		
	0600-1430	1430-1930	1930-2130
Props	\$644	\$336	\$865
Regional Jets	\$849	\$860	\$455
Standard Narrowbodies	\$5,879	\$6,112	\$4,800
Average	\$4,252	\$4,596	\$3,635

Caveats and Limitations

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- Data
- Strategic or long-term behavior not captured
- Second-best opportunity cost assumed to be zero
- Flight operations valued sequentially at the margin
- Profit opportunities across entire network vs. single airport
- JFK and EWR effects
- No consideration of equipment up-gauging
- No consideration of secondary market transactions

Conclusions

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- What is a Slot Worth? LGA Evidence:
 - Observed lease rates imply relatively low slot values – \$200-\$700 per operation
 - Operational values under extreme activity levels (based on opportunity costs and including delays)
 - Very low for props and regional jets – \$100-300
 - Very high for standard jets – \$4,000
 - Operational values under congestion pricing and current activity levels
 - Low for props and regional Jets – \$300-\$800
 - Highest for standard jets – \$5,500
- Implications for Congestion Pricing / Auctions