

History of the Slot Exchange Market in the US and Some Implications

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History of Slots in the U.S.

✈ 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



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

→ 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)

→ 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)

➔ 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
- HDR expired at LGA 1/1/07; replaced by temporary authorizations



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

→ 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
- August 2006: FAA final rule limiting operations until first phase of ORD expansion is completed in ~2008



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

→ 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
- Slots expired 1/1/07



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

➔ 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 under HDR

- Many sales among haves but few outright sales between haves and have-nots
- 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

SLOT EXCHANGES SINCE 2001

Lose Carrier Code	Lose Carrier Name	Gain Carrier Code	Gain Carrier Name	Slots	Year	NOTE
0042	FIRST SECURITY BANK, NATIONAL (as Trustee)	TWA	TWA AIRLINES, LLC (TWA INC. prior to 4/9/01)	52	2001	
TWA	TWA AIRLINES, LLC (TWA INC. prior to 4/9/01)	AAL	AMERICAN AIRLINES	28	2001	
TWA	TWA AIRLINES, LLC (TWA INC. prior to 4/9/01)	AAL	AMERICAN AIRLINES	14	2002	Sale of TWA to AA
TWA	TWA AIRLINES, LLC (TWA INC. prior to 4/9/01)	EGF	AMR EAGLE HOLDING COPR. (FORMERLY AMR EAGLE INC.)	10	2002	
ASH	MESA AIR d.b.a. LIBERTY EXP./FLA GULF	ALO	ALLEGHENY COMMUTER	1	2001	
CHQ	CHAUTAUQUA	ALO	ALLEGHENY COMMUTER	1	2001	Trade within US Air Commuter group
0040	MITSUBISHI BANK, LIMITED	NWA	NORTHWEST AIRLINES	25	2002	
NWA	NORTHWEST AIRLINES	0051	PENSION BENEFIT GUARANTY CORPORATION	49	2003	Title Changes
ACA	AIR CANADA	0050	WELLS FARGO BANK NORTHWEST, N.A.	45	2003	
0001	FAA (TEMPORARY HOLDER)	COM	COMAIR AIRLINES	1	2002	
0001	FAA (TEMPORARY HOLDER)	USA	US AIRWAYS	3	2004	Slot Recapture from FAA
AAL	AMERICAN AIRLINES	0001	FAA (TEMPORARY HOLDER)	1	2003	
AAL	AMERICAN AIRLINES	0001	FAA (TEMPORARY HOLDER)	1	2004	Slot Recapture by FAA
USA	US AIRWAYS	0001	FAA (TEMPORARY HOLDER)	2	2004	
USA	US AIRWAYS	EGF	AMR EAGLE HOLDING COPR. (FORMERLY AMR EAGLE INC.)	5	2003	
ALO	ALLEGHENY COMMUTER	EGF	AMR EAGLE HOLDING COPR. (FORMERLY AMR EAGLE INC.)	10	2003	Actual Slot Sales / Transfer
USA	US AIRWAYS	EGF	AMR EAGLE HOLDING COPR. (FORMERLY AMR EAGLE INC.)	3	2004	



Slot Consolidation Over Time

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

→ 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 Administrative Regimes

→ Airport-specific features

- Perimeter rules—reduces slot values
- Exemptions—reduces slot values
- Availability of related infrastructure—gates, hold rooms, baggage facilities

→ Other Considerations

- Slots could 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

- ➔ Many valuation studies have been done for air carriers seeking financing
 - 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
 - Little activity after 2001
 - Income approach—project future income stream created when slots are leased to another airline on a long-term basis



Typical Slot Valuations Based on Long-Term Lease Rates

➔ 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



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

	Time of Day		
	0600-1430	1430-1930	1930-2130
Daily Value	\$1,574	\$62	\$762
One Year Value (15%; 365 Days)	\$572,828	\$22,564	\$277,316
Five Year Value (15%)	\$2,208,241	\$86,983	\$1,069,047

Note: Average Values are higher than transactions prices because they include flights to hubs and other restricted airports, which are more likely to be profitable and less likely to be sold.



New “Authorizations” at ORD and LGA

NEW TEMPORARY AUTHORIZATIONS

	ORD	LGA
Authorizations	Arrivals only	Arrivals & Departures
Number: weekdays	88/hr 0700-1959 98/hr 2000	75 hour
Duration/Life	2008	Undefined
Buy	Yes via blind market	No
Lease	Yes via blind market	Yes
Exchange*	No (cash only)	Yes
New International	Yes; no withdrawals**	NA
Usage	80%	80%

* Were permitted before ORD rule went into effect.

** Cannot be sold



LGA Transactions Since January 1, 2007

Time	A/D	Lose Carrier	Gain Carrier	Frequency
900	D	COA	DAL	12345
1030	A	DAL	AAL	23
1900	A	DAL	AAL	23
2000	A	ACA	COA	12345 7
2000	A	ACA	COA	12345 7
630	D	AAL	MEP	12345
630	D	AAL	MEP	12345
2000	D	AAL	COA	7
800	A	NWA	DAL	12345
700	D	ACA	DAL	12345
730	A	DAL	JZA	12345
1200	A	ACA	UAL	12345 7
1230	A	UAL	ACA	12345 7
1530	A	UAL	ACA	12345 7
1930	D	UAL	ACA	12345 7
2000	D	NWA	AAL	12345 7
1430	A	USA	AMT	12345 7
1730	A	UAL	TRS	12345 7
1800	D	UAL	TRS	12345 7
1630	D	NWA	AAL	12345 7
1730	A	UAL	ACA	12345 7
1800	D	UAL	ACA	12345 7
1530	A	UAL	ACA	12345 7
1930	A	UAL	ACA	12345 7
1730	A	UAL	TRS	12345 7



MCF Transactions Since January 1, 2007

Time	A/D	Lose Carrier	Gain Carrier	Frequency
900	D	USA	UAL	12345
2000	A	NWA	USA	12345 7
1900	A	USA	NWA	12345 7
630	D	AAL	DAL	4
1630	D	PDT	NWA	7
1200	D	USA	DAL	7
2000	D	USA	AAL	7
1230	D	USA	EGF	7
1600	A	USA	AAL	7
2130	A	USA	AAL	7
1330	A	USA	AAL	7
1200	D	USA	EGF	7
1330	D	CHQ	AAL	7
1330	D	CHQ	AAL	7
2100	A	DAL	AAL	7
2100	A	DAL	AAL	7
1430	A	DAL	AAL	12345 7
2030	D	DAL	AAL	2
1000	D	DAL	AAL	2
1530	D	AMT	DAL	12345 7
1430	A	AMT	DAL	12345 7
600	D	AMT	AAL	12345
2130	A	AMT	AWI	12345 7

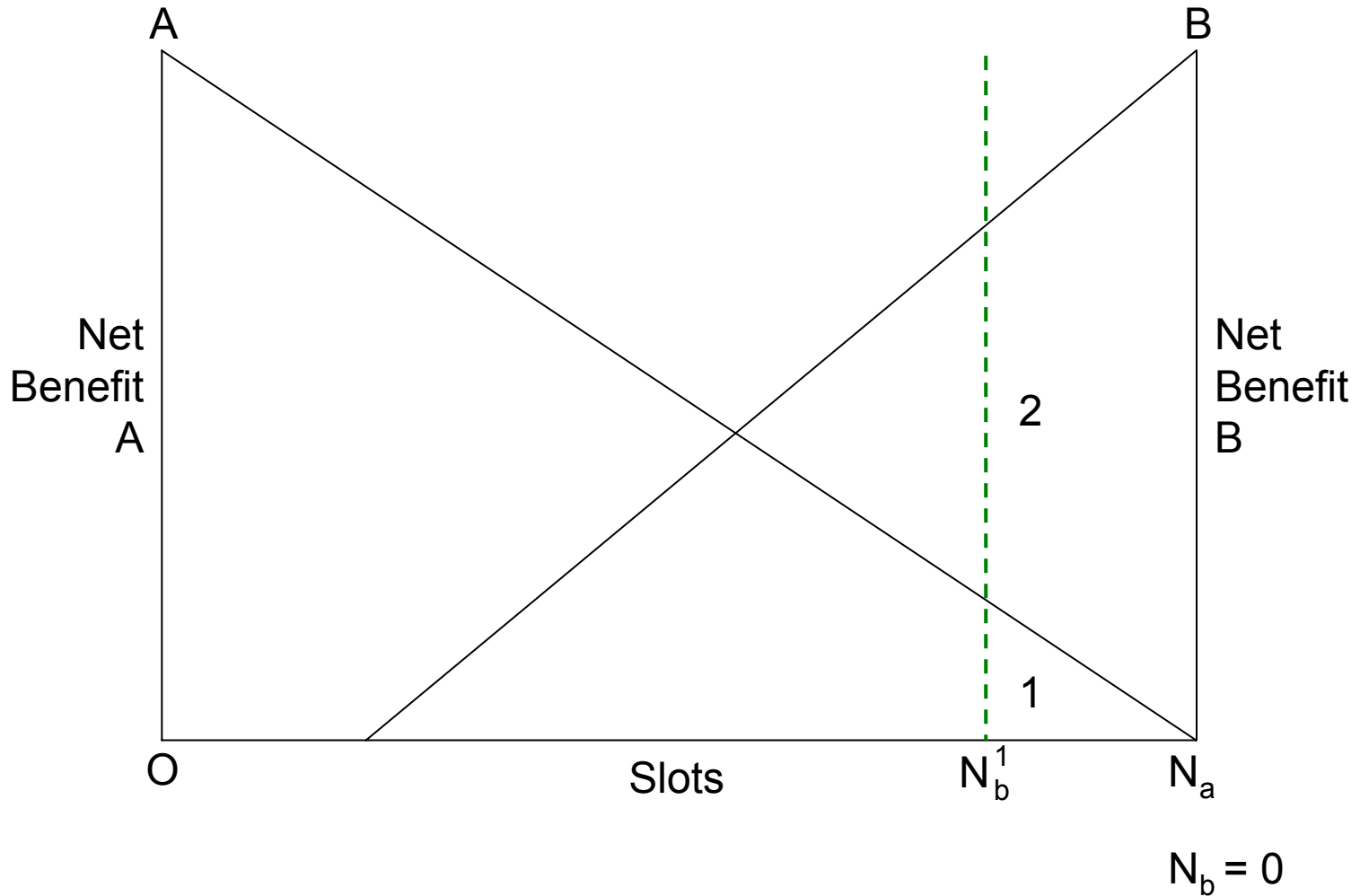


ORD Transactions Since January 1, 2007

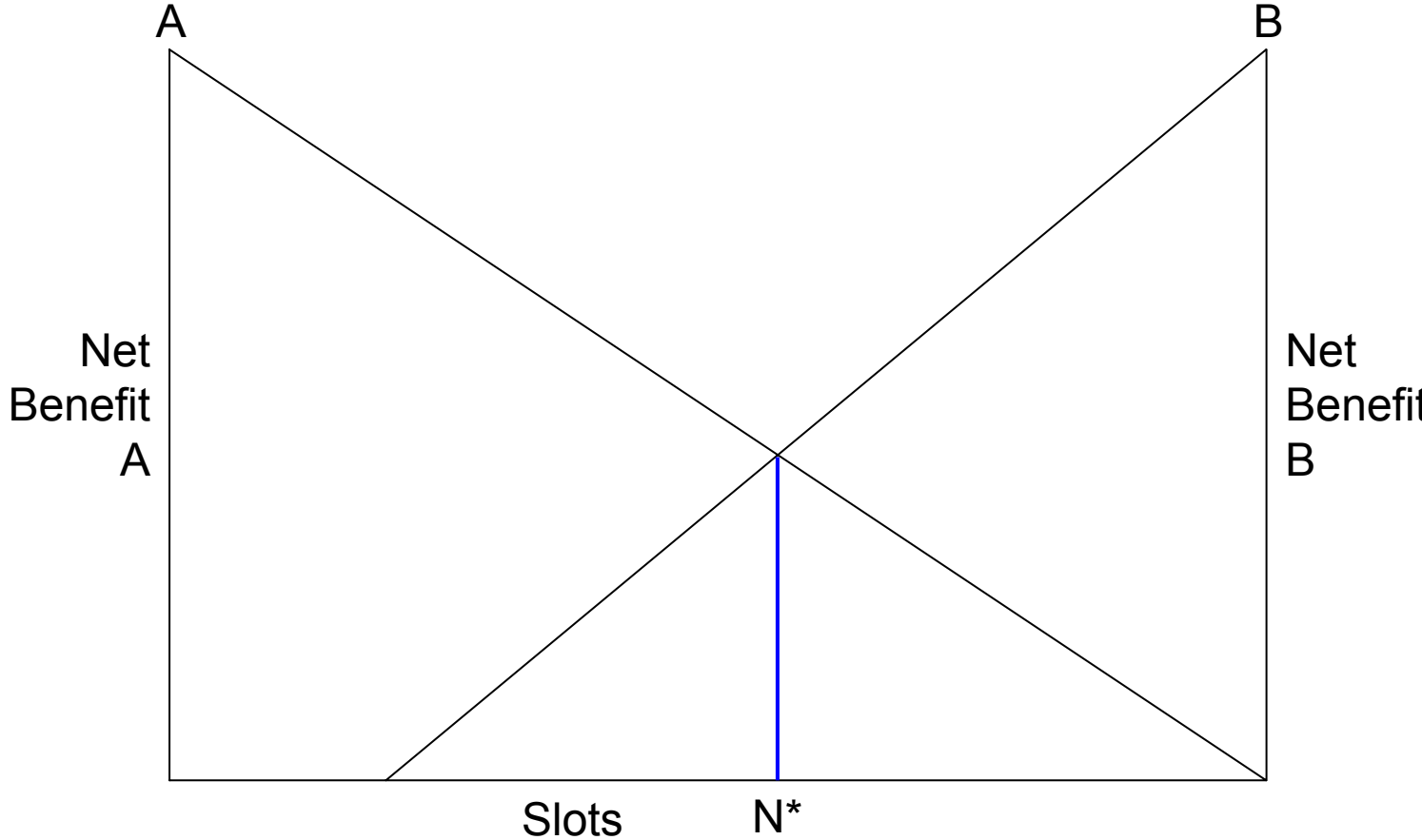
Time	A/D	Lose Carrier	Gain Carrier	Frequency
2030	A	NKS	UAL	12345 7
1900	A	NWA	JBU	12345 7
930	A	NKS	UAL	12345
930	A	NKS	UAL	12345
1100	A	ACA	UAL	12345
1300	A	NKS	UAL	12345 7
1630	A	NKS	UAL	12345 7
1730	A	NKS	UAL	12345 7
1930	A	NKS	UAL	12345 7
830	A	ACA	UAL	12345
900	A	ACA	UAL	12345
1030	A	ACA	UAL	12345
1330	A	ACA	UAL	12345 7
1630	A	ACA	UAL	12345 7
1830	A	ACA	UAL	12345 7
1300	A	USA	UAL	12345 7
1630	A	USA	UAL	12345 7
1830	A	USA	UAL	12345 7
900	A	NWA	UAL	12345
1500	A	UAL	NKS	12345 7



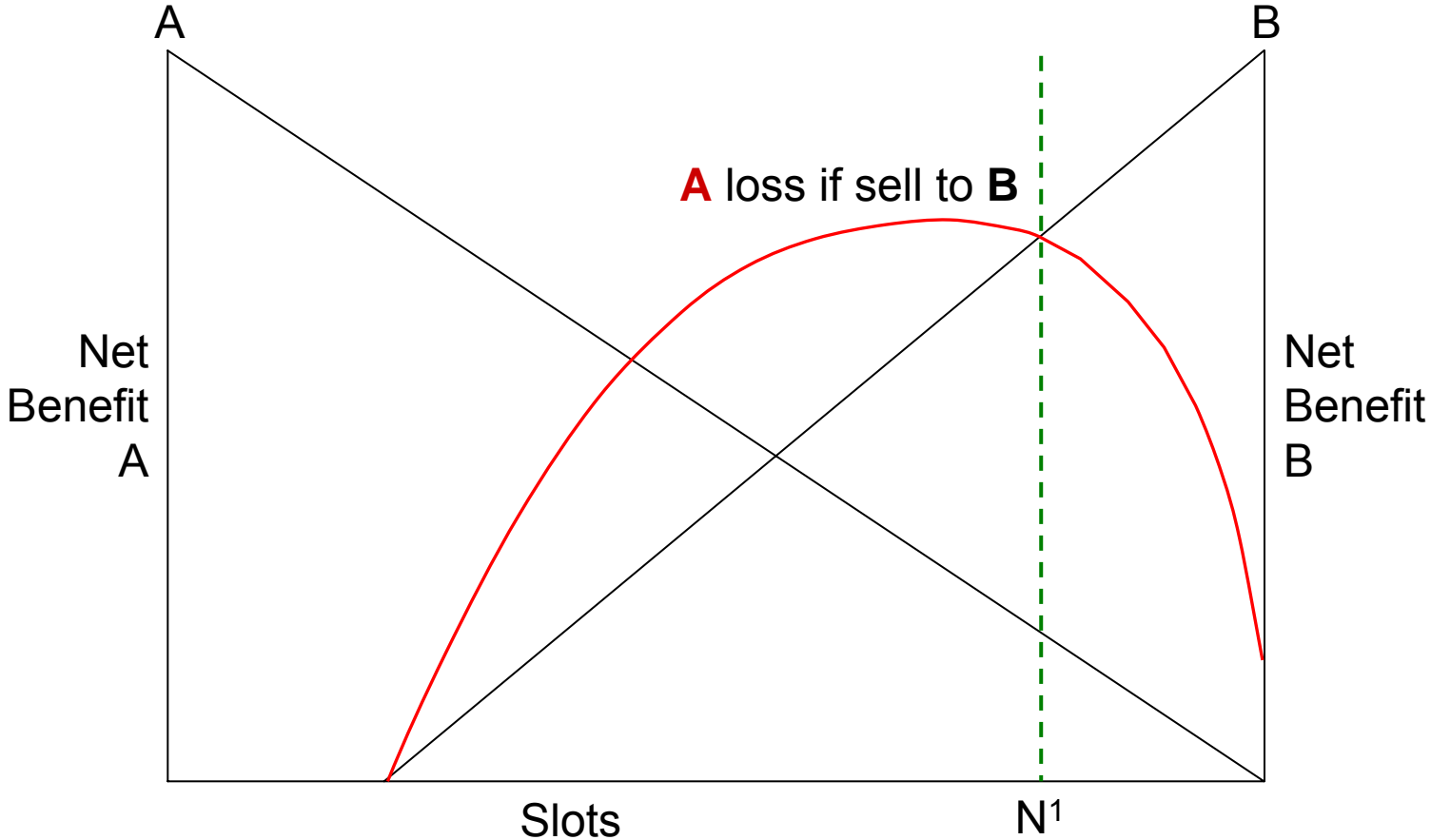
Net Benefits of a Slot Trade: Non-Competing Carriers



Idealized Trade Among Non-Competing Carriers



Limited Sales When Carriers Compete



Key Features of Secondary Markets

SOME KEY DESIGN FEATURES OF SECONDARY MARKETS		
Definition of slot	Right to take off or land	Access to all facilities
Slot property	FAA	Non federal entity
Domestic/Int'l Distinction	Yes	No
Exchange	Among airlines Sale, lease, barter Sponsored "market" Blind	Among any parties None or a subset Informal Parties known
Use of lose	Yes Bankruptcy provisions	No No
Life	Indefinite or permanent	Finite
Initial allocation	Grandfather	Other
Allocation of New Capacity	Market	Lottery



HDR SECONDARY MARKET

SECONDARY MARKET FOR HDR SLOTS		
Definition of slot	Right to take off or land	Access to all facilities
Slot property	FAA	Non federal entity
Domestic/Int'l Distinction	Yes	No
Exchange	Among airlines	Among any parties
	Sale, lease, barter	None or a subset
	Sponsored "market"	Informal
	Blind	Parties known
Use of lose	Yes	No
	Bankruptcy provisions	No
Life	Indefinite or permanent	Finite
Initial allocation	Grandfather	Other
Allocation of New Capacity	Market	Lottery



Idealized Design

AN ECONOMIST'S IDEALIZED DESIGN

Definition of slot	Right to take off or land	Access to all facilities
Slot property	FAA	Non federal entity
Domestic/Int'l Distinction	Yes	No
Exchange	Among airlines Sale, lease Sponsored "market" Blind	Among any parties None or a subset Informal Parties known
Use of lose	Yes Bankruptcy provisions	No No
Life	Indefinite or permanent	Finite
Initial allocation	Grandfather	Other
Allocation of New Capacity	Market	Lottery



One Design

ONE POTENTIALLY FEASIBLE DESIGN		
Definition of slot	Right to take off or land	Access to all facilities
Slot property	FAA	Non federal entity
Domestic/Int'l Distinction	Yes	No
Exchange	Among airlines Sale, lease Sponsored FAA "market" Blind	Among any parties None or a subset Informal Parties known
Use of lose	Yes Bankruptcy provisions	No No
Life	Indefinite or permanent	Finite
Initial allocation	Grandfather	Other
Allocation of New Capacity	Market	Lottery



Factors Influencing Observed Lease Rates

- 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

- ➔ 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



Network Revenue and Segment Cost Modeling Details

→ 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

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		3	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
GSO-PVD	12	3	2	2		4		23
GSP-PVD	9	3	2	1		4		19
IAD-PVD	8		2			4		14
ITH-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	8		3	2	3	4	4	24
TPA-PVD	17	1	3	6		2	5	34
Grand Total	241	33	37	47	10	38	33	439



Carrier Opportunity Cost

- 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
 - Carriers internalize own delay costs
 - Equipment Type

