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Airport Congestion Issues — Theory and Practices

Empirical Analysis of Airport Slot Trading in the U.S.

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ITPU セミナー
空港における混雑を巡る課題 — その理論と実務

米国における空港発着枠取引の経験的分析

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Research Purpose

- Purpose
  - Examine the openness and competitiveness of slot markets in the United States
- Why examine slot markets?
  - A relatively long history dating back to 1986
  - Very few empirical studies
- This research is an attempt to fill gaps in previous studies.

研究の目的

- 目的
  - 米国の発着枠市場の開放性と競争性の検討
- なぜ発着枠市場の検討なのか？
  - 1986年にまで遡る比較的長い歴史
  - にもかかわらず、経験的研究は少ない
- この研究は、先行研究の欠落を補う試み

Brief Background

- Slot allocation before the introduction of slot market
  - Unanimous agreement of scheduling committees
    - The committees consisted of all the carriers that served or wanted to serve the airports
  - At times deadlocked (e.g., National in 1980)

- Early proposal for the introduction of market-based method of slot allocation (at National)
  - Proposed in 1980 (Notice No. 80-16; 45 FR 71236)
  - Two alternatives
    - Administrative assignment
    - Auction
  - Not implemented

- Slot market (at National, Kennedy, LaGuardia, and O'Hare)
  - Proposed in 1984; Implemented in 1986 (50 FR 52161; 14 CFR 93.221)
  - Slots could be bought, sold or leased for any consideration and any time period
  - Caused considerable debate

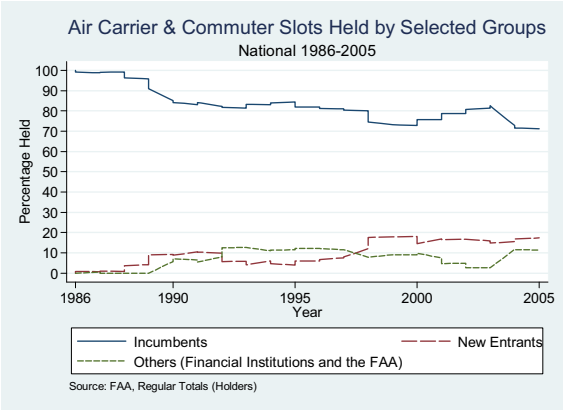
背景の概説

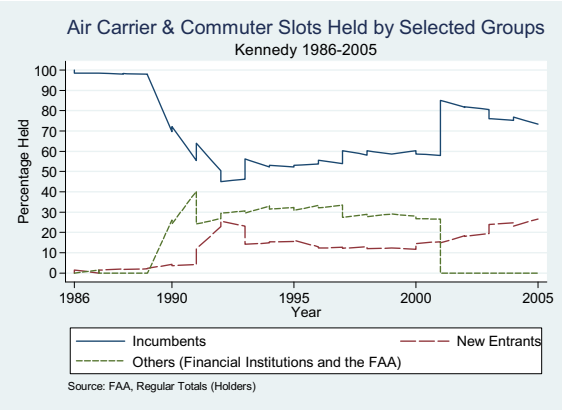
- 発着枠市場導入以前の発着枠配分
  - 運航計画策定委員会の全会一致の合意による配分
    - 委員会は、当該空港で運航していた航空会社と運航を希望する航空会社により構成
  - 全会一致の合意が得られないこともあった（例：1980年のナショナル空港）

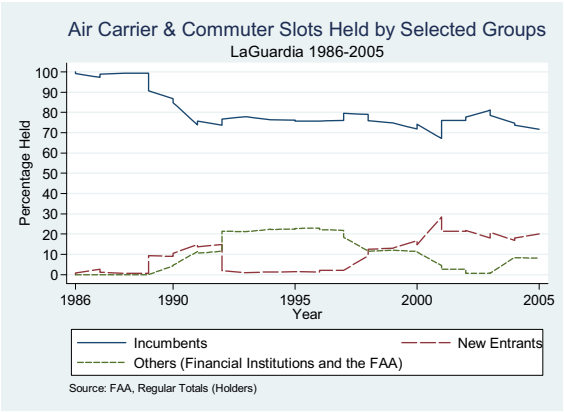
- 市場基底的な発着枠配分手法導入の初期の提案（ナショナル空港）
  - 1980年に提案 (Notice No. 80-16; 45 FR 71236)
  - 2つの選択肢
    - 行政による割当
    - オークション
  - 実施されず

- 発着枠市場（ナショナル空港、ケネディ空港、ラガーディア空港、オヘア空港）
  - 1984年に提案; 1986年に実施 (50 FR 52161; 14 CFR 93.221)
  - 発着枠は、対価及び期間を問わず、売買・貸借が可能に
  - 大きな論争を引き起こした

Figure 1: Purchase of slots has been difficult for new entrants







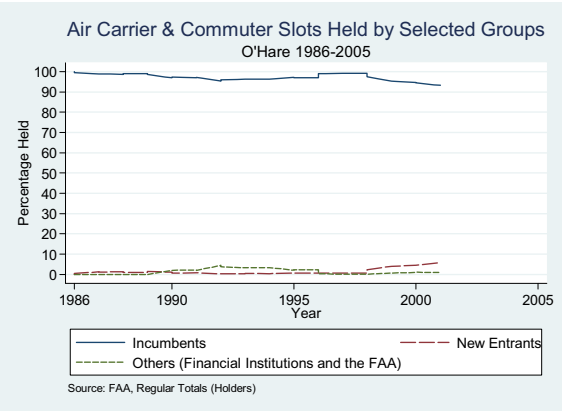
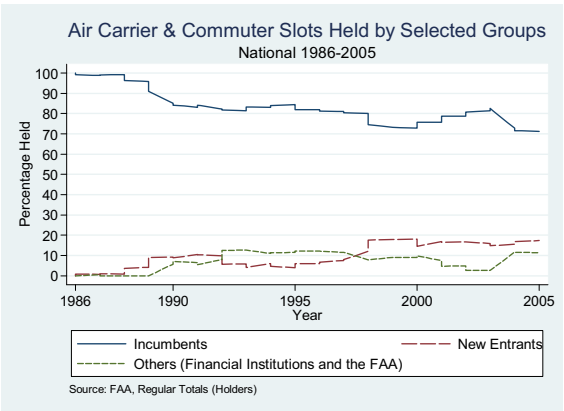
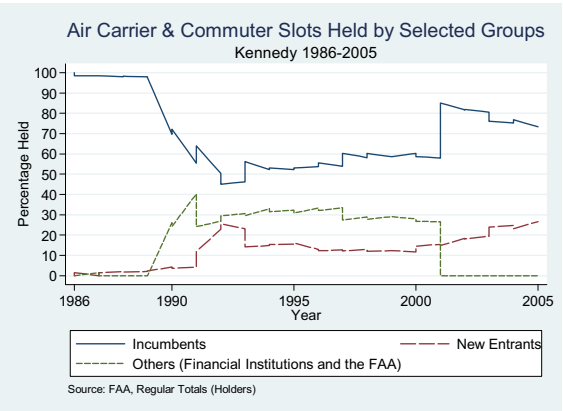
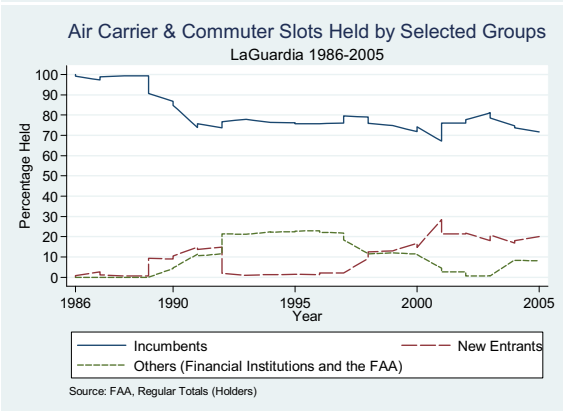


図 1:新規参入者にとって、発着枠の購入は困難であった







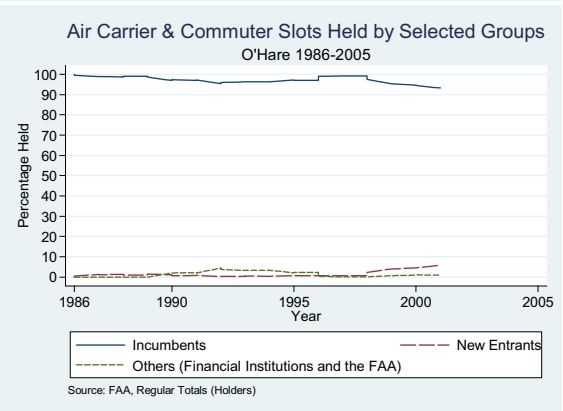


Figure 2: Purchase of slots has been also difficult for non-majors

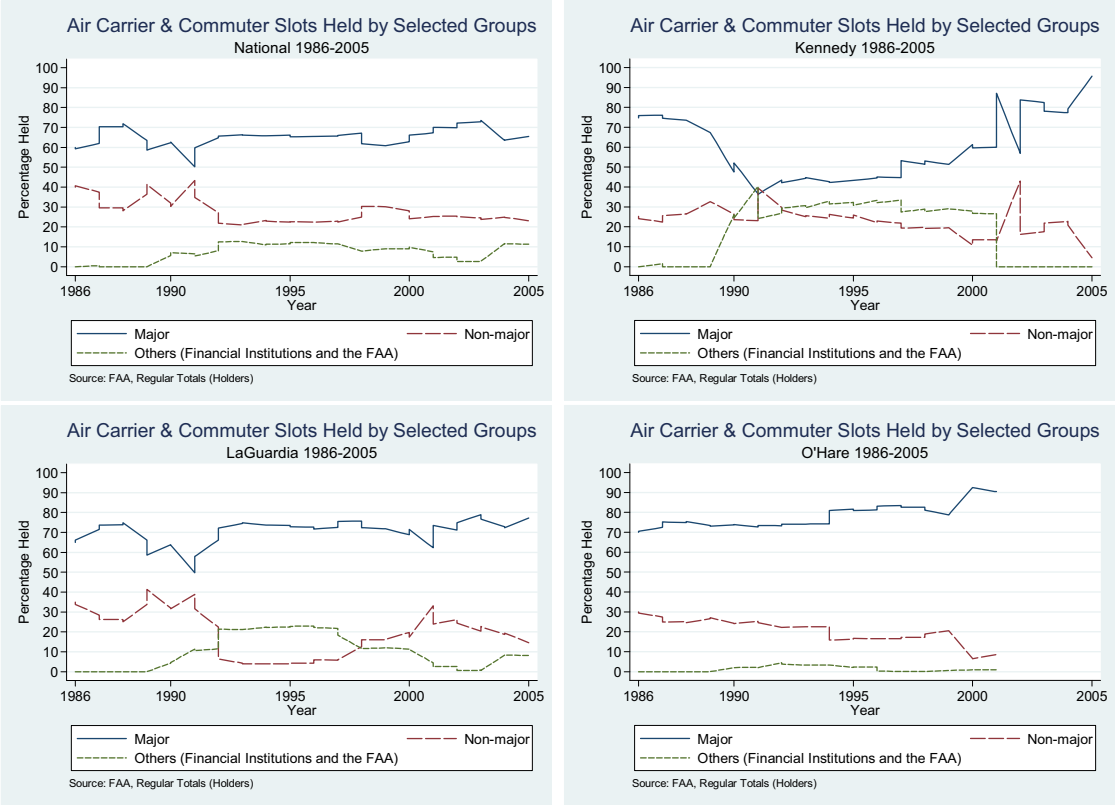
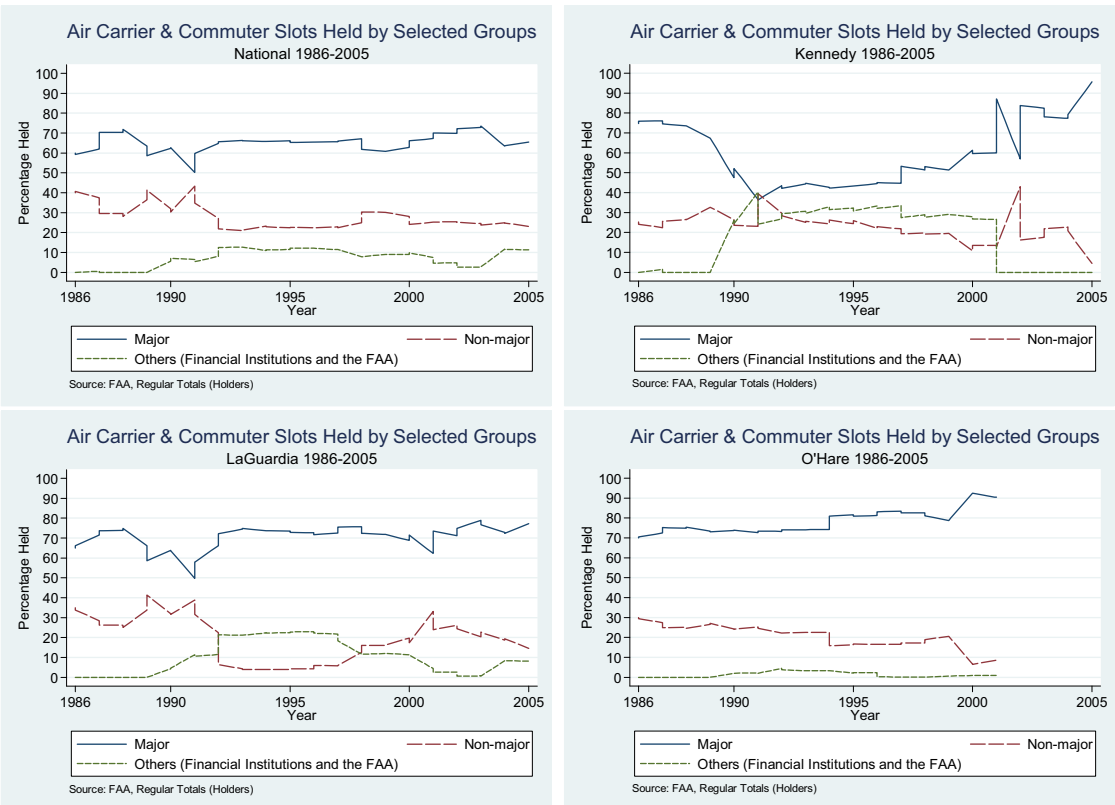


図 2:非大手にとっても、発着枠の購入は困難であった



Allegations by new entrants and non-majors

- "ValuJet [now AirTran] and other low fare carriers have been the object of discrimination by large, established, high cost carriers, the vast majority of which attempt to exclude the low fare carriers from the … slot market."
  - ValuJet Airlines, OST-1997-2442-6, June 11, 1997

- "…major-incumbent slot holders are routinely able to use their slot holdings to exclude the price-based competition of smaller, low-cost airlines…"
  - Midway Airlines, OST-2000-6970-1, February 22, 2000

- "While some large carriers have claimed that all carriers have the ability to purchase or lease slots, that statement is not based on fact. Most slot sales and transactions involve only two carriers. New entrants and low-fare carriers are rarely offered slot transactions."
  - AirTran Airways, OST-2000-7182-693, November 14, 2003

新規参入航空会社と非大手航空会社の申し立て

- 「ヴァリュジェット[現エアトラン]及び他の低運賃航空会社は、コストの高い著名な大手航空会社による差別の対象となってきた。実際、大手の多くは、低運賃航空会社を……発着枠市場から閉め出そうとしている。」
  - ValuJet Airlines, OST-1997-2442-6, June 11, 1997

- 「既存大手の発着枠保有者は、より小規模でコストの低い航空会社による価格ベースの競争を排除するために、その保有発着枠を日常的に利用することができる。」
  - Midway Airlines, OST-2000-6970-1, February 22, 2000

- 「いかなる航空会社も発着枠を購入または借用することができる、と主張する大手航空会社もあるが、その発言は事実に基づくものではない。ほとんどの場合、発着枠売却・取引に関与するのは、2社のみである。新規参入者や低運賃航空会社が発着枠取引を持ちかけられることは稀である。」
  - AirTran Airways, OST-2000-7182-693, November 14, 2003

Figure 3: Slot lease has been slightly easier than slot purchase for new entrants

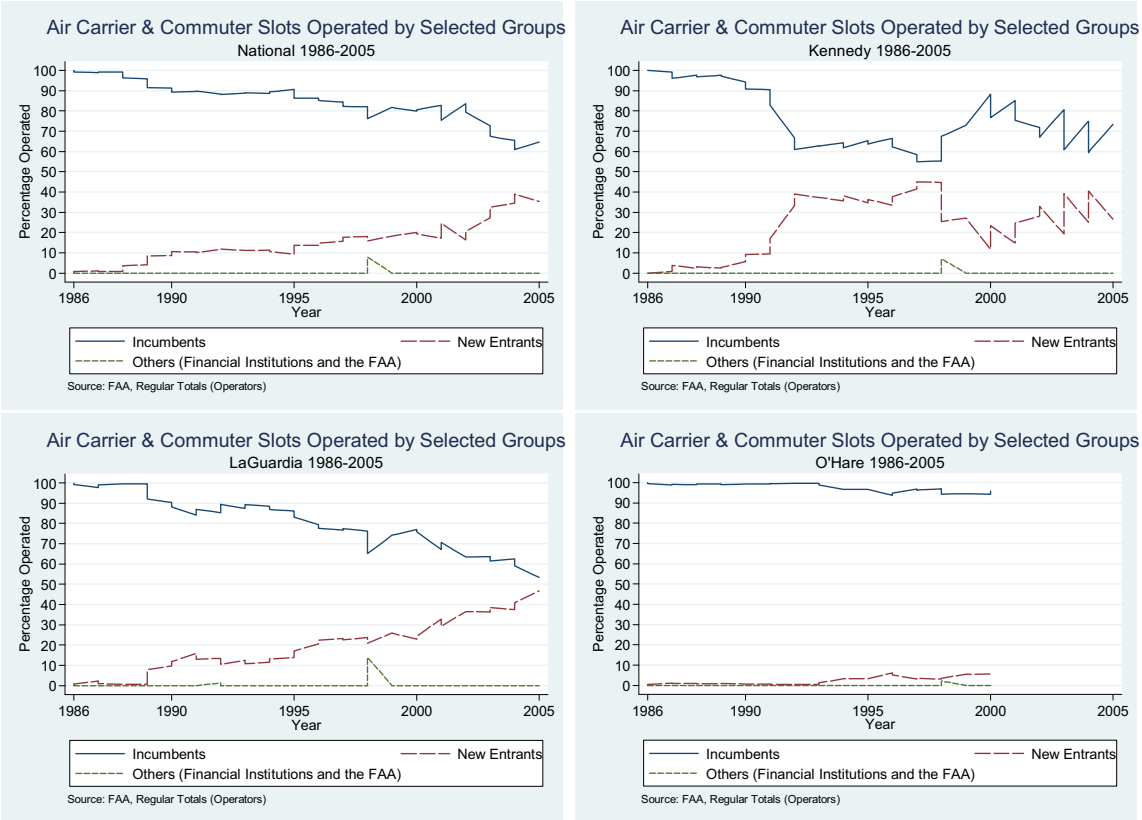


図 3:新規参入者にとって、発着枠の借用はその購入よりも若干、容易であった

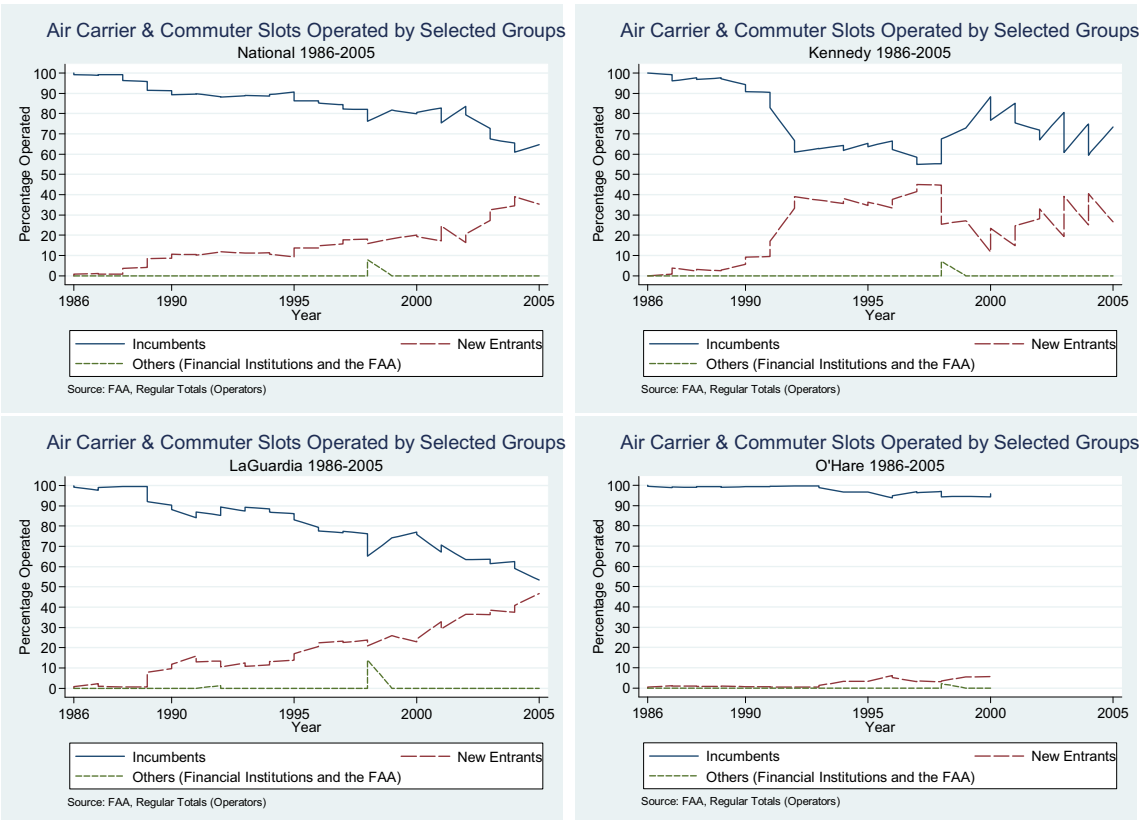


Figure 4: Slot lease has been also easier than slot purchase for non-majors

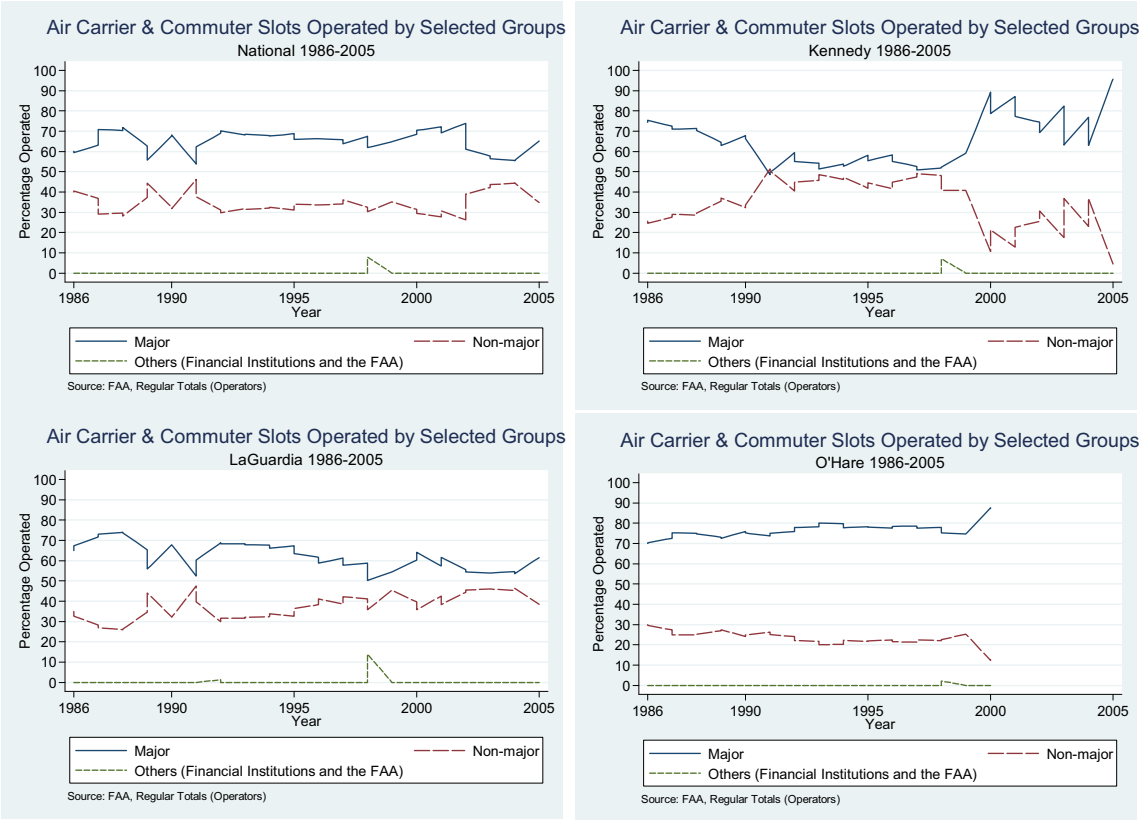
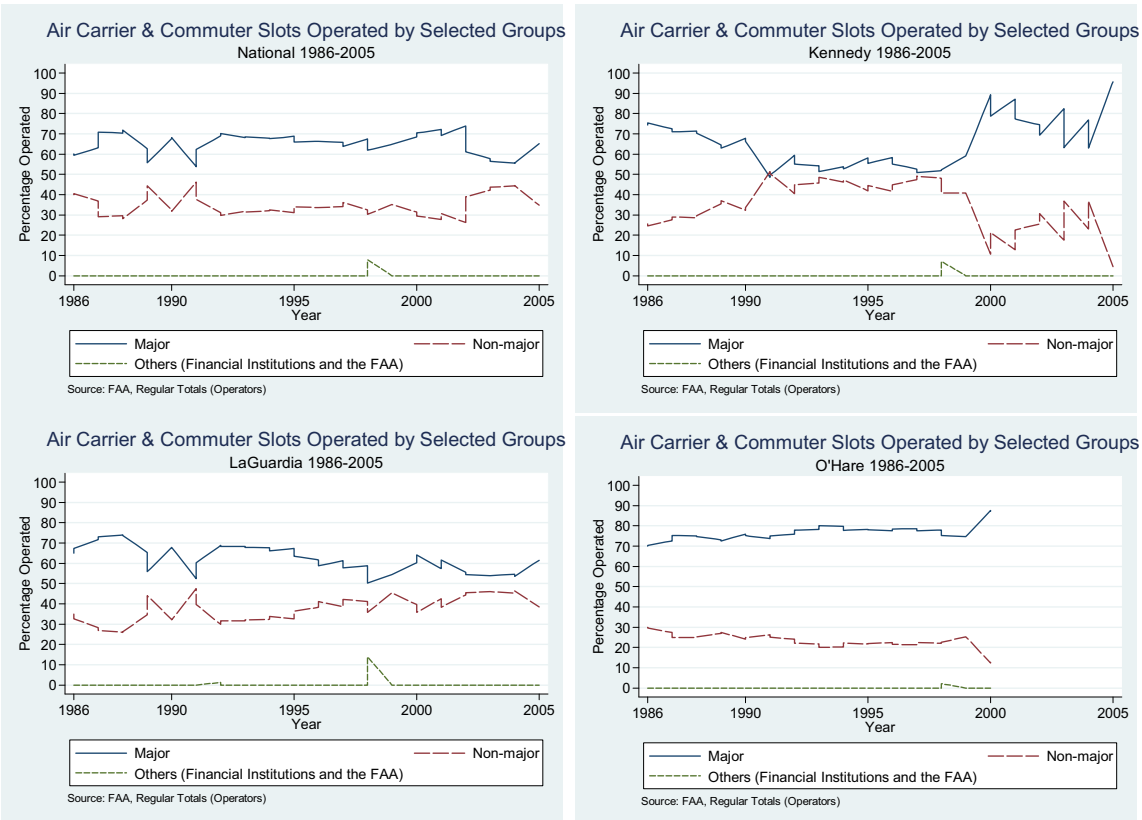


図 4：非大手にとっても、発着枠の借用はその購入よりも容易であった



Allegations by incumbents and majors

- "...it appears that the buy-sell rule has established a competitively functioning market for the efficient allocation of slots."
  - Delta Air Lines, OST-1997-2442-2, May 12, 1997

- "[T]he present slot allocation system under which major hub carriers have put slots to their highest use … has created the most efficient and competitive air transportation system in the world. … It should not be modified simply to accommodate carriers that desire to avoid the costs of participating in the buy/sell slot system, which has served well for the last dozen years."
  - Trans World Airlines, OST-1997-2230-12, July 18, 1997

- "…the system of buying, selling, leasing, sub-leasing and trading applied to date at slot-controlled airports has worked effectively and efficiently and does not need to be changed..."
  - Regional Airline Association, FAA-2005-20704-19, May 24, 2005

既存航空会社と大手航空会社の申し立て

- 「 ……売買規則は、競争的に機能する市場を確立し、発着枠の効率的な配分に寄与していると思われる」
  - Delta Air Lines, OST-1997-2442-2, May 12, 1997

- 「現在の発着枠配分システムの下では、大手ハブ・キャリアが発着枠を最大限に利用している……その結果、世界で最も効率的で競争的な航空輸送システムが作り出されている。……発着枠売買システムに加わるための費用負担を避けようとしている航空会社に便宜を図るためだけに、このシステムが修正されることがあってはならない。発着枠売買システムは、過去十数年にわたり申し分なくその役目を果たしてきたのだから。」
  - Trans World Airlines, OST-1997-2230-12, July 18, 1997

- 「発着枠に制約のある空港に今日まで適用されてきた〔発着枠〕売買・貸借のシステムは、効果的かつ効率的に機能してきた。それを変更する必要はない。」
  - Regional Airline Association, FAA-2005-20704-19, May 24, 2005

Results of previous studies reflect differences of opinion

- GAO (1990)
  - "The major airlines as a group have consistently increased the percentage of domestic slots they hold. Consequently, they have the ability to limit access to routes beginning or ending at any of the slot-controlled airports…"
  - "It now appears that allowing airlines to buy and sell slots has not produced the active market for distributing slots envisioned in the buy/sell rule. "
- Kleit and Kobayashi (1996)
  - There was no evidence that the two dominant carriers at O'Hare, United and American, were hoarding poorly utilized slots or were deterring entry into O'Hare by carriers likely to increase overall slot use.
- FTC (1994)
  - Concentration in the slot market was not leading to anticompetitive behavior of incumbent airlines

先行研究の結果は上記のような見解の相違を反映している

- GAO (1990)
  - 「大手航空会社は、1つの集団としてみると、国内線用発着枠の保有割合を着実に増やしてきた。その結果、大手航空会社は、発着枠が規制された空港を発着点とする路線への参入を制限することができる……。」
  - 「航空会社に発着枠の売買を許したことは、売買規則で描かれていた活発な発着枠配分市場の形成にはつながらなかったものと現時点では思われる。」
- Kleit and Kobayashi (1996)
  - オヘア空港の2つの支配的な航空会社、ユナイテッドとアメリカンが、十分に利用されていない発着枠を抱え込んでいるという証拠はない。また、これらの航空会社が、発着枠の全般的な利用を高めるような航空会社のオヘア参入を阻止していたという証拠もない。
- FTC (1994)
  - 発着枠市場における集中は、既存航空会社の反競争的行動を導いていたわけではない。

Congress tended to side with new entrants and non-majors

- Slot exemptions
  - Enacted in 1994
    - Federal Aviation Administration Authorization Act of 1994 (Public Law 103-305); Order 94-9-30
  - Authorized the DOT to grant exemptions from slot restrictions
- Phase-out of slot restrictions
  - Enacted in 2000
    - Wendell H. Ford Aviation Investment and Reform Act of the 21st Century (AIR-21) (Public Law 106-181)
  - Relaxed slot exemption access
  - Phased out slot restrictions entirely after July 1, 2002 at O'Hare and after January 1, 2007 at Kennedy and LaGuardia
- Results
  - Delays increased dramatically at LaGuardia and O'Hare
  - Congestion increased also at Kennedy and Newark in 2007

議会は新規参入者と非大手の側に立つ傾向にあった

- 発着枠規制適用免除
  - 1994年に成立
    - Federal Aviation Administration Authorization Act of 1994 (Public Law 103-305); Order 94-9-30
  - 運輸省に発着枠規制適用免除を認める権限を付与
- 発着枠規制の段階的廃止
  - 2000年に成立
    - Wendell H. Ford Aviation Investment and Reform Act of the 21st Century (AIR-21) (Public Law 106-181)
  - 発着枠規制適用免除を緩和・拡大
  - 発着枠規制を段階的に廃止。オヘア空港では2002年7月1日をもって、また、ケネディ空港とラガーディア空港では2007年1月1日をもって全廃。
- 帰結
  - ラガーディア空港とオヘア空港で遅延が劇的に増大
  - 2007年にはケネディ空港とニューアーク空港でも混雑が悪化

FAA's Responses

- Temporary limitations on flight operations
  - O'Hare, LaGuardia, Kennedy, Newark (71 FR 51382; 71 FR 77854; 73 FR 3510; 73 FR 29550)
  - Slot markets have been resurrected

- Two-part landing fees (73 FR 40430)
  - Per-operation charge + Weight-based charge
  - "…provide incentives to air carriers to use the airport at less congested times or to use alternate airports…" (73 FR 3310)
  - Became effective on July 14, 2008

  - The two-part landing fees have to be "revenue neutral"
    - 1996 Policy, 2.2 (61 FR 31994)

      "Revenues from fees imposed for use of the airfield ("airfield revenues") may not exceed the costs to the airport proprietor of providing airfield services and airfield assets currently in aeronautical use unless otherwise agreed to by the affected aeronautical users."
  - Thus, they do not represent true congestion pricing

連邦航空局の対応

- 一時的な運行制限
  - オヘア、ラガーディア、ケネディ、ニューアーク (71 FR 51382; 71 FR 77854; 73 FR 3510; 73 FR 29550)
  - 発着枠市場は復活

- 2部着陸料金制 (73 FR 40430)
  - 運航毎の使用料 ＋ 重量を基準とする使用料
  - 「……航空会社に対して、混雑のより少ない時間帯の空港利用や、代替空港の利用を促す」(73 FR 3310)
  - 2008年7月14日、発効

  - 2部着陸料金制は「収入中立的」でなければならない
    - 1996 Policy, 2.2 (61 FR 31994)

      「飛行場の利用に課される料金から得られる収入(「飛行場収入」)は、飛行場業務および航空業務に現に利用されている飛行場資産の供給が飛行場経営者にもたらす費用を超えてはならない。ただし、影響を受ける航空関連利用者が同意する場合はその限りではない。」
  - 従って、2部着陸料金制は純粋な意味での混雑料金制ではない

FAA's Responses (continued)

- Slot auction (73 FR 60544; 73 FR 60574)
  - LaGuardia
    - Approximately 85 percent of slots will be grandfathered
    - Approximately 3 percent of slots will be withdrawn and be auctioned every year from 2009 through 2013
  - Kennedy and Newark
    - 90 percent of slots will be grandfathered
    - 2 percent of slots will be withdrawn and be auctioned every year from 2009 through 2013
  - Slot sublease must be advertised on an FAA-run bulletin board
  - The auction was planned to be held on January 12, 2009
  - But it was suspended due to the legal challenges
    - Order Granting Motions for Stay, Port Authority of New York & New Jersey v. Federal Aviation Administration, No. 08-1329 (D.C. Cir. Dec. 8, 2008)

連邦航空局の対応（続）

- 発着枠オークション (73 FR 60544; 73 FR 60574)
  - ラガーディア
    - 約85%の発着枠が既得権尊重により割り当てられる
    - 約3%の発着枠が、2009年から2013年の間、毎年、回収されオークションにより配分される
  - ケネディとニューアーク
    - 90%の発着枠が既得権尊重により割り当てられる
    - 2%の発着枠が、2009年から2013年の間、毎年、回収されオークションにより配分される
  - 発着枠の転貸は連邦航空局運営の掲示板で公示されなければならない
  - オークションの実施は2009年1月12日に計画されていた
  - しかし、それは法的な異議申立により一時停止されている
    - Order Granting Motions for Stay, Port Authority of New York & New Jersey v. Federal Aviation Administration, No. 08-1329 (D.C. Cir. Dec. 8, 2008)

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Shortcomings of the previous studies

- Kleit and Kobayashi (1996), FTC (1994)
  - Their analyses are limited to the data on daily slot ownership and usage for two months (May-June 1990 and September-October 1993)
  - Thus, it is impossible to examine trade practice in the slot market

- GAO (1990)
  - The only study that examined trade practice in the slot market
  - However, the report's analysis covered only the earliest two and a half years (April 1, 1986-September 30, 1988)
  - Update reports (GAO, 1996; GAO, 1999) do not include detailed statistical analysis

先行研究の問題点

- Kleit and Kobayashi (1996), FTC (1994)
  - 彼らの分析は、2ヶ月分の発着枠保有および利用データに限定されている（1990年5-6月、および、1993年9-10月）
  - 従って、発着枠市場における取引の実態を検討することができない

- GAO (1990)
  - 発着枠市場における取引の実態を検討している唯一の研究
  - しかしながら、報告書の分析が対象としているのは発着枠市場の最初期2年半のみ（1986年4月1日－1988年9月30日）
  - その後の報告書 (GAO, 1996; GAO, 1999) にはデータに基づく詳細な分析は含まれていない

The hypothesis to be tested

- The anticompetitive slot trading hypothesis
  - The control of slots by slot-holding carriers restricted opportunities of other carriers, especially rival carriers, to operate as competitors in the slot-constrained airports
  - Suggested by the GAO and some new entrants

検証する仮説

- 反競争的発着枠取引仮説
  - 発着枠保有航空会社による発着枠の支配は、他の航空会社、とりわけライバル航空会社が、発着枠に制約のある空港で競合企業として活動する機会を制限してきた
  - GAOや新規参入者の一部が示唆

Slot data (obtained from the FAA)

- Regular Totals: Records of slot allocations by holder and by operator
  - Periods covered
    - January and July of each year
- Uneven Transfer Data: data of uneven slot transfers that were not on a one-for-one basis
  - Periods covered
    - (1) April 1, 1986 – December 10, 1990, (2) February 28, 1991 – July 1, 1992, (3) September 12, 1994 – July 1, 1999, (4) April 1, 2001 – December 31, 2006
      - According to the FAA, data gaps are due to staff shortages
  - Information contained
    - (1) Airport code, (2) Category of slot, (3) Code names of lessor and lessee, (4) Frequency, (5) Type of transfer, (6) Number of slots transferred, (7) Start and end date of the transaction

発着枠データ（連邦航空局より入手）

- Regular Totals: 保有者、利用者ごとの発着枠配分記録
  - 対象期間
    - 各年の1月と7月
- Uneven Transfer Data: 1対1の交換によらない不均等な発着枠移転のデータ
  - 対象期間
    - (1) 1986年4月1日 – 1990年12月10日, (2) 1991年2月28日 – 1992年7月1日, (3) 1994年9月12日 – 1999年7月1日, (4) 2001年4月1日 – 2006年12月31日
      - 連邦航空局によると、データの欠損は人員不足による
  - 記載情報
    - (1) 空港コード, (2) 発着枠の種類, (3) 貸し手と借り手のコード, (4) 発着枠を利用可能な曜日, (5) 移転の類型, (6) 移転された発着枠の数, (7) 取引の開始日および終了日

Limitation of slot data

- Information on slot transaction prices could not be obtained
  - It is impossible to examine the competitive implications of price discrimination in slot markets
- However, it is possible to examine the competitive implications of discrimination in limiting the opportunities to use slots
  - if analyzed with relevant control variables for factors affecting slot trading prices

発着枠データの限界

- 発着枠取引価格情報は入手できなかった
  - 発着枠市場における価格差別が競争に与える影響を検討することはできない
- しかしながら、発着枠利用の機会を制限する差別が競争に与える影響を検討することはできる
  - 発着枠取引価格に影響を与える要因をコントロールする適切な変数とともに分析されれば

Points of dispute over the trade practice in slot markets

1. Openness of the slot markets to new entrants and non-majors
   - whether “new entrant carriers” and “non-major carriers” have been the object of discrimination by the slot-holding carriers

↓

However, new entrants and non-majors include not only “rival carriers” but also “related carriers”

↓

Slot markets might be open to “related carriers”, but not to “rival carriers”

↓

2. Openness of the slot markets to rivals
   - whether “rival carriers” have been the object of discrimination by the slot-holding carriers

↓

Classification of relationships between slot trading entities

発着枠市場における取引の実態をめぐる論争点

1. 新規参入者および非大手に対する発着枠市場の開放性
   - 「新規参入航空会社」および「非大手航空会社」が発着枠保有航空会社による差別の対象となっていないか

↓

だが、新規参入者および非大手には、「ライバル航空会社」だけでなく「関連航空会社」も含まれる

↓

発着枠市場は、「関連航空会社」には開かれているかもしれないが「ライバル航空会社」にはそうでないかもしれない

↓

2. ライバルに対する発着枠市場の開放性
   - 「ライバル航空会社」が発着枠保有航空会社による差別の対象となっていないか

↓

発着枠取引に関わる主体間関係の分類が必要

Classification of slot transactions

1. Transactions between the FAA and carriers

2. Transactions between financial institutions and carriers

3. Transactions between related carriers
   - slot transactions between carriers that are related by common ownership or code-sharing agreements or by serving in the same slot holders' feeder networks

4. Transactions between rival carriers
   - slot transactions that are not between related carriers

   – Sources: (1) SEC filings, annual reports, press releases, and websites of each carrier, (2) Myron J. Smith, Jr., 2002, *The Airline Encyclopedia, 1909-2000*, 3 Volumes, Scarecrow Press, and (3) LexisNexis database of industry news
   – Full details of the sources and the classification of each transaction are available upon request from the author

発着枠取引の分類

1. 連邦航空局と航空会社との取引

2. 金融機関と航空会社との取引

3. 関連航空会社間の取引
   - 親会社子会社間取引、共同運航提携会社間取引、および支線運航グループ所属会社間取引

4. ライバル航空会社間の取引
   - 関連航空会社間の取引を除く航空会社間の取引

   – 典拠: (1)航空各社の米国証券取引委員会提出書類、年次報告書、報道発表、ウェブサイト、(2) Myron J. Smith, Jr., 2002, *The Airline Encyclopedia, 1909-2000*, 3 Volumes, Scarecrow Press、(3) LexisNexis database of industry news
   – 取引の組み合わせが139にのぼるため、分類の個別情報及び典拠の詳細は要請に応じて筆者より提供

Data period analyzed

- September 12, 1994 - July 1, 1999

  One of the most controversial periods of the slot markets
  - New entrants increasingly criticized the allegedly anticompetitive behavior of slot holders
  - Political pressures to remove the alleged barriers to entry into the four airports culminated in the abolition of slot markets
  - The period begins just before the issuance of the DOT's Order 94-9-30 (September 20, 1994) that began granting exemptions from slot limitations, and ends just before the congressional enactment of AIR-21 (April 5, 2000), which phased out slot restrictions at three airports

- Despite the restricted duration of data period, data from this crucial and controversial period is useful in testing the anticompetitive slot trading hypothesis

分析対象としたデータの期間

- 1994年9月12日 – 1999年7月1日

  発着枠市場が最も論争を呼んだ時期の1つ
  - 新規参入者は発着枠保有者の反競争的と目される行動への批判を高めていた
  - 4空港への参入を妨げているとされる障壁の除去を促す政治的圧力は、発着枠市場の廃止という形で頂点に達した
  - 発着枠規制の適用免除を認める運輸省のOrder 94-9-30 (1994年9月20日)発令直前に始まり、3空港で発着枠の制限を解除するAIR-21 (2000年4月5日)が議会で成立に至る少し前に終わる時期

- データ期間は限られているが、この重要かつ論争的な期間のデータは、反競争的発着枠取引仮説の検証に有益である

Table 1: Sale and lease transactions by airports

Airport	Total number of sale transactions	Total number of sold slots	Total number of lease transactions	Total number of leased slots
National	17	360	212	777
Kennedy	3	33	239	919
LaGuardia	7	19	345	1425
O'Hare	10	103	212	2252
Sum	37	515	1008	5373

Source: FAA, Uneven Slot Transfer List, September 12, 1994 – July 1, 1999

表1: 売買・貸借取引(空港別)

空港	売買取引総数	売買発着枠総数	貸借取引総数	貸借発着枠総数
ナショナル	17	360	212	777
ケネディ	3	33	239	919
ラガーディア	7	19	345	1425
オヘア	10	103	212	2252
合計	37	515	1008	5373

典拠: FAA, Uneven Slot Transfer List, September 12, 1994 – July 1, 1999

Table 2: Total number of sold slots disaggregated by purchaser's status (Incumbents, New Entrants, and Others)

	National	Kennedy	LaGuardia	O'Hare
Returned to the FAA	0	0	1	0
Sold to financial institutions	30	0	0	9
Sold to incumbent carriers	161	0	18	87
Sold to new entrant carriers	169	33	0	7
Yearly average number of slots during the period	761	297	933	2057

Source: FAA, Uneven Slot Transfer List, September 12, 1994 – July 1, 1999

表2: 売買発着枠総数(買い手の立場――既存、新規、その他――による集計)

	ナショナル	ケネディ	ラガーディア	オヘア
連邦航空局に返還	0	0	1	0
金融機関へ売却	30	0	0	9
既存航空会社へ売却	161	0	18	87
新規航空会社へ売却	169	33	0	7
期間中の年間平均発着枠数	761	297	933	2057

典拠: FAA, Uneven Slot Transfer List, September 12, 1994 – July 1, 1999

Table 3: Total number of sold slots disaggregated by purchaser's status (Major, Non-major, and Others)

	National	Kennedy	LaGuardia	O'Hare
Returned to the FAA	0	0	1	0
Sold to financial institutions	30	0	0	9
Sold to major carriers	159	2	17	76
Sold to non-major entrant carriers	171	31	1	18
Yearly average number of slots during the period	761	297	933	2057

Source: FAA, Uneven Slot Transfer List, September 12, 1994 – July 1, 1999

表3: 売買発着枠総数(買い手の立場——大手、非大手、その他——による集計)

	ナショナル	ケネディ	ラガーディア	オヘア
連邦航空局に返還	0	0	1	0
金融機関へ売却	30	0	0	9
大手航空会社へ売却	159	2	17	76
非大手航空会社へ売却	171	31	1	18
期間中の年間平均発着枠数	761	297	933	2057

典拠: FAA, Uneven Slot Transfer List, September 12, 1994 – July 1, 1999

Table 4: Total number of sold slots disaggregated by purchaser-seller relationship

	National	Kennedy	LaGuardia	O'Hare
Returned to the FAA	0	0	1	0
Allocated to carriers by the FAA	0	0	2	0
Sold to financial institutions by slot-holding carriers	30	0	0	9
Sold to carriers by financial institutions	228	2	0	79
Sold to related carriers by slot-holding carriers	85	31	1	5
Sold to rival carriers by slot-holding carriers	17	0	15	10
Yearly average number of slots during the period	761	297	933	2057

Source: FAA, Uneven Slot Transfer List, September 12, 1994 – July 1, 1999

表4: 売買発着枠総数(買い手と売り手の関係による集計)

	ナショナル	ケネディ	ラガーディア	オヘア
連邦航空局に返還	0	0	1	0
連邦航空局から航空会社へ配分	0	0	2	0
発着枠保有航空会社から金融機関へ売却	30	0	0	9
金融機関から航空会社へ売却	228	2	0	79
発着枠保有航空会社から関連航空会社へ売却	85	31	1	5
発着枠保有航空会社からライバル航空会社へ売却	17	0	15	10
期間中の年間平均発着枠数	761	297	933	2057

典拠: FAA, Uneven Slot Transfer List, September 12, 1994 – July 1, 1999

Table 5: Total number of leased slots and usable days of leased slots disaggregated based on lessee's status (Incumbents, New Entrants, and Others)

Airport	Lessee	Total number of leased slots	Total number of usable days of leased slots
National	Incumbent	554	261233
	New	223	107345
Kennedy	Incumbent	418	47753
	New	501	62876
	Returned to the FAA	4	462
LaGuardia	Incumbent	444	80178
	New	977	156450
O'Hare	Incumbent	1311	321125
	New	941	109326

Source: FAA, Uneven Slot Transfer List, September 12, 1994 – July 1, 1999

表5: 貸借発着枠総数および貸借発着枠利用可能総日数（買い手の立場――既存、新規、その他――による集計）

空港	借り手	貸借発着枠総数	貸借発着枠利用可能総日数
ナショナル	既存	554	261233
	新規	223	107345
ケネディ	既存	418	47753
	新規	501	62876
	連邦航空局に返還	4	462
ラガーディア	既存	444	80178
	新規	977	156450
オヘア	既存	1311	321125
	新規	941	109326

典拠: FAA, Uneven Slot Transfer List, September 12, 1994 – July 1, 1999

Table 6: Total number of leased slots and usable days of leased slots disaggregated based on lessee's status (Major, Non-major, and Others)

Airport	Lessee	Total number of leased slots	Total number of usable days of leased slots
National	Major	356	252623
	Non-major	421	115955
Kennedy	Major	285	37720
	Non-major	634	72909
	Returned to the FAA	4	462
LaGuardia	Major	259	48549
	Non-major	1162	188079
O'Hare	Major	563	231214
	Non-major	1689	199237

Source: FAA, Uneven Slot Transfer List, September 12, 1994 – July 1, 1999

表6: 貸借発着枠総数および貸借発着枠利用可能総日数(買い手の立場——大手、非大手、その他——による集計)

空港	借り手	貸借発着枠総数	貸借発着枠利用可能総日数
ナショナル	大手	356	252623
	非大手	421	115955
ケネディ	大手	285	37720
	非大手	634	72909
	連邦航空局に返還	4	462
ラガーディア	大手	259	48549
	非大手	1162	188079
オヘア	大手	563	231214
	非大手	1689	199237

典拠: FAA, Uneven Slot Transfer List, September 12, 1994 – July 1, 1999

Table 7: Total number of leased slots and usable days of leased slots disaggregated based on lessee's status (Related, Rival, and Others)

Airport	Lessee	Total number of leased slots	Total number of usable days of leased slots
National	Leased to carriers by financial institutions	1	2557
	Leased to related carriers	248	182781
	Leased to rival carriers	528	183240
Kennedy	Leased to related carriers	492	58402
	Leased to rival carriers	427	52227
LaGuardia	Returned to the FAA	4	462
	Leased to carriers by financial institutions	7	17899
	Leased to related carriers	924	117584
	Leased to rival carriers	490	101145
O'Hare	Leased to carriers by financial institutions	133	48255
	Leased to related carriers	1947	241774
	Leased to rival carriers	172	140422

Source: FAA, Uneven Slot Transfer List, September 12, 1994 – July 1, 1999

表7: 貸借発着枠総数および貸借発着枠利用可能総日数（買い手と売り手の関係による集計）

空港	借り手	貸借発着枠総数	貸借発着枠利用可能総日数
ナショナル	金融機関から航空会社へ貸出	1	2557
	関連航空会社へ貸出	248	182781
	ライバル航空会社へ貸出	528	183240
ケネディ	関連航空会社へ貸出	492	58402
	ライバル航空会社へ貸出	427	52227
ラガーディア	連邦航空局へ返還	4	462
	金融機関から航空会社へ貸出	7	17899
	関連航空会社へ貸出	924	117584
	ライバル航空会社へ貸出	490	101145
オヘア	金融機関から航空会社へ貸出	133	48255
	関連航空会社へ貸出	1947	241774
	ライバル航空会社へ貸出	172	140422

典拠: FAA, Uneven Slot Transfer List, September 12, 1994 – July 1, 1999

Regression Analysis

- $DAYS = \alpha_0 + \alpha_1 NEW + x\delta + \varepsilon$ (1)
- $DAYS = \beta_0 + \beta_1 NONMAJOR + x\delta + \varepsilon$ (2)
- $DAYS = \gamma_0 + \gamma_1 RIVAL + x\delta + \varepsilon$ (3)

  - *DAYS*: the number of usable days of slots leased between the same lessor and the same lessee aggregated on a quarterly basis
  - *NEW*: a dummy variable that equals one if the lessee was a new entrant
  - *NONMAJOR*: a dummy variable that denotes whether the lessee is a non-major carrier
  - *RIVAL*: a dummy variable that equals one if the slot lease transaction was between rival carriers
  - $X\delta$: an array of control variables that control for other factors that might affect slot trading and transaction prices, such as net income, economies of scale and density (cf., Brueckner and Spiller, 1994)
    - Descriptions and descriptive statistics of these variables are presented in Appendices A and B.
  - Estimated by the zero-truncated negative binomial model for count data

回帰分析

- $DAYS = \alpha_0 + \alpha_1 NEW + x\delta + \varepsilon$ (1)
- $DAYS = \beta_0 + \beta_1 NONMAJOR + x\delta + \varepsilon$ (2)
- $DAYS = \gamma_0 + \gamma_1 RIVAL + x\delta + \varepsilon$ (3)

  - *DAYS*: 同一組み合わせの貸し手・借り手間の取引における発着枠利用可能延べ日数の4半期毎の合計値
  - *NEW*: 借り手が新規参入者であるか否かを示すダミー変数
  - *NONMAJOR*: 借り手が非大手であるか否かを示すダミー変数
  - *RIVAL*: 貸借取引がライバル間のものであるか否かを示すダミー変数
  - $X\delta$: 規模・密度の経済や財務状況といった発着枠取引とその価格に影響を与え得るその他の要因をコントロールするための一連の変数 (cf., Brueckner and Spiller, 1994)
    - これらの変数に関する説明と記述統計はAppendices A & Bを参照
  - 計数データのためのゼロ切断負の2項回帰モデルにより推定

Table 8: Estimation result 1

	National		Kennedy		LaGuardia		O'Hare	
Variables	Coeff.	Std. err.	Coeff.	Std. err.	Coeff.	Std. err.	Coeff.	Std. err.
NEW	0.683	0.403	0.166	0.245	0.827*	0.337	0.572*	0.268
NONMAJOR	0.658	0.561	0.154	0.342	-0.386	0.416	0.490	0.632
RIVAL	-0.112	0.333	-0.610*	0.245	-0.639*	0.324	-1.304***	0.271
N	174		188		262		170	

- Only the coefficients on the lessee's status and the lessor-lessee relationship are reported. Full results are reported in Appendix C.
- Estimated by the zero-truncated negative binomial model. Robust standard errors adjusted for clustering by Lessor-Lessee pair. * p<0.05, ** p<0.01, *** p<0.001

表8: 推定結果1

	ナショナル		ケネディ		ラガーディア		オヘア	
変数	係数	標準誤差	係数	標準誤差	係数	標準誤差	係数	標準誤差
NEW	0.683	0.403	0.166	0.245	0.827*	0.337	0.572*	0.268
NONMAJOR	0.658	0.561	0.154	0.342	-0.386	0.416	0.490	0.632
RIVAL	-0.112	0.333	-0.610*	0.245	-0.639*	0.324	-1.304***	0.271
N	174		188		262		170	

- 借り手の立場と貸し手・借り手間関係の係数のみ示している。結果全体はAppendix Cを参照。
- ゼロ切断負の2項回帰モデルにより推定。標準誤差は、貸し手・借り手の組み合わせを考慮した頑健標準誤差。* p<0.05, ** p<0.01, *** p<0.001

Table 9: Sensitivity analysis of the key coefficients

	(1) Baseline		(2) 1994-1996 only		(3) 1997-1999 only	
Variables	Coeff.	Std. err.	Coeff.	Std. err.	Coeff.	Std. err.
National:	N = 174		N = 104		N = 70	
NEW	0.683	0.403	1.148*	0.456	0.624	0.691
NONMAJOR	0.658	0.561	0.598	0.826	-0.148	0.638
RIVAL	-0.112	0.333	-0.149	0.310	-0.434	0.817
Kennedy:	N = 188		N = 95		N = 93	
NEW	0.166	0.245	-0.191	0.359	1.084***	0.302
NONMAJOR	0.154	0.342	0.193	0.498	1.167*	0.504
RIVAL	-0.610*	0.245	-0.190	0.253	-1.424***	0.432
LaGuardia:	N = 262		N = 151		N = 111	
NEW	0.827*	0.337	1.193**	0.390	0.493	0.439
NONMAJOR	-0.386	0.416	-0.681	0.646	0.154	0.665
RIVAL	-0.639*	0.324	-0.173	0.415	-1.554***	0.357
O'Hare:	N = 170		N = 94		N = 76	
NEW	0.572*	0.268	0.306	0.259	0.146	0.393
NONMAJOR	0.49	0.632	0.163	0.572	0.588	1.039
RIVAL	-1.304***	0.271	-1.342***	0.347	-1.835***	0.449

The baseline specification in column 1 corresponds to the results reported in Table 8. Only the coefficients on the lessee's status and the lessor-lessee relationship are reported.
Robust standard errors adjusted for clustering by Lessor-Lessee pair. * p<0.05, ** p<0.01, *** p<0.001

表9: 主要な係数の感度分析

	(1) ベースライン		(2) 1994-1996 のみ		(3) 1997-1999 のみ	
変数	係数	標準誤差	係数	標準誤差	係数	標準誤差
ナショナル:	N = 174		N = 104		N = 70	
NEW	0.683	0.403	1.148*	0.456	0.624	0.691
NONMAJOR	0.658	0.561	0.598	0.826	-0.148	0.638
RIVAL	-0.112	0.333	-0.149	0.310	-0.434	0.817
ケネディ:	N = 188		N = 95		N = 93	
NEW	0.166	0.245	-0.191	0.359	1.084***	0.302
NONMAJOR	0.154	0.342	0.193	0.498	1.167*	0.504
RIVAL	-0.610*	0.245	-0.190	0.253	-1.424***	0.432
ラガーディア:	N = 262		N = 151		N = 111	
NEW	0.827*	0.337	1.193**	0.390	0.493	0.439
NONMAJOR	-0.386	0.416	-0.681	0.646	0.154	0.665
RIVAL	-0.639*	0.324	-0.173	0.415	-1.554***	0.357
オヘア:	N = 170		N = 94		N = 76	
NEW	0.572*	0.268	0.306	0.259	0.146	0.393
NONMAJOR	0.49	0.632	0.163	0.572	0.588	1.039
RIVAL	-1.304***	0.271	-1.342***	0.347	-1.835***	0.449

第1列のベースラインは表8の結果に対応する。借り手の立場と貸し手・借り手間関係の係数のみ示している。
標準誤差は、貸し手・借り手の組み合わせを考慮した頑健標準誤差。* p<0.05, ** p<0.01, *** p<0.001

Table 10: Estimation result 2

	National		Kennedy		LaGuardia		O'Hare	
Variables	Coeff.	Std. err.	Coeff.	Std. err.	Coeff.	Std. err.	Coeff.	Std. err.
*INC*MAJOR*RIVAL*	0.662	0.651	-0.324	0.570	-0.025	0.855	-1.634***	0.456
*INC*NONMAJOR*RELATED*	1.281	0.744	0.168	0.795	0.526	1.130	-0.859	0.638
*INC*NONMAJOR*RIVAL*	0.287	0.642	-0.427	0.755	-1.317	0.946	-	-
*NEW*MAJOR*RELATED*	-0.388	1.018	-1.268	0.784	1.877	1.130	-0.960	0.730
*NEW*MAJOR*RIVAL*	1.915*	0.891	-0.129	0.694	2.403	1.274	-	-
*NEW*NONMAJOR*RELATED*	1.090	0.700	0.571	0.692	0.882	1.045	-0.315	0.683
*NEW*NONMAJOR*RIVAL*	2.173**	0.834	-0.282	0.632	0.307	1.063	-1.914**	0.648
N	174		188		262		170	

Omitted base category is *INC*MAJOR*RELATED* (incumbent, major related carrier). Only the coefficients on the interaction variables are reported. Full results are reported in Appendix D.

Estimated by the zero-truncated negative binomial model. Robust standard errors adjusted for clustering by Lessor-Lessee pair. * p<0.05, ** p<0.01, *** p<0.001

表10: 推定結果2

	ナショナル		ケネディ		ラガーディア		オヘア	
変数	係数	標準誤差	係数	標準誤差	係数	標準誤差	係数	標準誤差
*INC*MAJOR*RIVAL*	0.662	0.651	-0.324	0.570	-0.025	0.855	-1.634***	0.456
*INC*NONMAJOR*RELATED*	1.281	0.744	0.168	0.795	0.526	1.130	-0.859	0.638
*INC*NONMAJOR*RIVAL*	0.287	0.642	-0.427	0.755	-1.317	0.946	-	-
*NEW*MAJOR*RELATED*	-0.388	1.018	-1.268	0.784	1.877	1.130	-0.960	0.730
*NEW*MAJOR*RIVAL*	1.915*	0.891	-0.129	0.694	2.403	1.274	-	-
*NEW*NONMAJOR*RELATED*	1.090	0.700	0.571	0.692	0.882	1.045	-0.315	0.683
*NEW*NONMAJOR*RIVAL*	2.173**	0.834	-0.282	0.632	0.307	1.063	-1.914**	0.648
N	174		188		262		170	

基準値は *INC*MAJOR*RELATED*（既存の大手関連航空会社）。交差項の係数のみ示している。結果全体は Appendix Dを参照。

ゼロ切断負の2項回帰モデルにより推定。標準誤差は、貸し手・借り手の組み合わせを考慮した頑健標準誤差。* p<0.05, ** p<0.01, *** p<0.001

Table 11: Slot transactions between rival carriers at National

Lessor	Lessee	Total number of leased slots	Total number of usable days of leased slots
American Airlines	Atlantic Coast Airlines	1	86
American Airlines	Jet Express	62	9588
Air Canada	Jet Express	13	68186
Piedmont Airlines	Jet Express	13	486
Trans World Airlines	Atlantic Coast Airlines	1	82
US Airways	Jet Express	1	30

Source: FAA, Uneven Slot Transfer List, September 12, 1994 – July 1, 1999

- American and Jet Express have agreed to mutually promote their frequent flyer programs on March 2, 1995. (They broke off the partnership on April 30, 2001.)

  → Their transactions should be classified as transactions between related carriers

表11: ナショナル空港におけるライバル航空会社間の発着枠取引

貸し手	借り手	貸借発着枠総数	貸借発着可能枠利用総日数
アメリカン航空	アトランティック・コースト航空	1	86
アメリカン航空	ジェット・エクスプレス	62	9588
エア・カナダ	ジェット・エクスプレス	13	68186
ピードモント航空	ジェット・エクスプレス	13	486
トランス・ワールド航空	アトランティック・コースト航空	1	82
USエアウェイズ	ジェット・エクスプレス	1	30

典拠: FAA, Uneven Slot Transfer List, September 12, 1994 – July 1, 1999

- 1995年3月2日、アメリカンとジェット・エクスプレスはFFPの共同推進に合意。（2001年4月30日に提携を解消。）

  → 上記2社間の取引は関連航空会社間取引に分類されるべきかもしれない。

Table 12: Estimation results for National reclassifying the transactions between American and Jet Express as transactions between related carriers

	(1) Baseline		(2) AAL-JEX regarded as related carriers	
Variables	Coeff.	Std. err.	Coeff.	Std. err.
RIVAL	-0.112	0.333	-0.438	0.305
*INC*MAJOR*RIVAL*	0.662	0.651	0.445	0.652
*INC*NONMAJOR*RELATED*	1.281	0.744	1.375	0.787
*INC*NONMAJOR*RIVAL*	0.287	0.642	0.410	0.677
*NEW*MAJOR*RELATED*	-0.388	1.018	-0.761	0.869
*NEW*MAJOR*RIVAL*	1.915*	0.891	1.771*	0.894
*NEW*NONMAJOR*RELATED*	1.090	0.700	1.521*	0.757
*NEW*NONMAJOR*RIVAL*	2.173**	0.834	2.221	1.548
N	174		174	

The baseline specification in column 1 corresponds to the results for National reported in Tables 8 and 10. The estimation results when Jet Express is regarded as a related carrier of American Airlines are reported in column 2. Only the coefficients on the lessor-lessee relationship and the interaction variables are reported.

Estimated by the zero-truncated negative binomial model. Robust standard errors adjusted for clustering by Lessor-Lessee pair. * p<0.05, ** p<0.01, *** p<0.001

表12: アメリカンとジェット・エクスプレスの取引を関連航空会社間取引に分類し直した場合の推定結果（ナショナル空港）

	(1) ベースライン		(2) AAL-JEX を関連航空会社とみなした場合	
変数	係数	標準誤差	係数	標準誤差
RIVAL	-0.112	0.333	-0.438	0.305
*INC*MAJOR*RIVAL*	0.662	0.651	0.445	0.652
*INC*NONMAJOR*RELATED*	1.281	0.744	1.375	0.787
*INC*NONMAJOR*RIVAL*	0.287	0.642	0.410	0.677
*NEW*MAJOR*RELATED*	-0.388	1.018	-0.761	0.869
*NEW*MAJOR*RIVAL*	1.915*	0.891	1.771*	0.894
*NEW*NONMAJOR*RELATED*	1.090	0.700	1.521*	0.757
*NEW*NONMAJOR*RIVAL*	2.173**	0.834	2.221	1.548
N	174		174	

第1列のベースラインは表8および表10のナショナル空港の結果に対応する。ジェット・エクスプレスがアメリカン航空の関連航空会社とみなされた場合の推定結果は第2列に示されている。

貸し手・借り手間関係および交差項の係数のみ示している。

ゼロ切断負の2項回帰モデルにより推定。標準誤差は、貸し手・借り手の組み合わせを考慮した頑健標準誤差。* p<0.05, ** p<0.01, *** p<0.001

Table 13: Slot leases to “new entrant, major rival carriers” at National

Lessor	Lessee	Total number of leased slots	Total number of usable days of leased slots
American Airlines	America West Airlines	1	1827
Business Express	Air Canada	6	8275
Jet Express	Air Canada	26	5522
Northwest Airlines	Air Canada	10	1110

- Under the Air Transport Agreement between the Government of the United States of America and the Government of Canada (signed on February 24, 1995), carriers of Canada are allowed to fly in the United States.
- However, they cannot carry local passengers in the United States (Agreement, Annex I, Section I).

↓

- The coefficient on *NEW*MAJOR*RIVAL* might be overestimated.
- It might be appropriate to exclude the observations including Air Canada from the estimations.

表13:ナショナル空港における「新規参入の大手ライバル航空会社」への発着枠貸出

貸し手	借り手	貸借発着枠総数	貸借発着枠利用可能日総数
アメリカン航空	アメリカ・ウエスト航空	1	1827
ビジネス・エクスプレス	エア・カナダ	6	8275
ジェット・エクスプレス	エア・カナダ	26	5522
ノースウェスト航空	エア・カナダ	10	1110

- 米加航空運送協定（1995年2月24日、締結）の下では、カナダの航空会社は米国内での空輸が認められている。
- しかし、カナダの航空会社は米国内で現地旅客を輸送することができない（協定、付属文書I、第I条）。

↓

- *NEW*MAJOR*RIVAL*の係数は過大に推定されている可能性がある。
- エア・カナダを含むデータを除外するのが適切かもしれない。

Table 14: Estimation results for National when observations including Air Canada as a “new entrant, major rival carrier” are excluded

	(1) Baseline		(2) ACA excluded & AAL-JEX regarded as rival carriers		(3) ACA excluded & AAL-JEX regarded as related carriers	
Variables	Coeff.	Std. err.	Coeff.	Std. err.	Coeff.	Std. err.
RIVAL	-0.112	0.333	-0.140	0.311	-0.379	0.279
*INC*MAJOR*RIVAL*	0.662	0.651	0.586	0.654	0.371	0.644
*INC*NONMAJOR*RELATED*	1.281	0.744	1.234	0.776	1.295	0.814
*INC*NONMAJOR*RIVAL*	0.287	0.642	0.222	0.658	0.320	0.698
*NEW*MAJOR*RELATED*	-0.388	1.018	-0.439	1.044	-0.926	0.857
*NEW*MAJOR*RIVAL*	1.915*	0.891	2.561**	0.922	1.963*	0.807
*NEW*NONMAJOR*RELATED*	1.090	0.700	1.015	0.714	1.459	0.803
*NEW*NONMAJOR*RIVAL*	2.173**	0.834	2.323**	0.889	2.618	1.590
N	174		169		169	

The estimation results when the observations including Air Canada are excluded and Jet Express is regarded as a rival carrier of American are reported in column 2. Column 3 reports the estimation results when the observations including Air Canada are excluded and Jet Express is regarded as a related carrier of American Airlines. Only the coefficients on the lessor-lessee relationship and the interaction variables are reported.

Estimated by the zero-truncated negative binomial model. Robust standard errors adjusted for clustering by Lessor-Lessee pair. * p<0.05, ** p<0.01, *** p<0.001

表14:エアカナダが「新規の大手ライバル航空会社」として含まれているデータを除外した場合の推定結果（ナショナル空港）

	(1) ベースライン		(2) ACAを除外しAAL-JEXをライバルとみなした場合		(3) ACAを除外しAAL-JEXを関連会社とみなした場合	
変数	係数	標準誤差	係数	標準誤差	係数	標準誤差
RIVAL	-0.112	0.333	-0.140	0.311	-0.379	0.279
*INC*MAJOR*RIVAL*	0.662	0.651	0.586	0.654	0.371	0.644
*INC*NONMAJOR*RELATED*	1.281	0.744	1.234	0.776	1.295	0.814
*INC*NONMAJOR*RIVAL*	0.287	0.642	0.222	0.658	0.320	0.698
*NEW*MAJOR*RELATED*	-0.388	1.018	-0.439	1.044	-0.926	0.857
*NEW*MAJOR*RIVAL*	1.915*	0.891	2.561**	0.922	1.963*	0.807
*NEW*NONMAJOR*RELATED*	1.090	0.700	1.015	0.714	1.459	0.803
*NEW*NONMAJOR*RIVAL*	2.173**	0.834	2.323**	0.889	2.618	1.590
N	174		169		169	

エア・カナダを含むデータが除外され、かつ、ジェット・エクスプレスがアメリカンのライバルとみなされた場合の推定結果は第2列に示されている。第3列には、エア・カナダを含むデータが除外され、かつ、ジェット・エクスプレスがアメリカンの関連会社とみなされた場合の推定結果が示されている。

貸し手・借り手間関係および交差項の係数のみ示している。

ゼロ切断負の2項回帰モデルにより推定。標準誤差は、貸し手・借り手の組み合わせを考慮した頑健標準誤差。* p<0.05, ** p<0.01, *** p<0.001

Summary

- Little evidence of discrimination against new entrants per se and non-majors per se for the four airports
- Potential evidence of discrimination against rival carriers for Kennedy, LaGuardia and O'Hare

Airport	On a quarterly basis, the number of usable days of slots leased to ***rival carriers*** is expected to be **shorter** than that of **related carriers** by
Kennedy	**46 percent (331 days)**
LaGuardia	**47 percent (398 days)**
O'Hare	**73 percent (1212 days)**

Airport	On a quarterly basis, the number of usable days of slots leased to ***new entrant, non-major rival carriers*** is expected to be **shorter** than that of **incumbent, major related carriers** by
O'Hare	**85 percent (2235 days)**

Effects are calculated holding all other variables at their mean.

要約

- 4つのいずれの空港でも、新規参入者それ自体、および、非大手それ自体に対する差別の証拠はほとんどない
- ケネディ、ラガーディア、オヘアでは、ライバル航空会社に対する差別の痕跡が認められる

空港	***ライバル***への貸出発着枠の利用可能延べ回数（4半期合計値）が、**関連会社**へのそれに比べて少なくなると見込まれる割合（日数）
ケネディ	**46パーセント（331日）**
ラガーディア	**47パーセント（398日）**
オヘア	**73パーセント（1212日）**

空港	***新規参入の非大手ライバル***への貸出発着枠の利用可能延べ回数（4半期合計値）が、**既存の大手関連会社**へのそれに比べて少なくなると見込まれる割合（日数）
オヘア	**85パーセント（2235日）**

効果は他の全変数を平均値に固定し計算。

Conclusion

- Limitations of the analysis
  - Competitive implications of price discrimination in slot market could not be examined
  - Analysis period should be extended
- Anticompetitive slot trading hypothesis
  - Not supported for National
  - Supported for Kennedy, LaGuardia and O'Hare
- Policy Implications
  - Slot market has the potential to increase the possibility of competitive entry and efficient use of scarce resources
  - However, bilateral slot trading system does not, on its own, necessarily secure fair and effective slot trading
  - There is still room for further improvement

結論

- 本分析の限界
  - 発着枠市場における価格差別が競争に与える影響を検討することはできなかった
  - 分析対象期間は拡大されなければならない
- 反競争的発着枠取引仮説
  - ナショナル空港については棄却
  - ケネディ空港、ラガーディア空港、オヘア空港については棄却されず
- 政策的含意
  - 発着枠市場には、競争的参入と稀少資源の効率的利用の可能性を高める潜在的力がある
  - だが、〔従来型の〕2社間での発着枠取引システムは、公正で効果的な発着枠取引を、必ずしも自然にもたらすものではない
  - 改善の余地は依然として残っている

Topics for future research

- Design of additional mechanisms for slot allocation
  - Central clearinghouse for slot trading
  - Slot auction
  - （Congestion pricing）

- Analysis of whether the slot market has improved the efficiency of slot use
  - Conclusions of previous studies

    Borenstein (1988), FTC (1994), Kleit and Kobayashi (1996) , Sened (1997), Starkie (2008)
    - Efficiency of slot use has improved
    - High degree of concentration of slots might be beneficial (Starkie=positive; Borenstein=negative)
  - Shortcomings of the previous studies

    FTC (1994), Kleit and Kobayashi (1996)
    - Data periods are too short (only two months)

    Borenstein (1988)
    - National, Kennedy and LaGuardia are not examined
    - Period of data after the opening of slot market is short (only one year)

    Sened (1997)
    - Kennedy and LaGuardia are not examined
    - Period of data after the opening of slot market is short (only two years)
    - Only slot sale data is analyzed (Slot lease data should also be analyzed)

今後の研究項目

- 発着枠配分のための補助的または追加的メカニズムの設計
  - 発着枠取引のための中央交換所
  - 発着枠オークション
  - （混雑料金）

- 発着枠市場が発着枠利用の効率性に与えた影響の分析
  - 先行研究の結論

    Borenstein (1988), FTC (1994), Kleit and Kobayashi (1996) , Sened (1997), Starkie (2008)
    - 発着枠利用の効率性は向上した
    - 発着枠の高度の集中は有益かもしれない（Starkieは肯定的、Borensteinは否定的）
  - 先行研究の問題点

    Kleit and Kobayashi (1996) , FTC (1994)
    - データの期間があまりにも短い（それぞれ2か月間のみ）

    Borenstein (1988)
    - ナショナル空港、ケネディ空港、ラガーディア空港が分析されていない
    - 発着枠市場開設後のデータ期間が短い（1年間のみ）

    Sened (1997)
    - ケネディ空港とラガーディア空港が分析されていない
    - 発着枠市場開設後のデータ期間が短い（2年間のみ）
    - 発着枠売買データしか分析されていない（発着枠貸借データも分析されるべき）

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Appendix A: Descriptions of control variables

The following variables[1] are included to control for other factors that might affect slot trading.

L_NET and *G_NET* indicate a quarterly net income (dollars in millions) of lessor (L) and lessee (G) during the quarter previous to the slot transactions.

L_ROU and *G_ROU* indicate the number of routes served by lessor (L) and lessee (G) at each HDR airport during the quarter previous to the slot transactions. These variables, which are indicators of the size of the lessor's and lessee's flight networks, are included to control for economies of scale associated with the lessor's and lessee's flight networks (cf., Brueckner and Spiller, 1994; Caves, et al, 1984).

L_RPM and *G_RPM* indicate the revenue passenger miles (in millions) per route served by lessor (L) and lessee (G) at each HDR airport during the quarter previous to the slot transactions. These variables, which are indicators of the traffic density per route of lessor and lessee, are included to control for economies of density associated with the lessor's and lessee's flight networks (cf., Brueckner and Spiller, 1994; Caves, et al, 1984).

L_DCA, *L_JFK*, *L_LGA*, *L_ORD*, *G_DCA*, *G_JFK*, *G_LGA*, and *G_ORD* indicate the number of holding slots of lessor (L) and lessee (G) at each HDR airport, with DCA referring to Washington National, JFK to Kennedy, LGA to LaGuardia, and ORD to O'Hare. Airport slots are intangible assets, and it is reported that a slot's value rises appreciably when bundled with other slots and assets (Apogee Research, 1995). The suggestion is that the larger the number of holding slots as assets, the more the opportunities for slot transactions. These variables are included to control for the effect of slots as intangible assets.

L_HUB is a dummy variable that equals one if the lessor was American or United and *G_HUB* is a dummy variable that equals one if the lessee was American or United. These dummies are included only in the estimation for O'Hare because the airport is a dual hub of American and United. It is thought that the hubbing carriers may value slots more highly than non-hub carriers value them and thus outbid non-hub carriers in the slot markets. The hub carrier

[1] In this paper, the principal explanatory variables are assumed to be exogenous. This is one of the limitations of this paper. Estimation of a structural model, which would provide some correction for possible endogeneity, is left for subsequent research.

dummies are intended to control for this hubbing effect.

EXCLU_GATE and *SHARE&COMM_GATE* are the aggregated number of exclusive-use gates and the aggregated number of shared-use plus common-use gates, respectively, of the four HDR airports. Carriers seeking to enter the HDR airport markets or seeking to expand their services at the markets need not only slots but also airport facilities such as gates. Previous studies have identified long-term, exclusive-use gate-lease arrangements as a barrier to entry (cf., TRB, 1999). These variables are intended to control for the effect of gate leasing arrangements.

E_REVISION is a dummy variable that equals one if the beginning day of slot lease was after October 24, 1997, when the DOT loosened its criteria for approving slot exemption, and zero otherwise.

A_SLOT is a dummy variable that denotes whether the leased slot was an air carrier slot.

1995, *1996*, *1997*, *1998*, and *1999* are year dummy variables to control for unobservable or difficult-to-measure factors such as usage conditions of essential airport facilities other than gates (e.g., baggage claim areas, passenger check-in and hold rooms) or terms and conditions of support services that smaller air carrier often need to operate (e.g., baggage handling, fueling, towing, catering, minor maintenance) that may change over time.

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Appendix B: Descriptive statistics

	National				Kennedy			
Variables	Mean	Standard deviation	Minimum	Maximum	Mean	Standard deviation	Minimum	Maximum
DAYS	1201.063	5480.965	21.000	68186.000	587.527	769.909	24.000	4633.000
NEW	0.247	0.433	0.000	1.000	0.505	0.501	0.000	1.000
NONMAJOR	0.466	0.500	0.000	1.000	0.590	0.493	0.000	1.000
RIVAL	0.736	0.442	0.000	1.000	0.665	0.473	0.000	1.000
L_NET	50.148	135.993	-331.537	345.494	32.776	131.694	-258.645	570.626
G_NET	52.231	122.506	-331.537	570.626	39.889	109.884	-275.909	570.626
L_ROU	13.410	9.115	1.000	41.000	17.691	11.519	1.000	47.000
G_ROU	15.137	10.770	1.000	41.000	17.488	12.382	1.000	47.000
L_RPM	15.784	9.899	0.207	54.011	23.768	24.851	0.000	97.600
G_RPM	11.657	10.736	0.154	54.011	21.012	24.521	0.210	97.273
L_DCA	65.586	53.964	0.000	187.000	46.755	55.492	0.000	187.000
L_JFK	18.546	20.565	0.000	66.000	12.122	19.066	0.000	66.000
L_LGA	74.684	89.409	0.000	286.000	51.229	83.239	0.000	284.000
L_ORD	103.086	205.944	0.000	759.000	111.489	231.345	0.000	759.000
G_DCA	66.885	61.308	0.000	187.000	23.660	32.976	0.000	112.000
G_JFK	14.471	18.875	0.000	66.000	15.963	20.347	0.000	66.000
G_LGA	70.207	102.048	0.000	286.000	30.426	54.222	0.000	177.000
G_ORD	94.270	210.991	0.000	759.000	109.511	235.557	0.000	759.000
L_HUB	-	-	-	-	-	-	-	-
G_HUB	-	-	-	-	-	-	-	-
E_REVISION	0.213	0.410	0.000	1.000	0.309	0.463	0.000	1.000
A_SLOT	0.851	0.358	0.000	1.000	0.936	0.245	0.000	1.000
EXCLU_GATE	310.943	1.932	308.000	319.000	310.500	1.772	308.000	319.000
SHARE_GATE	82.236	7.464	79.000	106.000	83.372	7.828	79.000	106.000
1995	0.305	0.462	0.000	1.000	0.223	0.418	0.000	1.000
1996	0.218	0.414	0.000	1.000	0.234	0.425	0.000	1.000
1997	0.236	0.426	0.000	1.000	0.250	0.434	0.000	1.000
1998	0.126	0.333	0.000	1.000	0.223	0.418	0.000	1.000
1999	0.040	0.197	0.000	1.000	0.021	0.145	0.000	1.000
N		174				188		

Appendix B: Descriptive statistics (continued)

	LaGuardia				O'Hare			
Variables	Mean	Standard deviation	Minimum	Maximum	Mean	Standard deviation	Minimum	Maximum
DAYS	834.844	1423.702	25.000	12246.000	2248.212	5805.350	29.000	53495.000
NEW	0.527	0.500	0.000	1.000	0.188	0.392	0.000	1.000
NONMAJOR	0.641	0.481	0.000	1.000	0.435	0.497	0.000	1.000
RIVAL	0.523	0.500	0.000	1.000	0.435	0.497	0.000	1.000
L_NET	41.247	122.790	-331.537	570.626	109.520	143.993	-252.132	570.626
G_NET	27.604	93.143	-275.909	519.838	44.330	120.215	-523.427	570.626
L_ROU	17.231	10.088	2.000	42.000	63.049	36.851	3.000	100.000
G_ROU	15.499	11.954	1.000	47.000	35.816	35.548	1.000	99.000
L_RPM	14.544	11.147	0.131	51.541	47.367	28.696	0.000	87.342
G_RPM	10.267	12.179	0.007	40.316	26.888	28.683	0.126	87.342
L_DCA	46.672	63.990	0.000	186.000	29.765	36.892	0.000	187.000
L_JFK	9.416	17.366	0.000	66.000	14.712	21.333	0.000	66.000
L_LGA	70.733	100.304	0.000	286.000	44.665	56.443	0.000	284.000
L_ORD	91.760	219.604	0.000	759.000	280.159	290.677	0.000	759.000
G_DCA	28.794	50.970	0.000	186.000	18.429	27.674	0.000	92.000
G_JFK	8.115	17.683	0.000	66.000	7.953	15.614	0.000	58.000
G_LGA	43.130	79.269	0.000	286.000	26.612	40.126	0.000	176.000
G_ORD	49.874	154.117	0.000	759.000	211.065	317.241	0.000	759.000
L_HUB	-	-	-	-	0.329	0.471	0.000	1.000
G_HUB	-	-	-	-	0.276	0.449	0.000	1.000
E_REVISION	0.275	0.447	0.000	1.000	0.324	0.469	0.000	1.000
A_SLOT	0.863	0.345	0.000	1.000	0.841	0.367	0.000	1.000
EXCLU_GATE	310.763	2.089	308.000	319.000	310.735	2.327	308.000	319.000
SHARE_GATE	83.378	8.176	79.000	106.000	84.329	8.772	79.000	106.000
1995	0.202	0.402	0.000	1.000	0.253	0.436	0.000	1.000
1996	0.305	0.461	0.000	1.000	0.212	0.410	0.000	1.000
1997	0.191	0.394	0.000	1.000	0.165	0.372	0.000	1.000
1998	0.191	0.394	0.000	1.000	0.229	0.422	0.000	1.000
1999	0.042	0.201	0.000	1.000	0.053	0.225	0.000	1.000
N		262				170		

Appendix C: Estimation results for National

Dependent variable: DAYS (Number of usable days of leased slots aggregated on a quarterly basis)

	(1)		(2)		(3)	
Independent variables	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
NEW	0.683	0.403				
NONMAJOR			0.658	0.561		
RIVAL					-0.112	0.333
L_NET	0.001	0.001	0.001	0.001	0.001	0.001
G_NET	0.002	0.002	0.002	0.001	0.001	0.002
L_ROU	0.044	0.035	0.045	0.035	0.048	0.039
G_ROU	0.014	0.029	0.020	0.038	0.004	0.033
L_RPM	0.097 ***	0.021	0.100 ***	0.021	0.103 ***	0.022
G_RPM	-0.001	0.018	0.010	0.022	-0.008	0.020
L_DCA	-0.008	0.007	-0.009	0.007	-0.009	0.007
L_JFK	-0.021	0.012	-0.028 *	0.012	-0.026 *	0.013
L_LGA	-0.002	0.003	-0.002	0.003	-0.002	0.003
L_ORD	-0.002	0.001	-0.001	0.001	-0.001	0.001
G_DCA	0.001	0.006	-0.004	0.008	0.000	0.006
G_JFK	-0.033 ***	0.010	-0.036 ***	0.010	-0.034 **	0.011
G_LGA	0.001	0.004	0.004	0.004	0.002	0.004
G_ORD	0.000	0.001	0.000	0.001	0.001	0.001
E_REVISION	0.081	0.399	0.119	0.415	0.145	0.406
A_SLOT	-1.232 **	0.420	-1.498 ***	0.353	-1.530 ***	0.344
EXCLU_GATE	0.075	0.040	0.067	0.040	0.065	0.038
SHARE_GATE	0.008	0.028	0.015	0.028	0.014	0.027
Constant	-17.472	12.053	-15.487	11.729	-14.194	11.180
Year Controls?	Yes		Yes		Yes	
Log likelihood	-1286.939		-1287.929		-1288.990	
Wald test	140.675***		157.394***		155.2073***	
LR test (H_0: Poisson Model)	chibar2(01) = 1.8e+05***		chibar2(01) = 1.8e+05***		chibar2(01) = 1.8e+05***	
N	174					

Estimated by the zero-truncated negative binomial model because of significant evidence of overdispersion. Robust standard errors adjusted for clustering by Lessor-Lessee pair. The Wald test statistics indicate that the joint null hypothesis of estimated coefficients equaling zero is rejected at the significance level of 0.001. * p<0.05, ** p<0.01, *** p<0.001

Appendix C (continued): Estimation results for Kennedy

Dependent variable: DAYS (Number of usable days of leased slots aggregated on a quarterly basis)

	(1)		(2)		(3)	
Independent variables	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
NEW	0.166	0.245				
NONMAJOR			0.154	0.342		
RIVAL					-0.610 *	0.245
L_NET	0.001	0.001	0.001	0.001	0.001	0.001
G_NET	0.001	0.001	0.000	0.001	0.000	0.001
L_ROU	0.014	0.010	0.016	0.010	0.017	0.009
G_ROU	-0.019 *	0.008	-0.019 *	0.008	-0.019 *	0.008
L_RPM	-0.017 *	0.007	-0.016 *	0.007	-0.014 *	0.007
G_RPM	-0.011 *	0.005	-0.010	0.006	-0.010	0.005
L_DCA	0.003	0.005	0.003	0.005	0.007	0.005
L_JFK	-0.016 **	0.005	-0.017 **	0.005	-0.016 **	0.005
L_LGA	-0.001	0.003	-0.001	0.003	-0.003	0.003
L_ORD	0.002 ***	0.001	0.002 ***	0.001	0.002 **	0.001
G_DCA	-0.003	0.005	-0.002	0.004	-0.002	0.005
G_JFK	0.028 **	0.010	0.027 **	0.010	0.016	0.009
G_LGA	-0.006	0.006	-0.006	0.006	-0.003	0.005
G_ORD	0.001 *	0.001	0.001 *	0.001	0.001 *	0.001
E_REVISION	0.911 ***	0.209	0.923 ***	0.206	0.920 ***	0.213
A_SLOT	0.947 *	0.419	0.868 *	0.382	0.931 *	0.443
EXCLU_GATE	-0.055	0.040	-0.057	0.041	-0.045	0.035
SHARE_GATE	-0.081 **	0.025	-0.080 **	0.024	-0.080 ***	0.023
Constant	29.595 **	10.627	30.361 **	10.950	26.917 **	9.261
Year Controls?	Yes		Yes		Yes	
Log likelihood	-1353.596		-1353.718		-1349.458	
Wald test	145.329***		133.492***		154.262***	
LR test (H_0: Poisson Model)	chibar2(01) = 9.8e+04***		chibar2(01) = 9.8e+04***		chibar2(01) = 9.2e+04***	
N	188					

Estimated by the zero-truncated negative binomial model because of significant evidence of overdispersion. Robust standard errors adjusted for clustering by Lessor-Lessee pair. The Wald test statistics indicate that the joint null hypothesis of estimated coefficients equaling zero is rejected at the significance level of 0.001. * p<0.05, ** p<0.01, *** p<0.001

Appendix C (continued): Estimation results for LaGuardia

Dependent variable: DAYS (Number of usable days of leased slots aggregated on a quarterly basis)

	(1)		(2)		(3)	
Independent variables	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
NEW	0.827 *	0.337				
NONMAJOR			-0.386	0.416		
RIVAL					-0.639 *	0.324
L_NET	-0.001	0.001	-0.001	0.001	-0.001	0.001
G_NET	0.000	0.001	0.000	0.001	0.000	0.001
L_ROU	0.034	0.023	0.062 **	0.022	0.065 **	0.021
G_ROU	-0.006	0.014	-0.011	0.012	-0.015	0.011
L_RPM	0.046 **	0.017	0.065 ***	0.018	0.077 ***	0.019
G_RPM	-0.033 *	0.014	-0.054 ***	0.014	-0.035 **	0.013
L_DCA	0.020 **	0.008	0.028 ***	0.008	0.030 ***	0.006
L_JFK	-0.014	0.012	-0.027 *	0.011	-0.025 *	0.010
L_LGA	-0.014 *	0.006	-0.022 ***	0.006	-0.026 ***	0.005
L_ORD	-0.001	0.001	-0.001	0.001	0.000	0.000
G_DCA	-0.015	0.008	-0.017	0.012	-0.016	0.010
G_JFK	0.035 **	0.012	0.031 **	0.012	0.031 **	0.011
G_LGA	0.008	0.005	0.007	0.007	0.007	0.006
G_ORD	-0.002 *	0.001	-0.002 *	0.001	-0.002 *	0.001
E_REVISION	1.588 ***	0.470	1.611 ***	0.433	1.501 ***	0.447
A_SLOT	-0.201	0.290	-0.250	0.294	-0.232	0.272
EXCLU_GATE	0.046	0.038	0.024	0.041	0.026	0.042
SHARE_GATE	-0.041	0.027	-0.035	0.025	-0.041	0.027
Constant	-5.868	11.349	0.874	12.406	0.892	12.831
Year Controls?	Yes		Yes		Yes	
Log likelihood	-1936.440		-1942.253		-1939.301	
Wald test	438.350***		333.233***		374.270***	
LR test (H_0: Poisson Model)	chibar2(01) = 2.4e+05***		chibar2(01) = 2.4e+05***		chibar2(01) = 2.4e+05***	
N			262			

Estimated by the zero-truncated negative binomial model because of significant evidence of overdispersion. Robust standard errors adjusted for clustering by Lessor-Lessee pair. The Wald test statistics indicate that the joint null hypothesis of estimated coefficients equaling zero is rejected at the significance level of 0.001. * p<0.05, ** p<0.01, *** p<0.001

Appendix C (continued): Estimation results for O'Hare

Dependent variable: DAYS (Number of usable days of leased slots aggregated on a quarterly basis)

	(1)		(2)		(3)	
Independent variables	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
NEW	0.572 *	0.268				
NONMAJOR			0.490	0.632		
RIVAL					-1.304 ***	0.271
L_NET	-0.001	0.001	-0.001	0.001	-0.001	0.001
G_NET	-0.002	0.001	-0.002	0.001	-0.002 *	0.001
L_ROU	0.017 *	0.009	0.020 *	0.010	0.017 *	0.007
G_ROU	-0.028 *	0.013	-0.031 *	0.014	-0.039 **	0.012
L_RPM	0.005	0.013	0.003	0.014	0.005	0.009
G_RPM	0.007	0.011	0.017	0.013	0.010	0.009
L_DCA	0.020	0.024	0.021	0.027	0.025	0.024
L_JFK	0.008	0.014	0.010	0.015	0.010	0.011
L_LGA	-0.016	0.015	-0.017	0.017	-0.017	0.015
L_ORD	0.002	0.004	0.001	0.003	-0.002	0.003
G_DCA	-0.019 *	0.009	-0.016	0.009	-0.016	0.008
G_JFK	0.057 ***	0.017	0.050 *	0.019	0.052 **	0.017
G_LGA	0.018	0.012	0.019	0.012	0.020	0.013
G_ORD	-0.002	0.002	-0.004	0.003	-0.003	0.002
L_HUB	-3.195	2.071	-2.593	2.042	-0.968	1.877
G_HUB	1.851	1.554	2.863	1.613	3.300 *	1.595
E_REVISION	0.049	0.739	0.146	0.756	-0.044	0.735
A_SLOT	-0.432	0.272	-0.491	0.267	-0.267	0.362
EXCLU_GATE	0.008	0.042	0.013	0.040	0.010	0.041
SHARE_GATE	0.012	0.034	0.012	0.035	0.009	0.034
Constant	3.170	11.004	1.354	10.610	3.804	10.651
Year Controls?	Yes		Yes		Yes	
Log likelihood	-1339.133		-1341.027		-1333.699	
Wald test	1365.211***		1585.081***		1156.733***	
LR test (H_0: Poisson Model)	chibar2(01) = 4.6e+05***		chibar2(01) = 4.6e+05***		chibar2(01) = 4.6e+05***	
N			170			

Estimated by the zero-truncated negative binomial model because of significant evidence of overdispersion. Robust standard errors adjusted for clustering by Lessor-Lessee pair. The Wald test statistics indicate that the joint null hypothesis of estimated coefficients equaling zero is rejected at the significance level of 0.001. * p<0.05, ** p<0.01, *** p<0.001

Appendix D: Estimation results for National, Kennedy, LaGuardia, and O'Hare

Dependent variable: DAYS (Number of usable days of leased slots aggregated on a quarterly basis)

	National			Kennedy			LaGuardia			O'Hare		
	(1)			(2)			(3)			(4)		
Independent variables	Coef.		Std. Err.	Coef.		Std. Err.	Coef.		Std. Err.	Coef.		Std. Err.
INC*MAJOR*RIVAL	0.662		0.651	-0.324		0.570	-0.025		0.855	-1.634	***	0.456
INC*NONMAJOR*RELATED	1.281		0.744	0.168		0.795	0.526		1.130	-0.859		0.638
INC*NONMAJOR*RIVAL	0.287		0.642	-0.427		0.755	-1.317		0.946	-		-
NEW*MAJOR*RELATED	-0.388		1.018	-1.268		0.784	1.877		1.130	-0.960		0.730
NEW*MAJOR*RIVAL	1.915	*	0.891	-0.129		0.694	2.403		1.274	-		-
NEW*NONMAJOR*RELATED	1.090		0.700	0.571		0.692	0.882		1.045	-0.315		0.683
NEW*NONMAJOR*RIVAL	2.173	**	0.834	-0.282		0.632	0.307		1.063	-1.914	**	0.648
L_NET	0.001		0.001	0.000		0.001	-0.001		0.001	0.000		0.001
G_NET	0.002		0.001	0.001		0.001	0.000		0.001	-0.002		0.001
L_ROU	0.016		0.031	0.015		0.011	0.049	*	0.021	0.018	*	0.007
G_ROU	0.022		0.033	-0.019	*	0.008	0.001		0.014	-0.033	**	0.010
L_RPM	0.073	***	0.022	-0.015	*	0.007	0.066	**	0.023	0.005		0.009
G_RPM	0.002		0.021	-0.008		0.006	-0.035	**	0.013	0.007		0.015
L_DCA	-0.003		0.007	0.007		0.006	0.028	***	0.008	0.023		0.024
L_JFK	-0.023	*	0.011	-0.012	*	0.005	-0.026	*	0.011	0.006		0.012
L_LGA	-0.003		0.003	-0.004		0.004	-0.022	***	0.007	-0.015		0.015
L_ORD	-0.001		0.001	0.002	**	0.001	-0.002	**	0.001	-0.002		0.003
G_DCA	0.003		0.007	-0.004		0.005	-0.021	**	0.007	-0.018		0.010
G_JFK	-0.027	**	0.009	0.014		0.010	0.029	**	0.011	0.057	**	0.018
G_LGA	-0.001		0.004	-0.001		0.006	0.011	*	0.005	0.019		0.013
G_ORD	0.000		0.001	0.001		0.001	-0.002	**	0.001	-0.004		0.002
L_HUB										-0.830		1.821
G_HUB										3.540	*	1.664
E_REVISION	0.127		0.380	0.937	***	0.213	1.443	***	0.424	-0.066		0.702
A_SLOT	-0.814	*	0.408	1.018		0.557	-0.244		0.262	-0.329		0.346
EXCLU_GATE	0.092	*	0.037	-0.040		0.040	0.038		0.034	0.020		0.041
SHARE_GATE	0.013		0.026	-0.082	***	0.024	-0.029		0.027	0.007		0.032
Constant	-24.114	*	11.104	25.040	*	11.053	-4.451		10.207	1.264		10.959
Year Controls?	Yes			Yes			Yes			Yes		
Log likelihood	-1277.269			-1347.612			-1919.277			-1330.429		
Wald test	228.372***			9.4e+05***			667.121***			4675.72***		
LR test (H_0: Poisson Model)	chibar2(01) = 1.6e+05***			chibar2(01) = 9.1e+04***			chibar2(01) = 2.1e+05***			chibar2(01) = 4.6e+05***		
N	174			188			262			170		

Estimated by the zero-truncated negative binomial model because of significant evidence of overdispersion. Robust standard errors adjusted for clustering by Lessor-Lessee pair. The Wald test statistics indicate that the joint null hypothesis of estimated coefficients equaling zero is rejected at the significance level of 0.001. * p<0.05, ** p<0.01, *** p<0.001