HOW OVER-SCHEDULING AFFECTS SCHEDULED BLOCK TIMES IN HUB AIRPORTS

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MOTIVATION

▶ Total cost of air transportation delays is estimated up to 9.4 billion dollars annually. The U.S. spent more than 4.5 billion dollars in 2002-04 to reduce flight delays

▶ Limited research on the potential impact of congestion pricing, and little, if any, estimates of the potential benefits from introducing congestion pricing

▶ Difficult to come up with a useful research framework since there is no available comparison between airports with and without congestion pricing

SCHEDULED DELAYS

- ► Longer travel time can result both from planned and unplanned events

  - ► Unplanned events - unexpected weather conditions, mechanical problems, etc.

  - ► Planned/scheduled events - expected traffic pattern at time of operation, number of available runways, expected weather conditions, etc.

- ► Both types of events have merits as congestion measures, but the first one gets all the attention - WHY?

- ► This project focuses on the *planned* events component, and examines how block times of flights change during bank periods in different hub airports

HOW TO MEASURE LONGER SCHEDULED TRAVEL TIME?

1. For each directional route I obtain as a benchmark the shortest block time in that month and year
2. For each flight I derive the excess block time by subtracting the relevant benchmark from the flight block time

For example, the shortest block time from San Francisco to Newark in October 2000 is 290 minutes. Thus for a flight in the same route with a block time of 333 minutes we derive an excess block time of 43 minutes

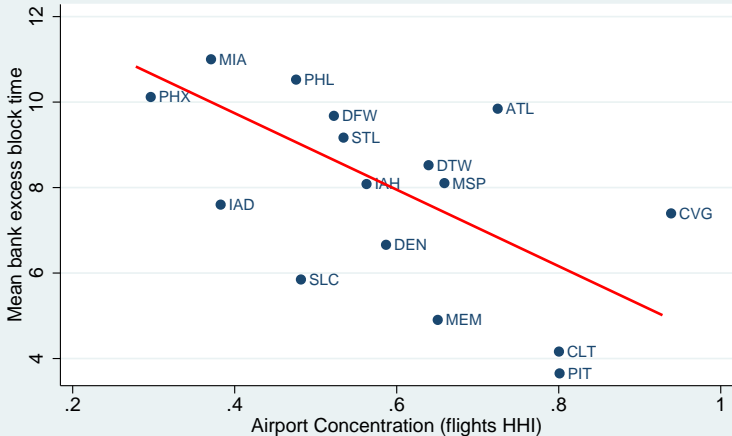# WHY DIFFERENT BLOCK TIME PATTERNS ARISE IN DIFFERENT AIRPORTS?

Operating during over scheduling periods clearly affects a flight block time, but why and how should it vary across airports? Take two extreme cases:

1. An airport dominated by one airline ('monopolistic airport')

   ▸ Over-scheduling by the monopolistic airline would impose potential delays on other aircrafts operated by the airline itself

2. A hub airport with several airlines ('competitive airport')

   ▸ Over-scheduling in a competitive airport would likely impose delays on aircrafts operated by other airlines

Thus a monopolistic airline has an incentive to avoid over-scheduling compared to an airline in a competitive airport

Excess Block Time & Airport Concentration

Mean bank excess block time (y-axis)
Airport Concentration (flights HHI) (x-axis)

Data points: MIA, PHL, PHX, DFW, ATL, STL, DTW, MSP, IAH, IAD, CVG, DEN, SLC, MEM, CLT, PIT

departing banks
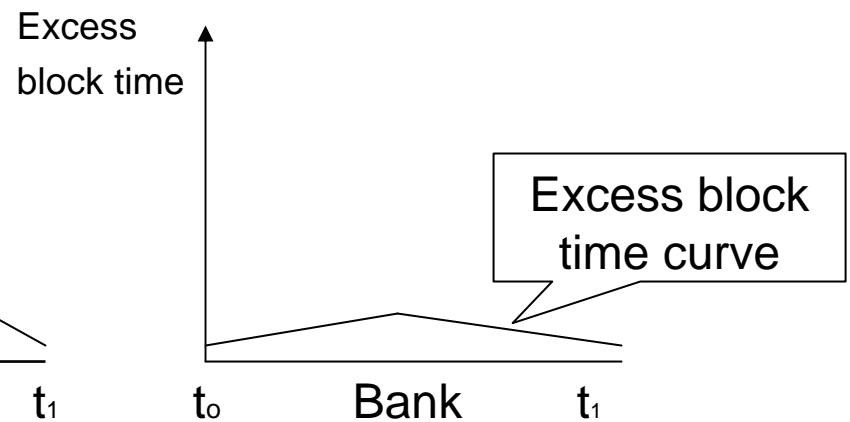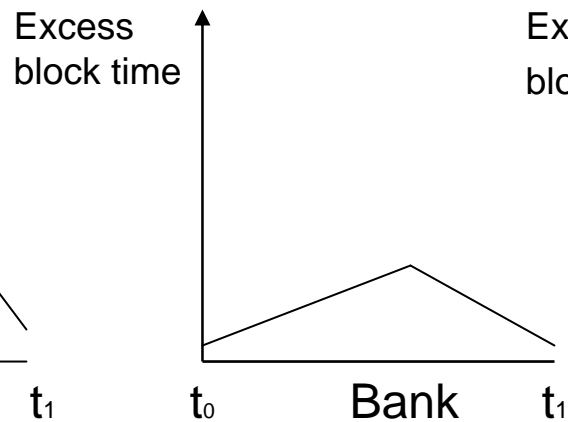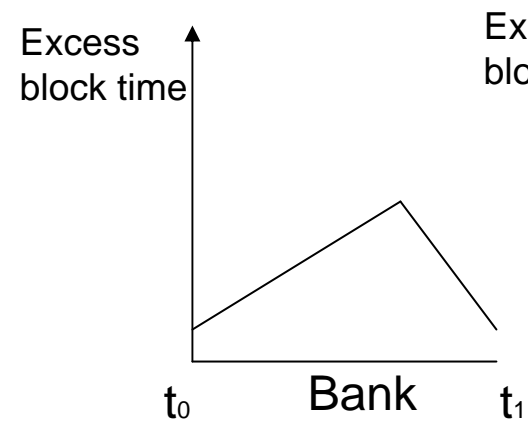Benchmark: min. block time in route, Oct. 00'

CONGESTION PRICING

In fact, economically speaking - the role of congestion pricing is to achieve the monopolistic airport outcome by creating incentives for the airlines such that they will take into consideration how their own actions affect other airlines
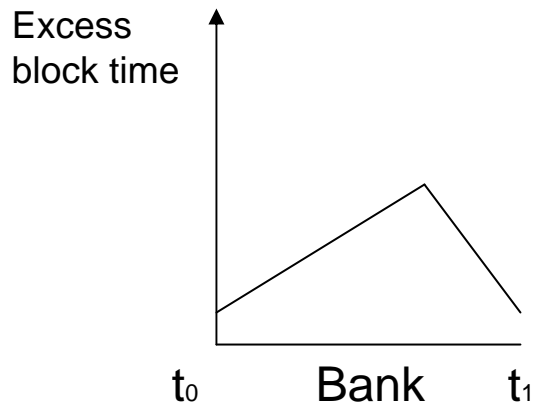
Graphic Illustration (1)

Graphic Illustration (2)

Departing bank

Excess
block time

t$_0$ Bank   t$_1$

Arriving bank

Excess
block time

t$_0$ Bank   t$_1$
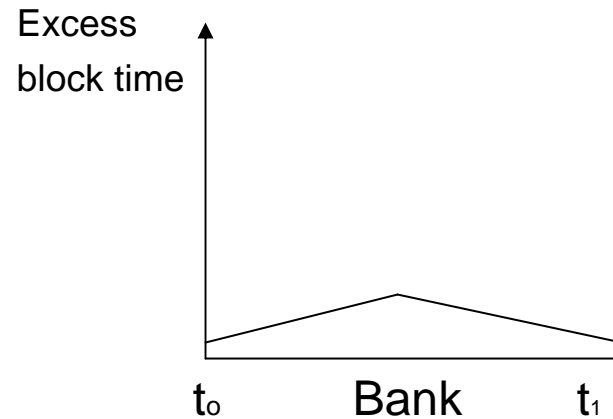
TESTABLE IMPLICATIONS FOR HUB AIRPORTS

1. Within banks - Flights scheduled closer to the center of the bank experience more delays; the slope of the curve is positive and then negative

2. Across departing and arriving banks - Since the cost of queuing is larger in arriving banks than in departing banks; the slope of the excess block time curve is steeper in departing banks than in arriving banks

3. Across airports - The more concentrated the airport the less congested it is; the excess block time curve is flatter in concentrated airports

DATA

- ▶ Scheduled departures and arrival times of flights in October 2000. Total of 165,000 flights (DOT on-time performance database)
- ▶ Capacity levels of airports (FAA)
- ▶ Characteristics of aircrafts: # of seats, engine, age (FAA Registry)
- ▶ Allocation of gates in airports (Competition Plan Reports)
- ▶ October 2000 enplanements (T100 database)

Focus on 31 largest airports (16 hub airports and 15 non-hub airports) (excluding LGA, ORD)
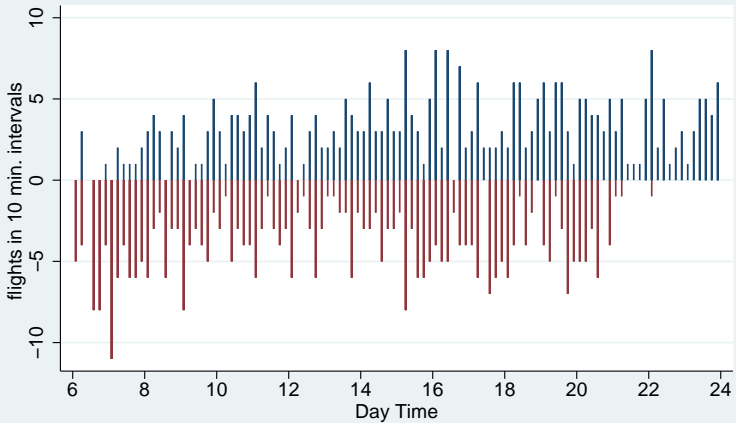
AIRPORT LOCATIONS

HUBBING BEHAVIOR
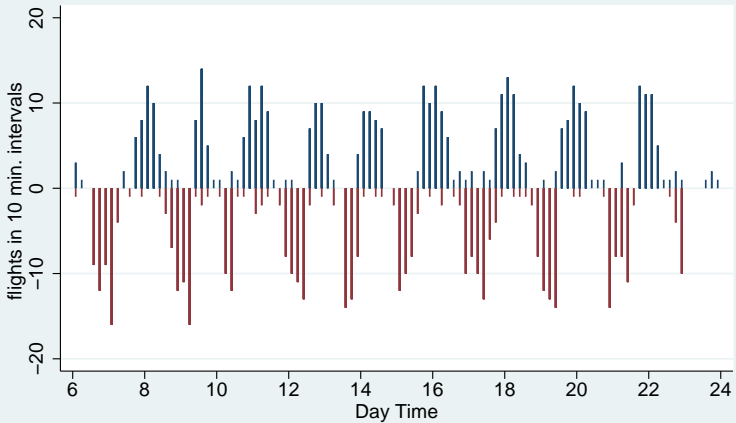
airport capacity is (23 – 31) flights per 10 minutes
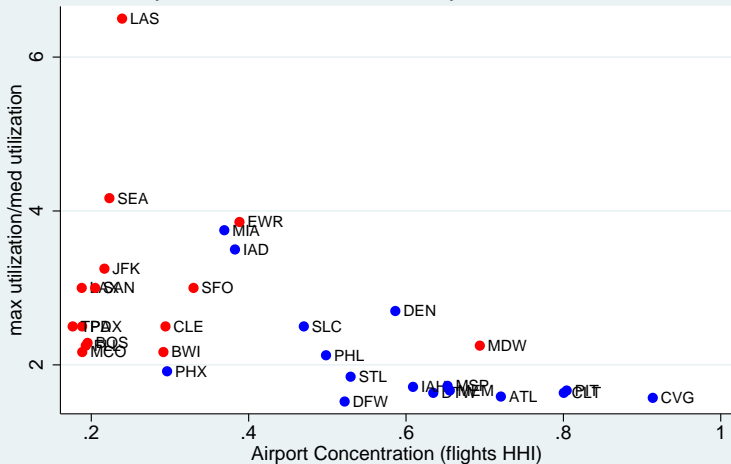DTW, 10/04/00

NON-HUBBING BEHAVIOR

airport capacity is (11 – 15) flights per 10 minutes
EWR, 10/04/00

Airprt Utilization Ratio & Airport Concentration

y-axis: max utilization/med utilization

x-axis: Airport Concentration (flights HHI)

Oct. 00' – operations are measured in ten minutes intervals

- ► Regression analysis results provide evidence supporting the three testable implications

- ► In particular, changing an airport level of concentration to the level of concentration of a fully monopolized airport could save on average **2.25 minutes** for a departing flight and **1.5 minutes** for an arriving flight

The more competitive the airport the larger the potential benefits from "shifting" to a monopoly level of concentration

- If all airports operated as a monopoly airport, using a value of $30 per hour of a passenger, **18.3 million** enplanements in the 16 hub airports, we would get potential savings of $**34.32** million in October, and $**412 million** annually

- This figure reflects only travel time savings of passengers, and NOT direct savings of airlines (fuel, capital, wages etc.)

- The figure corresponds to the potential savings only in the 16 hub airports, and not in the entire system

RECOMMENDATIONS

- Adopting airlines' padding of schedule as a measure of congestion

- Implementing congestion pricing can improve block time performance during over-scheduling periods

- Start implementing congestion pricing in relatively competitive airports before introducing it in concentrated airports

- Congestion pricing of high peak departing operations is preferable over the congestion pricing of arriving flights

QUESTIONS?