Congestion in a competitive world: A study of the impact of competition on airline operations

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Outline

- Airline Scheduling in the US
- Issues in the current situation
- Case study: why airlines won't voluntarily reduce frequency using PODS (revenue management simulator)

Some Numbers for the US

- Total profit in 2007 $5.6 Billion (< 2%)
- Total delay in 2008 4.3 Mio hours
- Delay costs in 2008 $41 Billion
  - $19 Billion additional operating costs
  - $12 Billion passengers' value of time
  - $10 Billion spill out to other industries
- Additional tons of carbon dioxide 7.1 Mio

  (0.12% of total US emission)

Situation is getting worse

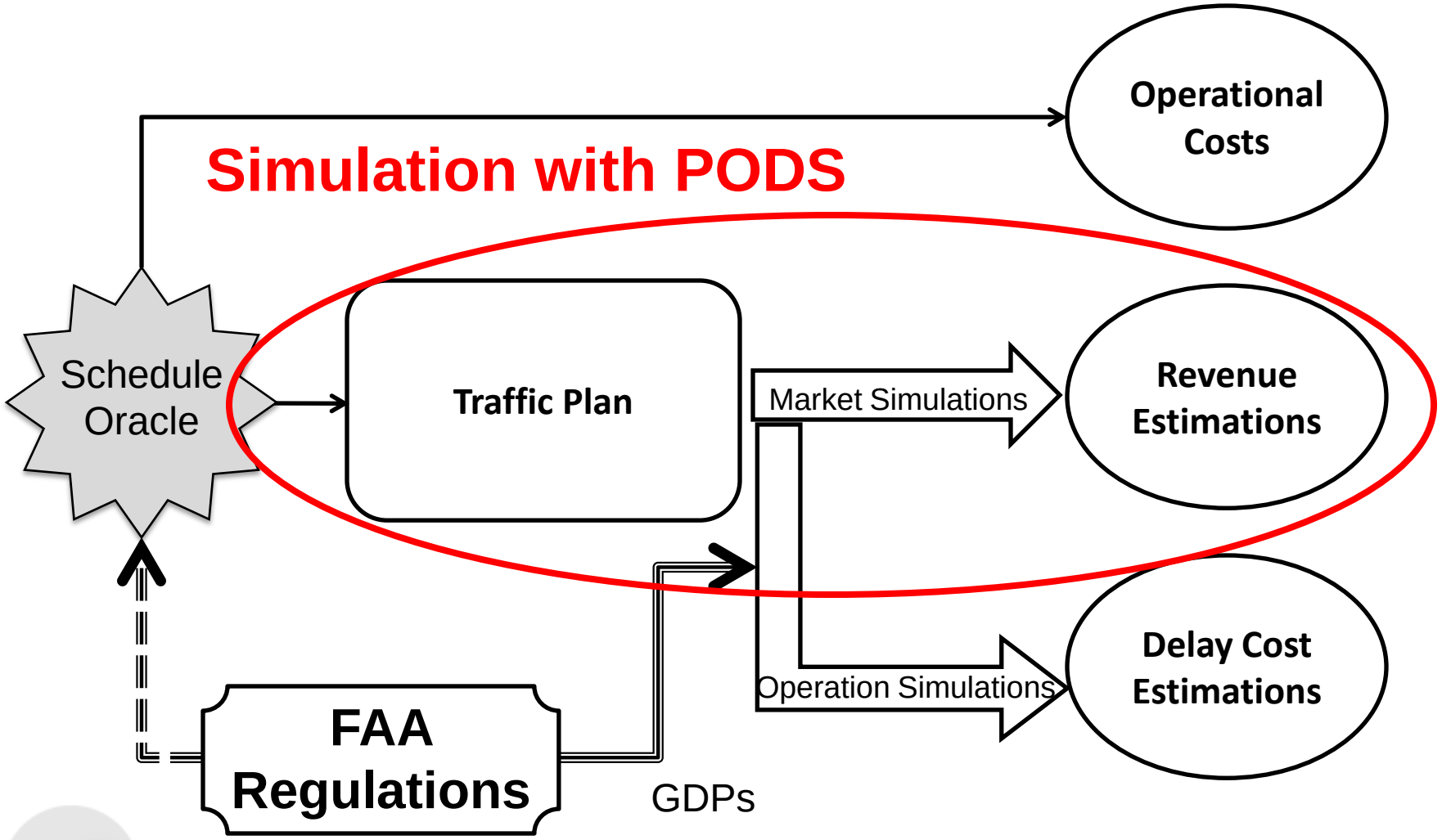
- Yearly increase of 2.5% flights/year until 2025 (FAA Annual Report, 2008)

- Each 1% additional flights generates 5% additional delays (Shaefer et al., 2005)

Issues and open questions

- Can airport capacity expand at the same rate?
- Will airlines reduce frequency by their own?
- Are external regulations required?
  - What should the regulations be?
  - How to get airlines involved?
  - How to guarantee fairness?
- Are regulations applicable, at what cost?

US Airline Scheduling Process



Case Study

- Single OD market
  - 1440 miles
  - 3.39 hours block time
  - 6 fare classes
- 2 Competing airlines (A1 and A2)
  - 5 flights per day
  - 100 seats per flight (500 seats a day in total)

2 Types of Scenarios

- A1 only changes schedule (NO competitive response)
  - A1 retimes flights (500 seats)
  - A1 cuts a flight (400 seats)
  - A1 cuts a flight and retimes (400 seats)
  - A1 cuts a flight, retimes and increases capacity (450 seats)
- A2 reacts to A1's change of schedule
  - A1 cuts, A2 adds a flight (400 seats for A1,600 for A2)
  - A2 adds a flight and reduces capacity per flight

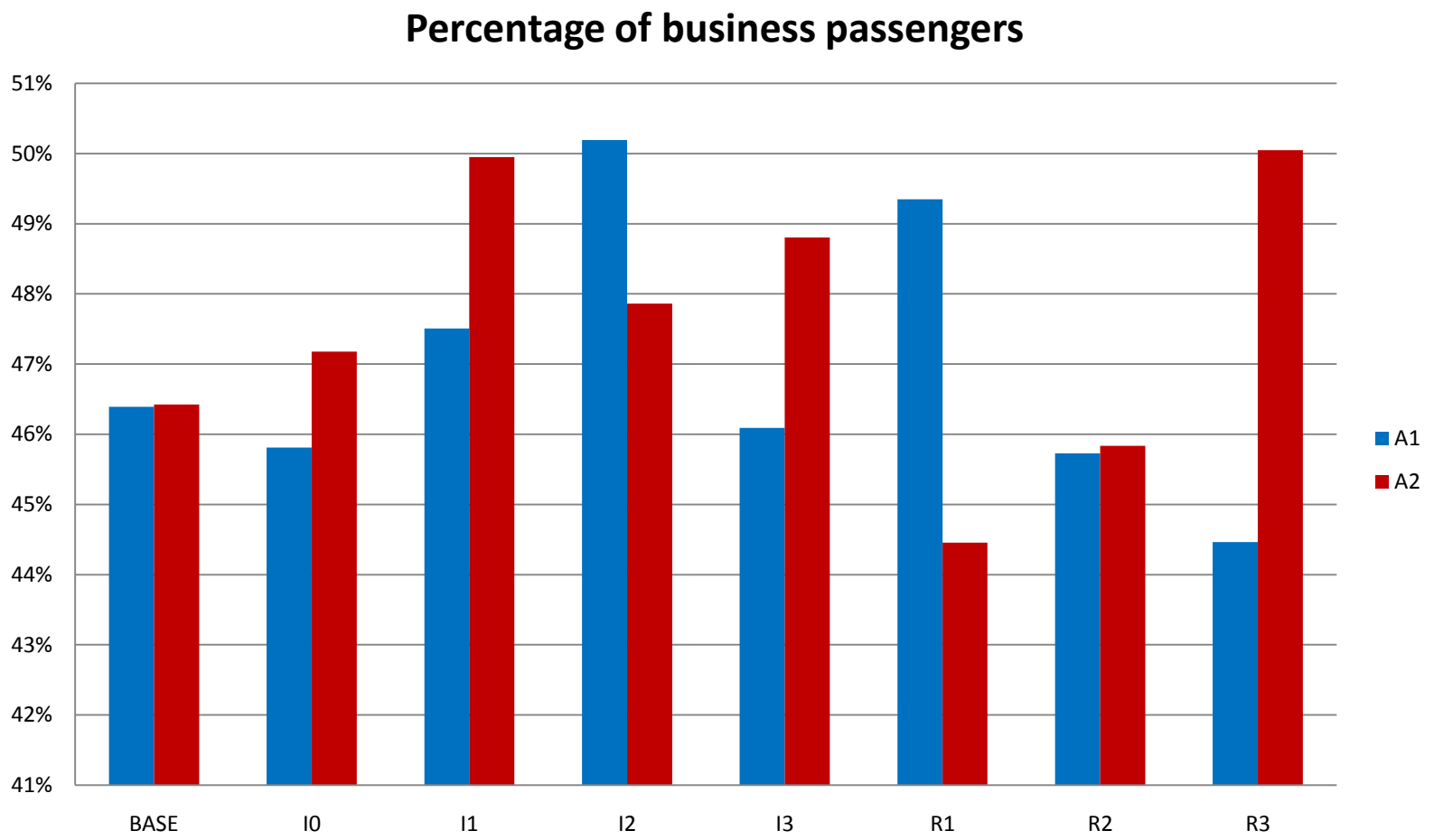
    (450 seats for A1 and 500 seats for A2)

No Competitive Response

- Retiming only
  - retiming only affects revenue
  - Poor retiming decision: direct revenue transfer of ~2.5%
- Frequency reduction
  - A1 loses from 7.4% to 14.3% of its initial revenue
  - A2 gains 4.4% to 8.3% more revenue
  - A1 recaptures some of the lost revenue by retiming and increasing capacity

Competitive Response

- Competitive response to cut only
  - A2 gets15.4% more revenue, A1 loses 15.2%
  - A1 loses 17.7% pax, A1 has 17.4% more pax
- Response to cut and retiming (450 vs 600 seats)
  - A1 recaptures 29.2% of lost revenue and 44% of lost pax
  - A2 increases initial revenue by 13.8% and 14.8% pax
  - A1 loses 10.8% of initial revenue and 9.9% of pax
- A2 high-frequency-low-capacity (450 vs 500 seats)
  - A1 loses 9.2% of initial revenue, A2 increases it by 6.0%
  - A2 captures most of the high fare passengers


Percentage of business passengers
51%
50%
49%
48%
47%
46%
45%
44%
43%
42%
41%
BASE
I0
I1
I2
I3
R1
R2
R3
A1
A2

Big picture

- A2 gains from A1's frequency reduction even without response
- A1 is less cost-efficient: it sells more low-fare seats to fill the aircraft
- A2 cannot recapture all lost revenue by A1 without increasing frequency
- Higher frequency allows for better match of high-fare demand profiles
- Add capacity is increasing revenue, but not necessarily increasing profit

Conclusions

- Airline congestion in the US is a major issue
- Airlines benefit from increased frequency
- Airlines have no interest in reducing voluntarily their frequency
- Are these results extending to more complex schedules (networks?)

Thank you!