



# The economic potential for de- peaking of hub airports

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# Conclusions

- De-peaking is feasible and attractive for hub-carriers under certain market conditions
- De-peaking of hubs will deliver substantial benefits to stakeholders other than the hub airline, including ATM
- De-peaking delivers environmental gains and helps to deal with the capacity crunch



# Outline

- **Network economies of hub-and-spoke systems**
- **Diseconomies of hubbing and external effects**
- **Results of de-peaking at US hubs from an economic and operational perspective**
- **Conclusions**

# Airline hub-and-spoke networks driven by network economies

# hub connections via the hub (with transfer)

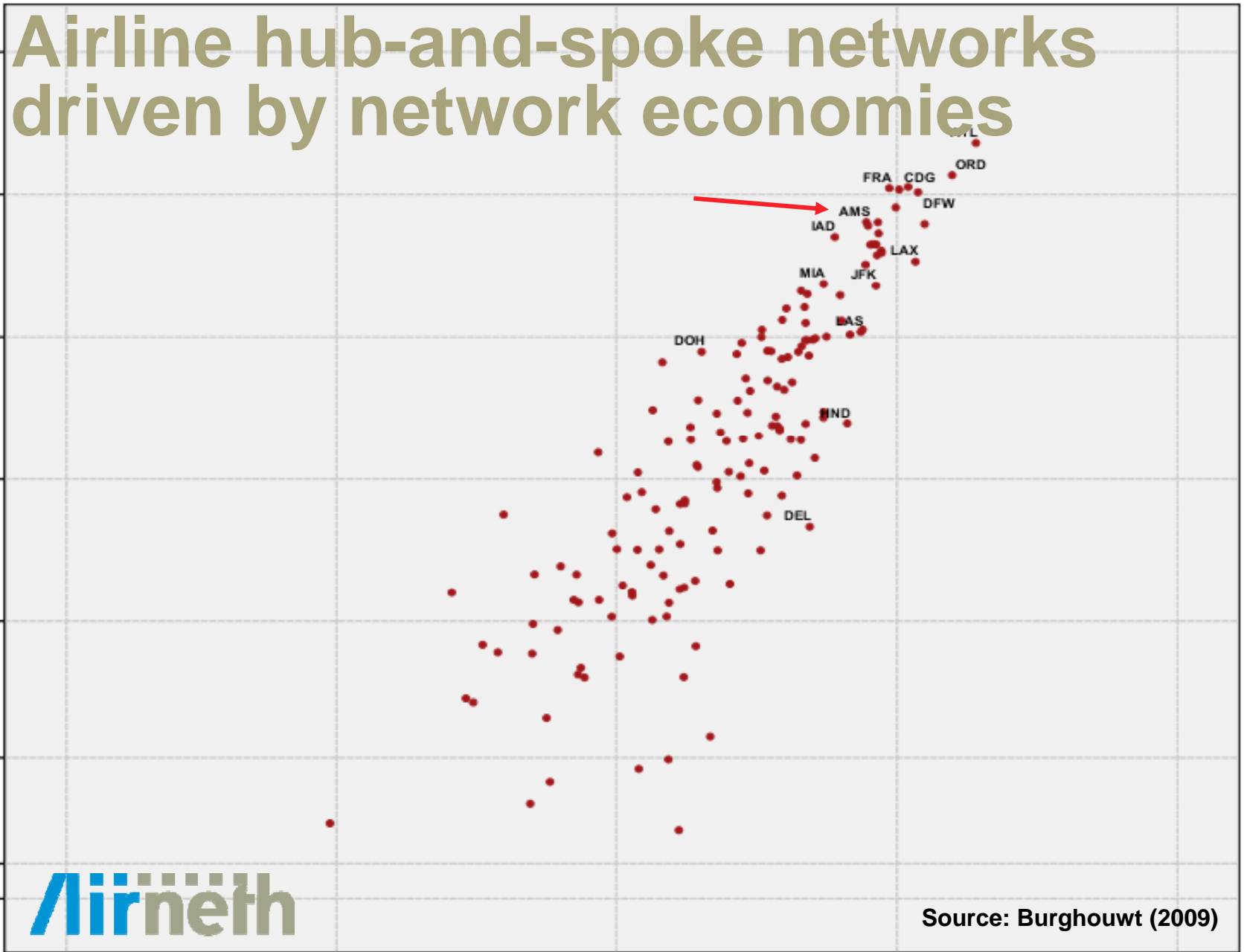
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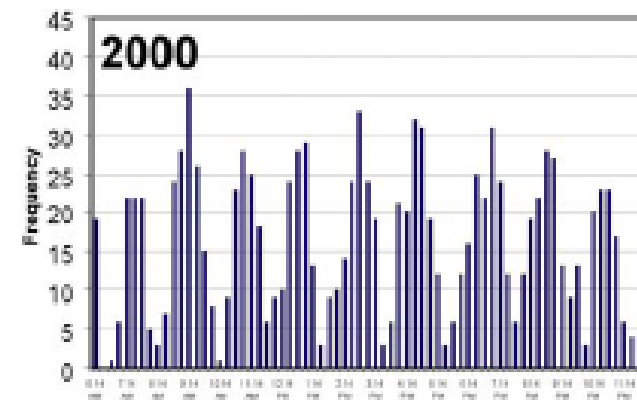
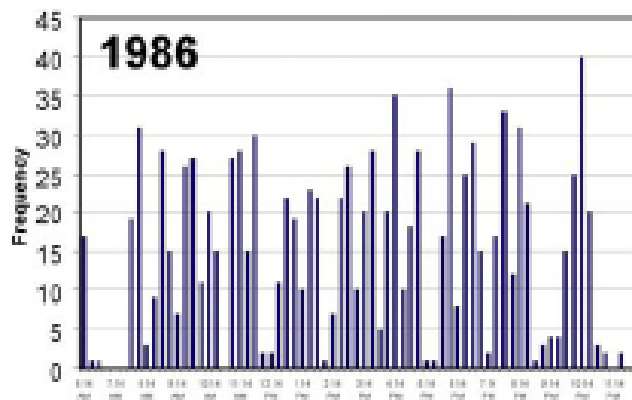
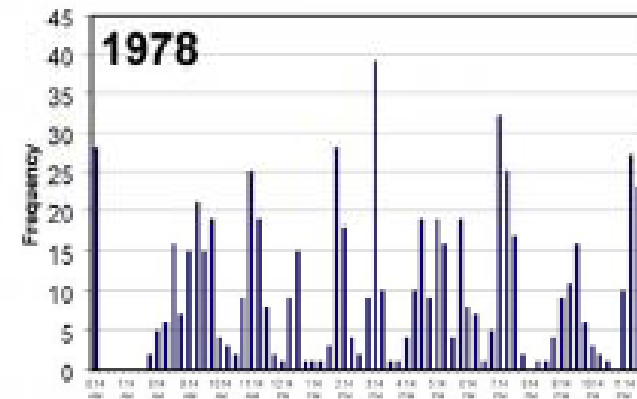
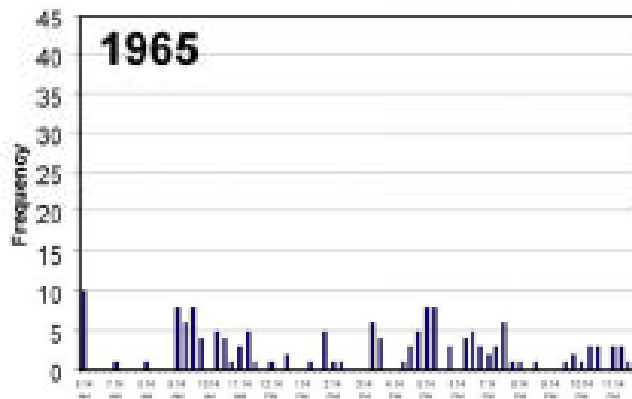
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# direct flights from the hub

Source: Burghouwt (2009)



# Maximization of network economies requires peaking of flights. Or not?



Hub service development of Delta Airlines at Atlanta:  
# frequencies per 15-min. period on an average weekday



# Diseconomies of hubbing for airlines

Hub carriers accept cost penalties through scheduling constraints in return for optimized revenue potential:

- Reduced schedule reliability (block time and ground time delays)
- Compromises on utilization of aircraft (turn around times)
- Compromises on employee productivity
- High cost, complex handling process at airports

Furthermore:

- High revenue yields justifying lower operational efficiency of hub-system increasingly under pressure
  - According to Franke (2003), cost differential HS versus LCC's cannot be supported when LCC penetration in Europe reaches US levels
- Operational/capacity constraints can make further growth of hub-system unfeasible



# External effects of airline hubbing

## Infrastructure & operation

- High peak-hour demands by hub airline:
  - Inefficient use of airport capacity due to peaks and valleys
  - Airport operator bears the hub infrastructure costs: high airport unit costs
  - Non-hub airlines pay for hub infrastructure costs through landing fees without direct benefit
- High peak loads for various stakeholders in the airport system: ATM, security, baggagehandlers etc.

## Environmental impacts

- Schipper & Rietveld (1998):
  - Fully connected network inferior to hub-and-spoke network in terms of environmental burden
  - Effects unevenly distributed in space: local environment deteriorates around the hub airport but remains stable at non-hubs
- Due to lower schedule efficiency: higher fuel burn and emissions
- Airport land use in densely populated areas

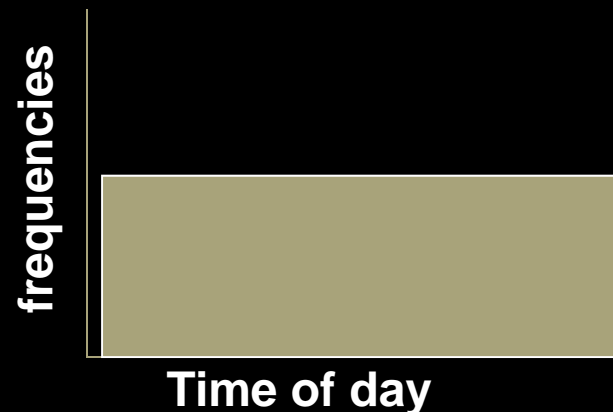
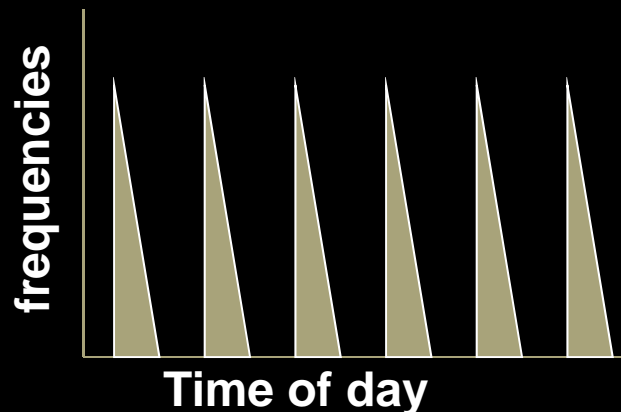
# Is it possible to combine revenue generating power of peaked hub with efficiency of a 'continuous' schedule?

## Peaked hub

- Wave-system structure built around arrival/departure waves
- Optimizes revenue via maximized connections and minimized connection times
- Peaks and valleys of demand/supply leading to operational inefficiencies

## De-peaked hub/continuous structure

- Un-banked structure with constant flow of arrivals and departures
- May cause lower revenues due to fewer connections and longer connection times
- Smooth operation, maximizing operational efficiency
- Decreased load on scarce airport infrastructure

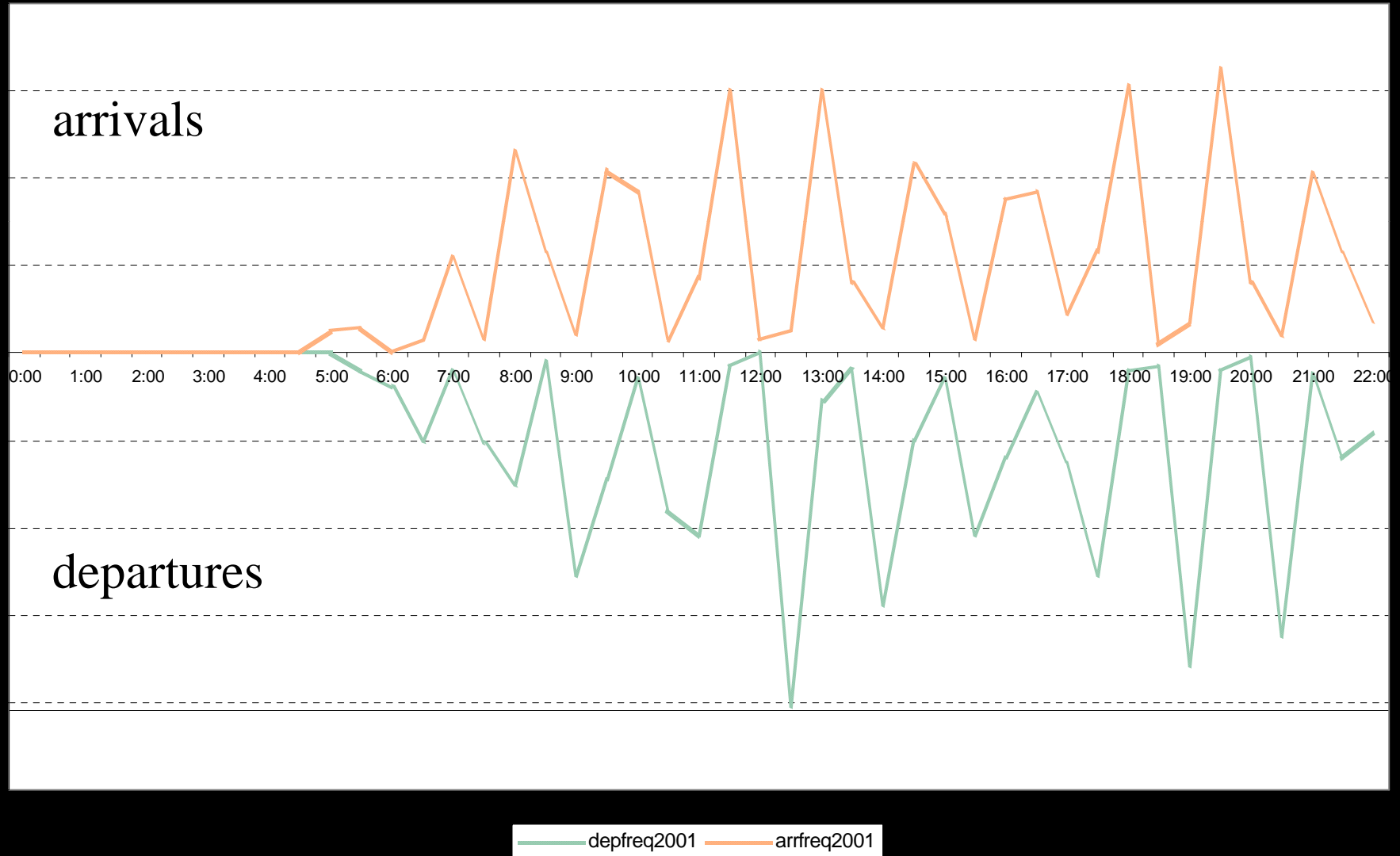




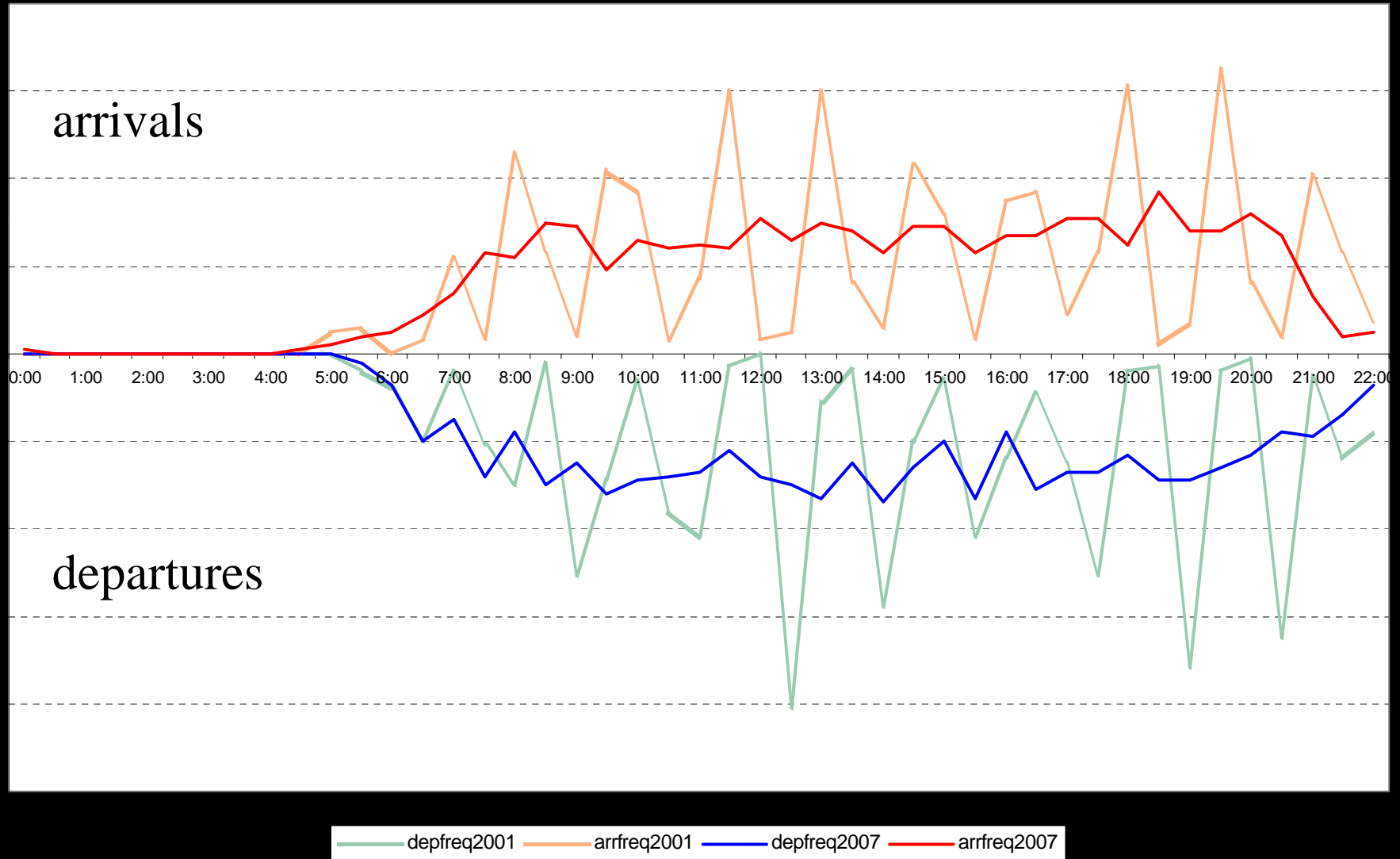
# Feasibility of de-peaking at US hubs: an economic perspective

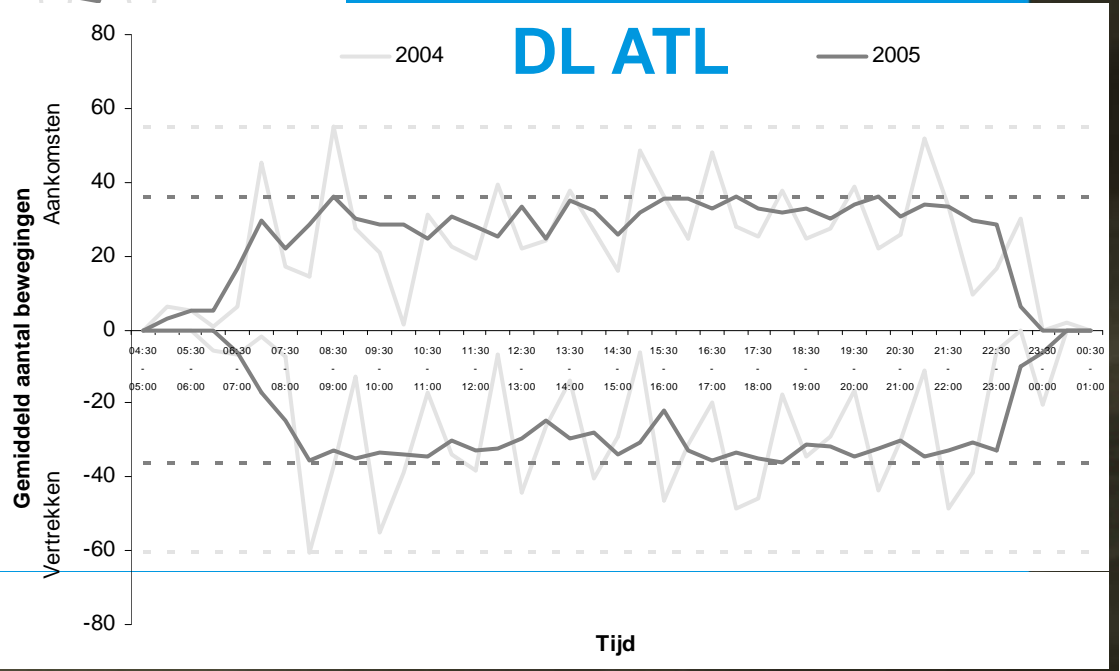
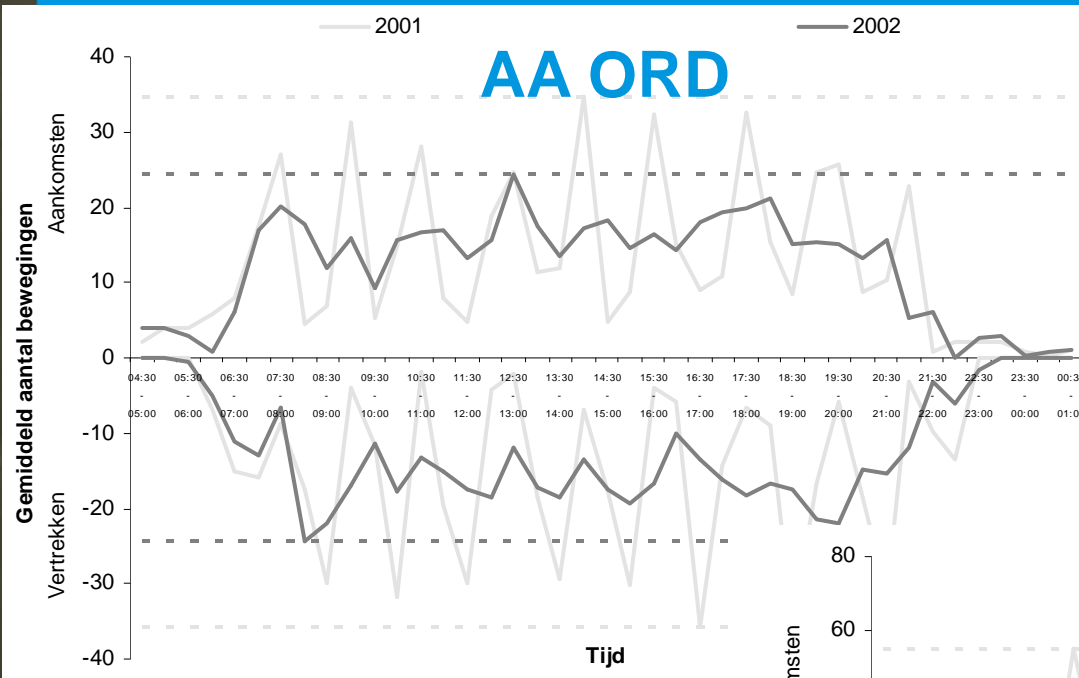
- Delta de-peaked ATL in 2004 because of operational constraints to growth and need to reduce costs
- AA de-peaked DFW and ORD in 2002 to achieve cost reductions
- What have been the effects from an economic and operational perspective?
  - Results from literature review and SEO Netscan+ analyses
  - Connecting quality, connectivity, revenues and on-time performance

# De-peaking American Airlines at Dallas Ft. Worth april '02 (2001 en 2007)

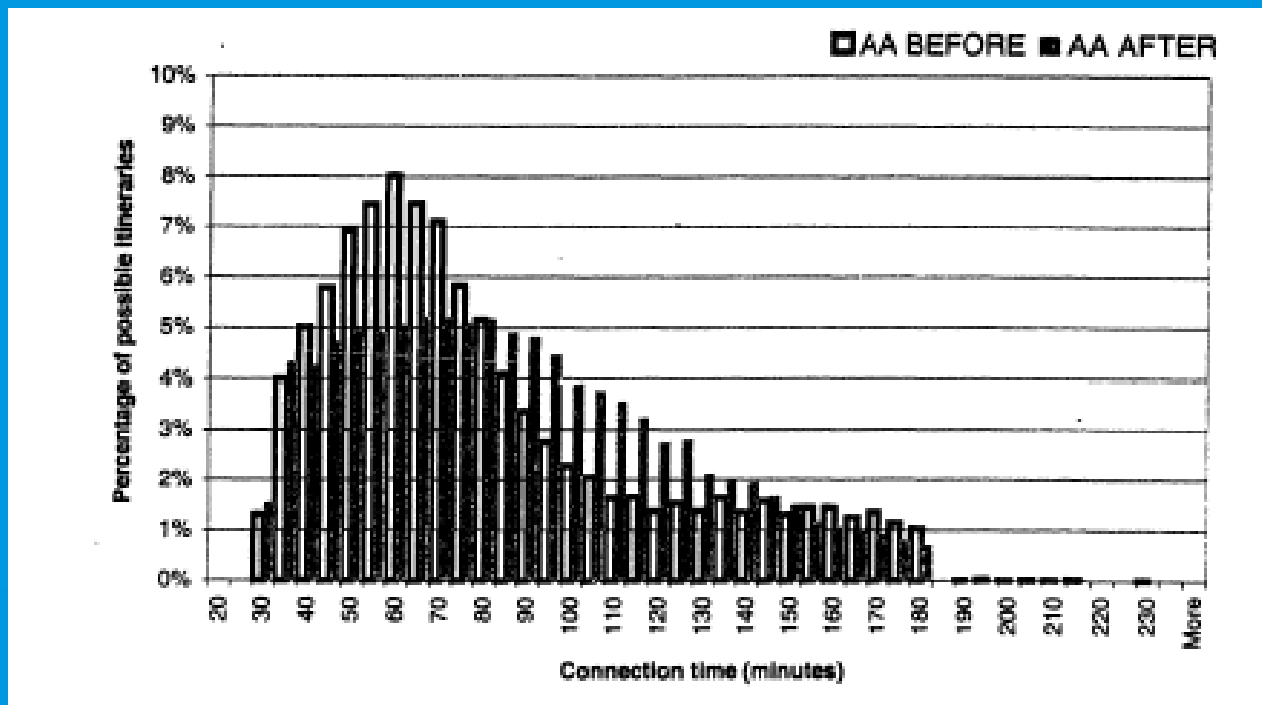


# De-peaking American Airlines at Dallas Ft. Worth april '02 (2001 en 2007)





# Impact on connection times of AA at Chicago O'Hare



Source: Bogush (2003)



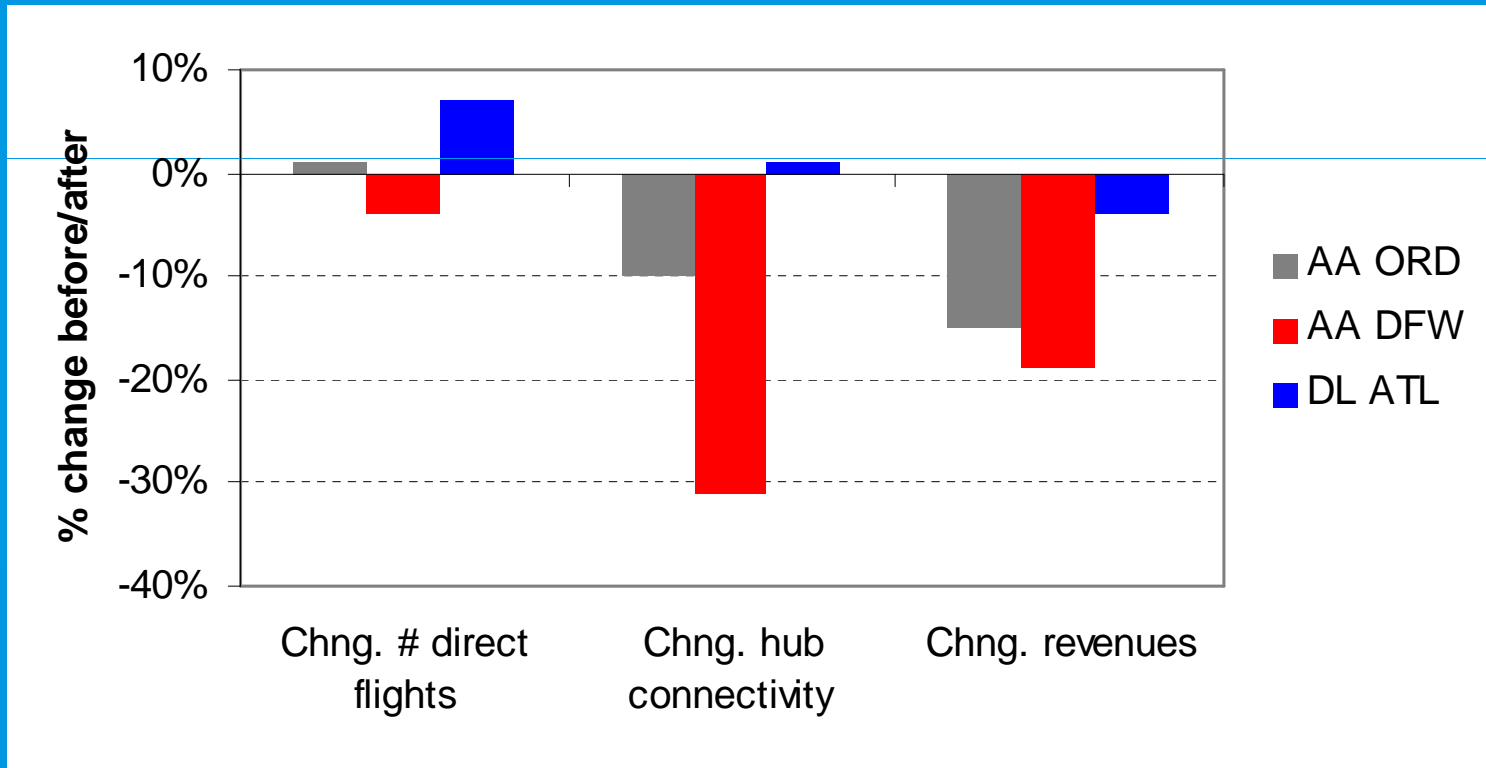
## Result: quality hub connections decreases due to de-peaking

	Quality before	Quality after	% Change
AA ORD	0,3	0,28	-5%
AA DFW	0,31	0,28	-9%
DL ATL	0,25	0,25	0%

Quality of hub connections is a function of transfer and detour time

Source: SEO Netscan+ analyses

# Impacts of de-peaking on connectivity and revenues (summer before/after)



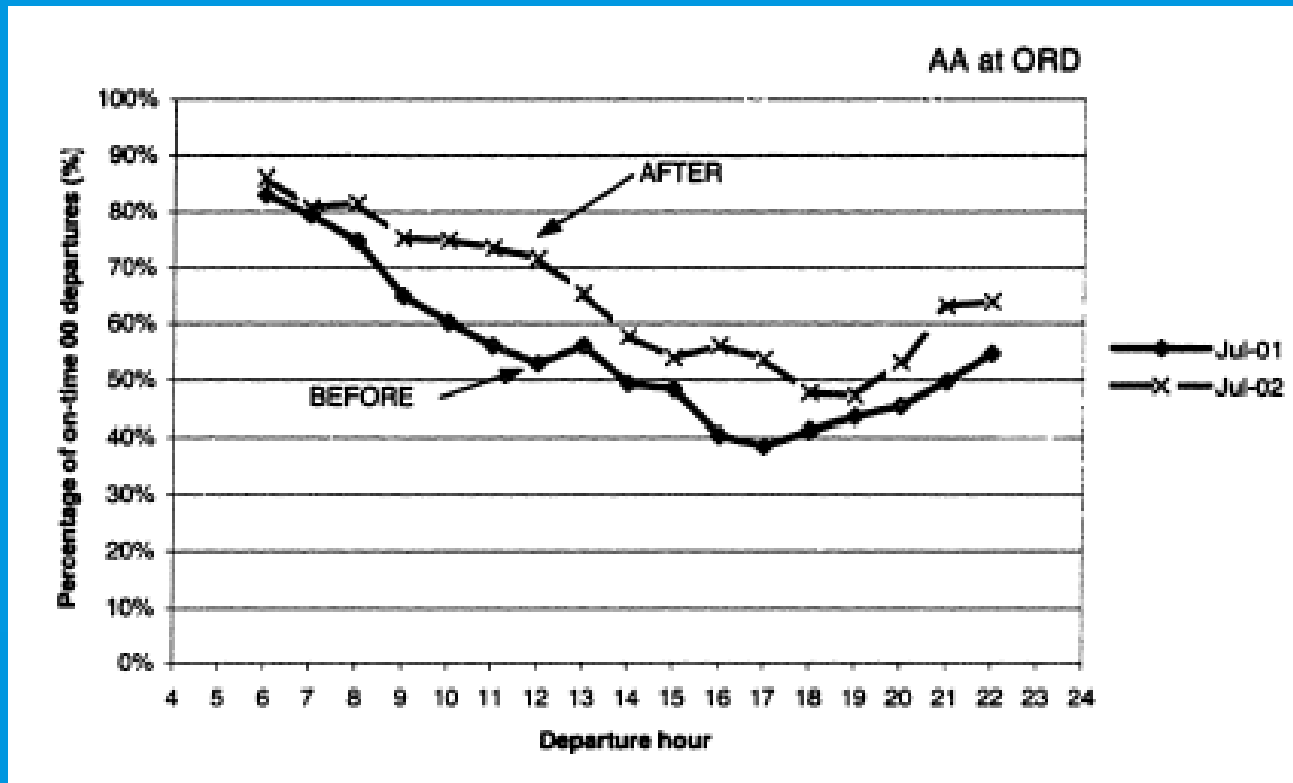
Source: SEO analysis



## Simulations of moving flights to off-peak periods show that frequency and competition levels are crucial for the size of connectivity impacts

- For high frequency routes, impact on hub connectivity and revenues is smaller than for low frequency routes
  - “Subway effect”
- Airline can minimize revenue loss by decreasing the quality of those connections with least competition
  - On monopoly routes, passengers are captive and will accept longer transfer times

# Better on-time performance AA at ORD before and after de- peaking



Source: Bogush (2003)



# Other effects

- **AA at ORD and DFW:**
  - 4 gates less needed
  - 5 aircraft less
- **DL at ATL:**
  - 10% gain in daily aircraft utilization
  - Freeing up of 10 aircraft to be reinvested back into the network
  - Capacity created for 120 additional departures per day
  - Reduced average taxi times

Source: Franke (2003); Petroccione (2007)



# Conclusions

- Is there a limit to hubbing?
- Balancing of revenue maximization and complexity costs:
  - De-peaking of hubs can reduce block times, fuel burn, staffing and need for peak-hour capacity, better aircraft utilization
  - But: lower connectivity, revenues and market share
- Substantial differences exist between the hubs under consideration.
  - Impact on connectivity and revenues depends on size of markets affected, competition levels and operational model.
- Simulations show that economic opportunities exist for moving services of the hub carrier to off-peak periods where it faces little competition