Airport and Airway Congestion

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(MIT PhD September 2006)

The Problem

- What does it cost?
  - Economists Steven A. Morrison and Clifford Winston (Robyn 2001) have said that the failure to price airport access appropriately leaves as much $7 billion in annual benefits on the table. This is a conservative estimate.
- At a basic level, demand for runway and airspace time exceeds supply.
- Congestion is a result of this demand-supply imbalance and a policy of waiting line queues.
  - These queues are inefficient because they manage scarcity through deadweight losses as opposed to allowing economic profits.
  - Alfred Kahn (2002) has noted that the queuing is a direct product of the "government's failure to respond to the increased demand for infrastructure – specifically, air traffic control and airports – and to price it correctly."
- Our focus: Incentives created by airport fees and FAA taxes

Deleterious Incentives

- Current system charges emphasize
  - Passengers
  - Revenue
  - Fuel consumption
  - Aircraft size
- Michael Levine (1969):

  "Smaller aircraft can be scheduled at relatively high frequency during peak hours and will incur the same airport charges as would be incurred by fewer larger aircraft carrying the same number of passengers. For short-haul routes especially, greater frequency confers substantial competitive advantages. Thus airlines have a strong incentive to contribute to congestion and misallocation by scheduling frequent, relatively low-value flights in smaller aircraft."

Tragedy of the Commons

- Hardin (1968): “Each man is locked into a system that compels him to increase his herd without limit – in a world that is limited.”
  - Current aviation taxes and fees are about as smart as charging a poll tax to reduce overgrazing in the case of the common.
  - Just as the solution to the commons problem is to charge per unit of grazing, the solution here is to set charges by use of runways and airspace.

Proposal: Equitable Pricing

- Airport Fees:
  - Change landing fee to “revenue-neutral” flat fee.
  - Allocate more “overhead” to “landing fields” cost center as opposed to “terminal buildings”
- FAA Taxes
  - Abolish ticket tax, segment fee, and fuel tax
  - Establish “revenue-neutral” navigation fee.
  - Example of such a charge:
    - $400 per departure
    - $1.30 per mile flown

Elements of Cost Structure

Analyzed airline costs by:

- **Costs per Day:** Aircraft costs and hull insurance.
- **Costs per Block-hour:** Pilots, flight attendants, fuel, fuel taxes, and a portion of maintenance.
- **Costs per Departure:** Flight dispatch, landing fees, gate charges, deicing, a portion of maintenance, and proposed FAA fees.
- **Costs per Mile:** Proposed FAA Fees.
- **Costs per Passenger:** Reservations, airport rents, airport personnel, and airport equipment.
- **Costs per Revenue Passenger Mile (RPM):** Liability insurance.
- **Costs of Revenues:** Agency commissions and credit card fees.
- **Overhead:** G&A, Marketing, other depreciation, and miscellaneous.

Game

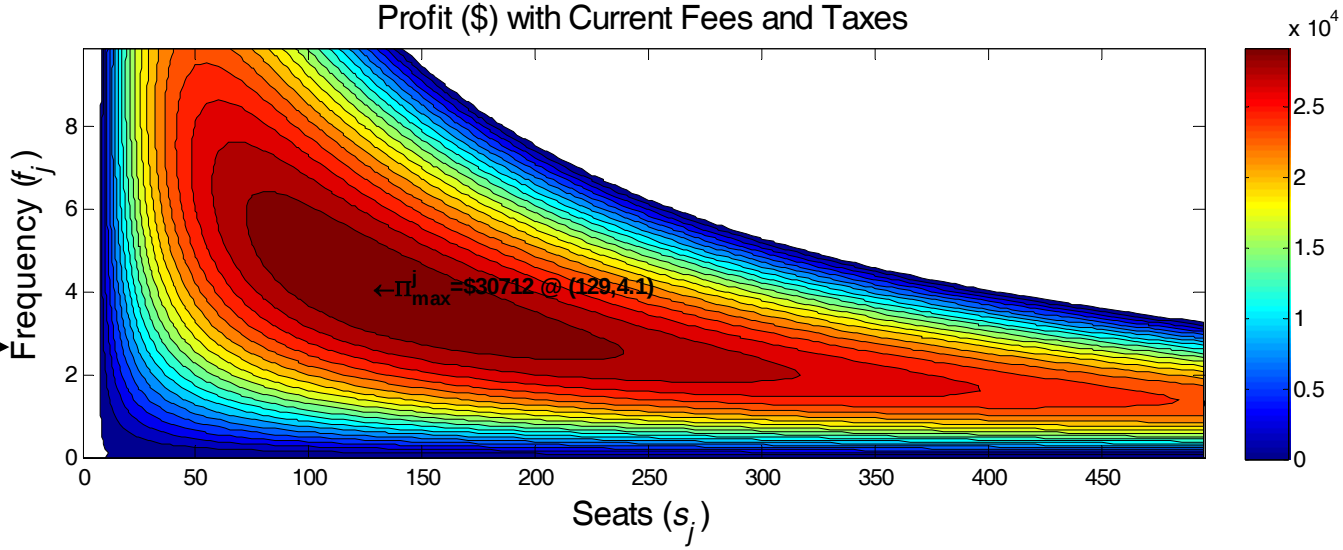
- *N* symmetric players
- Profit maximizing
- Cournot competition: Each player maximizes its profits by adjusting capacity while assuming competitors hold supply constant.
- Variables: Frequency, Aircraft Size
- Conditions for Nash Equilibrium:
  - First derivative of profit w.r.t. frequency must be zero.
  - First derivative of profit w.r.t. size must be zero.
  - Symmetry
- Nash equilibrium always exists and is unique.
  - (Unstable in inelastic markets).

Results of Base Case

- For a fixed number of competing firms, switching to the new fees and taxes has the following effects:
  - Gross and net revenues are just slightly higher.
  - Airline expenditures are somewhat larger.
  - Profits and profit margins rise slightly.
  - Airlines schedule about 1/3 fewer flights but use aircraft that are approximately 80% larger. The net effect is that there are 18% more seats in the market and more seats sold. This translates into a 14% decrease in average price.
- An increase in competition (number of competitors) has the following effects:
  - Airlines do not substantially change the size of aircraft they operate.
  - Each airline operates fewer flights but the total number of flights rises. The result is more seats available and sold and lower prices.
  - The increased volume and lower prices offset each other in terms of their effects on revenues, with total revenues virtually changed. However, operating more flights entails more costs and aggregate profits suffer as a result.

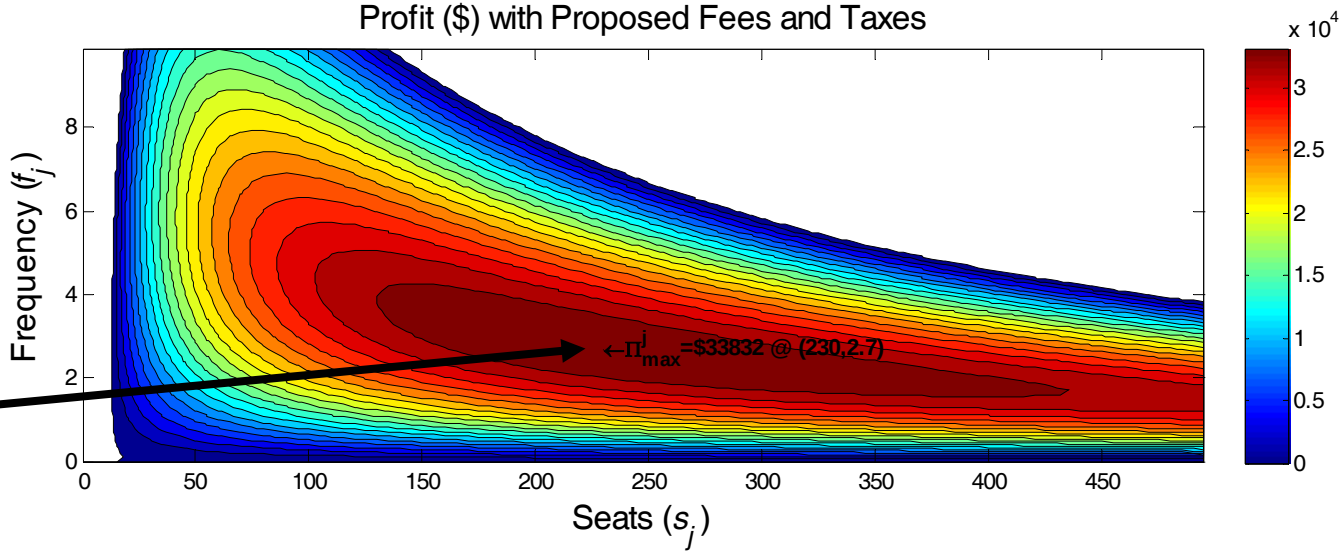
--- Base Case with 2 Competitors & 1000 Miles Distance ---

Profit ($) with Current Fees and Taxes



Each contour is 5% of maximum profit. White areas are negative profits.

Profit ($) with Proposed Fees and Taxes



The equilibrium is one of much larger aircraft and fewer frequencies

Evaluating the Proposal

- DeNeufville and Odoni (2003) state the following criteria for an ideal airport "demand management" system:
  - Promote economically efficient use
  - Maintain access
  - Nondiscriminatory
  - Not a move to regulation
  - Not provide collusion opportunities
  - Not allow airports to profit
  - Transparent and easy

Category	*Efficient*	*Access*	*Fair*	*Avoid Regulation*	*Prevent Collusion*	*Prevent Airport Profits*	*Transparent*
Grandfathered Slots	Less	Less	Less	Less	Less		
Slot Lottery	Less	Less		Less			
Secondary Market	More	?	Less		Less		Less
Congestion Pricing	More		?			Less	Less
Congestion Auction	More		?			Less	Less