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Costs

Istanbul Technical University

Air Transportation Management, M.Sc. Program

Aviation Economics and Financial Analysis

Module 3

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Outline

- **Cost classification**
  - Variable
  - Fixed
  - Short run vs long run
- **Cost relationship with:**
  - Distance
  - Traffic levels
  - Network size and scope

Outline – Cont.

- **Cost Structure**
  - Fuel
  - Labour
  - Marketing & distribution
  - Taxes
  - Air navigation
  - Airport fees
  - Other costs
- **Economies of scale, scope and density**

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Cost Classification



Variable, fixed and total costs

- **Variable costs are costs that change with the level of production**
  - i.e., fuel costs for aircraft is higher if more flights are performed with an aircraft
- **Fixed costs do not vary with the level of production**
  - i.e., the ownership costs of an aircraft (lease payment, interest payment, insurance) are the same whether the aircraft flies or is parked
- **Total costs" the sum of variable and fixed costs**

Source: Vasigh et al. (2008)

Average and marginal costs

- **Average costs are obtained by dividing costs by total output**
  - Average costs per passenger
    - Flight cost: $5000
    - Pax = 100
    - Average cost = $50

Source: Vasigh et al. (2008)

Average and marginal costs

- **Marginal cost (incremental cost) is the change in total costs by adding one more unit of output**
  - Marginal cost
    - Flight cost: $5000 for 100 passengers
    - Flight cost: $5025 for 101 passengers
      - Perhaps extra fuel, an extra drink, a bit more time for cleaning aircraft
    - Marginal cost = $25

Source: Vasigh et al. (2008)

Average and marginal costs

- **Marginal cost (incremental cost) is the change in total costs by adding one more unit of output**
  - Marginal cost of 101st passenger may be different from the marginal cost of 110th passenger
    - E.g., extra flight attendant may be required
    - Pilot might add more fuel for 10 pax, but not for one

Source: Vasigh et al. (2008)

Long run vs. short run costs

- **In the short run, costs can be variable or fixed**
  - There are costs that are obligations for a period of time
    - e.g., lease payments might be ‘locked in’ for 3 years for a given aircraft

Source: Vasigh et al. (2008)

Long run vs. short run costs

- **In the long run, costs eventually become variable**
  - Lease may have option to return the aircraft after 3 years
    - Hence the lease cost now becomes variable
  - Even with a given aircraft on a long term lease, lease costs may be variable
    - A320 frame numbers 15-37 may be on a 20 year lease
    - But if aircraft #5 has its lease expiring this year, the size of the fleet can be changed by returning that aircraft

Source: Vasigh et al. (2008)

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CASM, RASM and BELF



Costs and revenues

- **Costs and revenues are compared in unit terms:**
  - CASM = Cost per available seat mile

$$\frac{\text{Total operating costs}}{\text{(total seats available for purchase * total miles flown)}}$$

  - RASM = Revenue per available seat mile

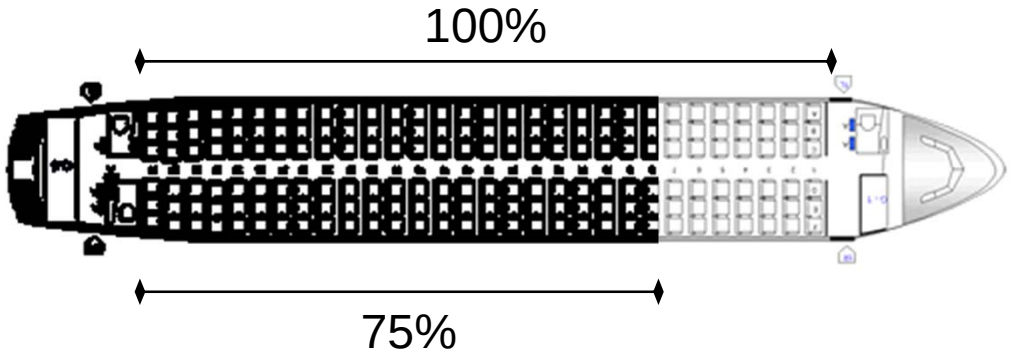
$$\frac{\text{Total operating revenues}}{\text{(total seats available for purchase * total miles flown)}}$$

RASM > CASM, good/profitable

RASM < CASM, not so good/not profitable

Load Factor

- **Load Factor:**
  - Measure of how full a plane is, by percentage



  - Passengers ÷ Total Available Seats = Load Factor
  - Load factor can also be computed as
    - Revenue passenger miles ÷ Available seat miles
    - Or as a weight load factor
      - Revenue ton miles ÷ Available ton miles

Break Even Load Factor

- **BELF = load factor where flight costs are covered**
  - BELF = CASM/RASM
  - Ex) CASM = 5 cents
    RASM = 7 cents
    BELF = 71%
  - Ex) CASM = 5 cents
    RASM = 4.8 cents
    BELF = 104%
    - I.e., even if the aircraft is full, flight will lose money (NW in 2003)

Yield vs. RASM

- RASM = Revenue per ***available*** seat mile

  Total operating revenues

  (total seats available for purchase * total miles flown

- Yield = Revenue per ***occupied*** seat mile

  Total operating revenues

  (number of seats sold * total miles flown)

  - Ex) 120 seat aircraft, 100 are sold
    flight distance = 1000 miles
    Flight revenue = $7500

Seats	Pax	dist	ASM	RPM	Revenue	CASM	Yield
120		1000	120,000		$ 7,500	$ 0.063	
	100	1000		100,000	$ 7,500		$ 0.075

Yields

- **Comparisons of revenue earned on routes of different lengths.**

$$\text{ORD-JFK} \quad \frac{\$109}{740 \text{ mi}} = 14.7¢$$

$$\text{ORD-LAX} \quad \frac{\$109}{1{,}745 \text{ mi}} = 6.2¢$$

What are the key drivers of airline costs?

- **Operating expenses (IATA, 2008)**
  - Fuel (32%)
  - Labor – wages and benefits (20%)
  - Depreciation and amortization (6%)
  - Aircraft Rentals (4%)
  - Everything else (38%)

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Cost Management



Fuel costs

- **Greatest share of an airlines operating costs**
- **Fuel cost per available seat mile is affected by**
  - Fuel price
  - Fuel efficiency
- **Airlines can create fuel efficiencies through**
  - Right sizing aircraft to demand on route
  - Use of fuel-efficient aircraft
  - Effective flight planning
  - Longer stage lengths have lower fuel cost per mile
  - Lower engine use while taxiing/ grounded at airports

Source: Vasigh et al. (2008)

Labour costs

- **Second largest operating cost**
- **Can be difficult to alter costs**
  - Generally a unionized labour force
    - Difficult to change contracts to match changes in demand
  - Government regulations on work rules
- **Bankruptcy has been used to achieve lower labour costs**
  - Improved productivity (ex 2 vs 3 pilots on 737-200)
  - Lower wages or benefits
  - Changes to work rules

Source: Vasigh et al. (2008)

Maintenance costs

- **A high costs**
  - But safety is more important than cutting costs
    - Huge costs of safety failure
    - Lower revenues if pax perceive safety problems
- **Airlines manage maintenance costs by:**
  - Outsourcing maintenance to third-parties
    - Varies amongst airlines
  - Having a younger fleet
    - Older aircraft require more maintenance/checks
  - Having a common fleet
    - Requires less spare parts inventory

Source: Vasigh et al. (2008)

Other operating costs

- **Examples:**
  - Airport costs
  - Catering costs
  - Distribution costs
  - Administrative expenses

Source: Vasigh et al. (2008)

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Cost Relationships

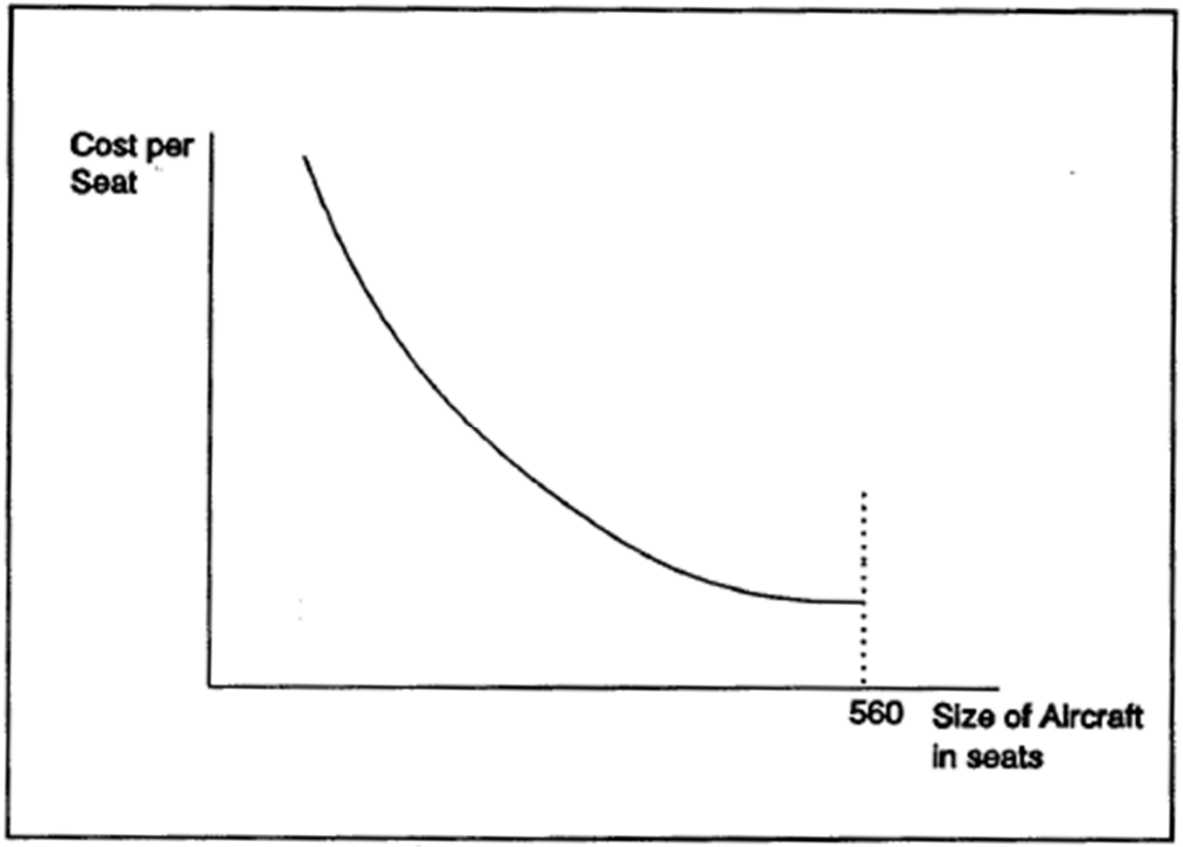


Cost characteristics

- **Larger aircraft**
  tend to have lower CASM than smaller aircraft
- **Longer distance flown tends to lower CASM**
- **Higher load factors reduce costs per passenger**
- **Adding more flights or more seats on a flight reduces per seat costs**
- **Higher flight frequency on a route lowers costs**
  - Ex) station manger costs, advertising costs do not increase

Cost per seat and aircraft size

- **Decline in cost per seat generally represents technology**



Source: Tretheway and Oum (1992)

Relationship between cost and distance flown

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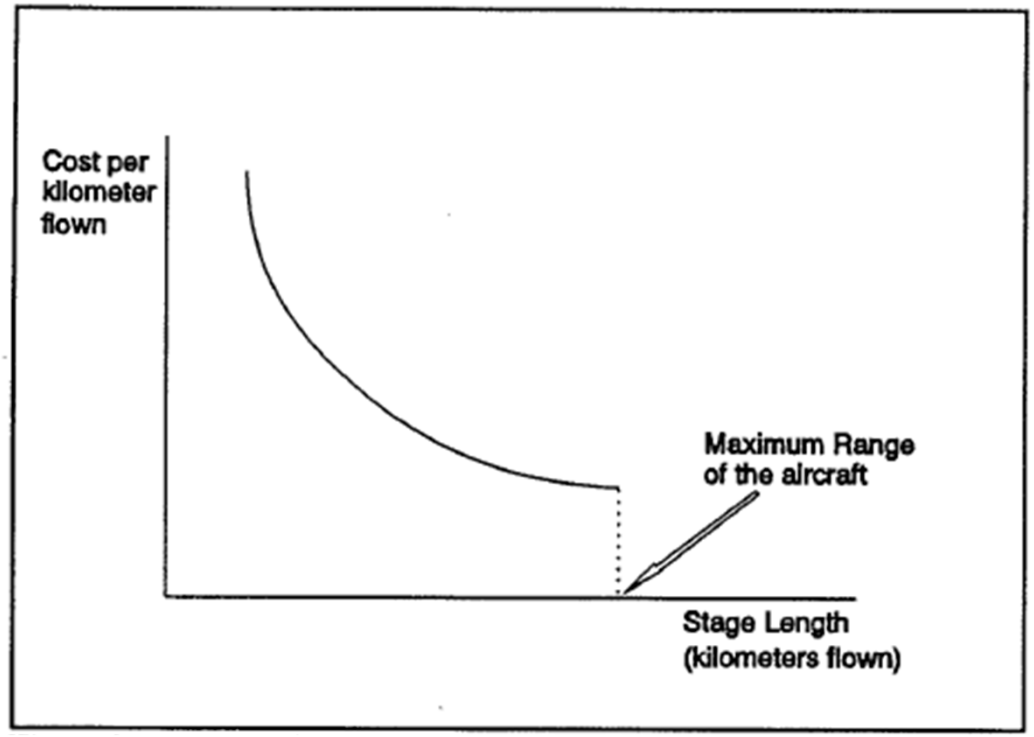
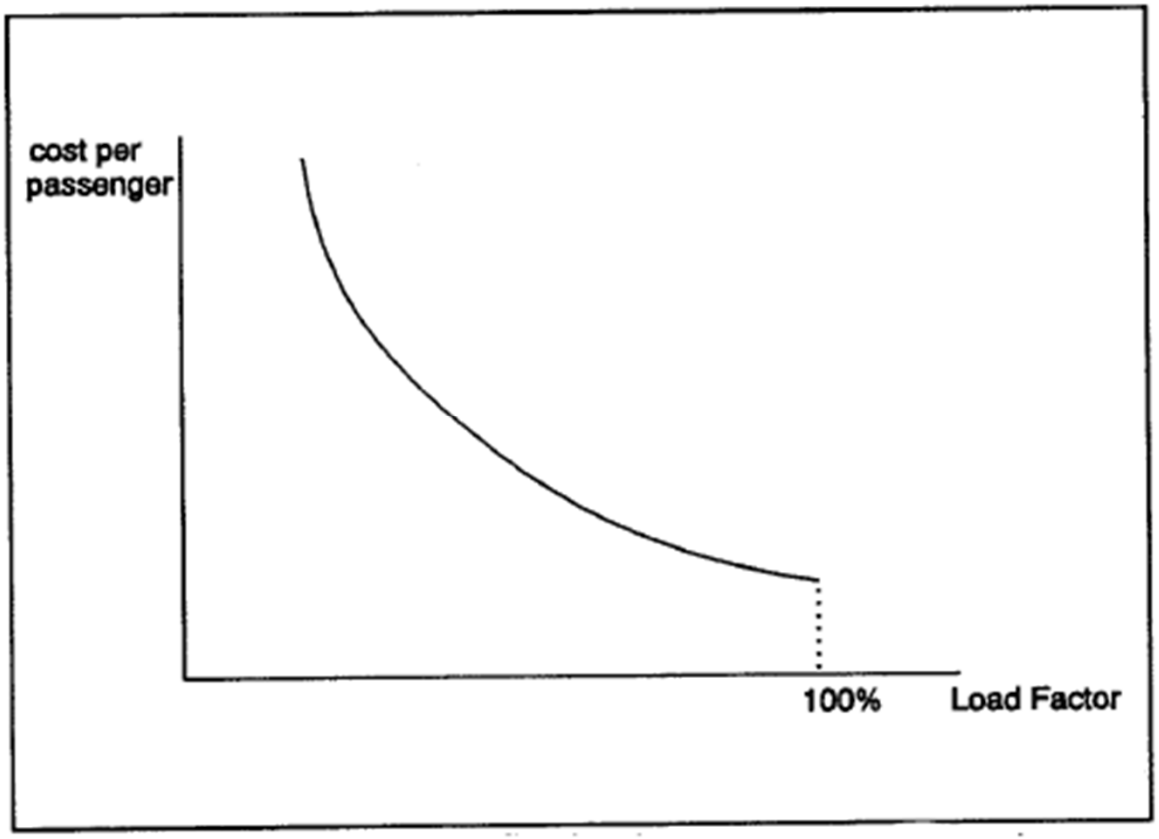
- **Many costs are the same across distance flown, so cost per kilometer flown decreases with distance**



Source: Tretheway and Oum (1992)

Cost per passenger and load factor

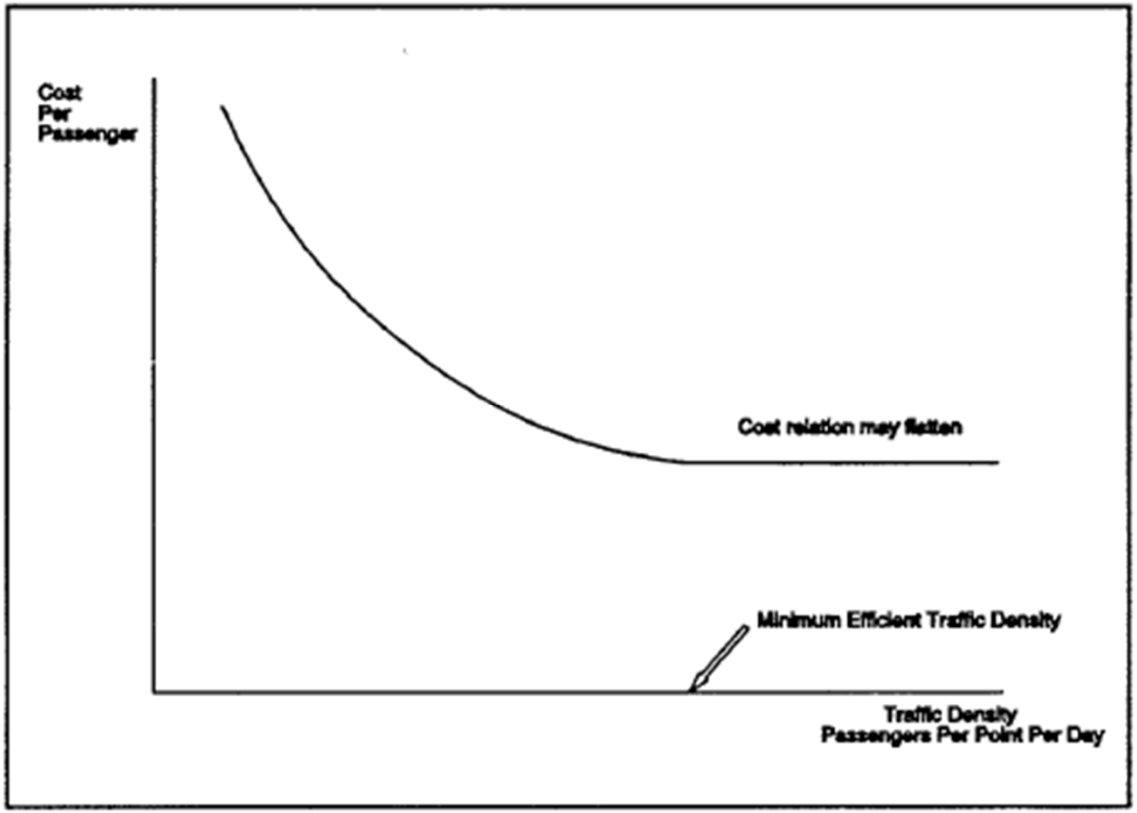
- **A large portion of the cost of a flight is fixed**
  - The cost per pax will fall as more seats are sold



Source: Tretheway and Oum (1992)

Traffic density

- **Adding more flights or more seats on a flight for a given route reduces per seat costs**



Source: Tretheway and Oum (1992)

Operating leverage

- **Ratio between growth in operating profit and growth in sales**
  - Elasticity showing relationship between financial health and sales growth
- **Can also be viewed as the percentage of fixed costs**
- **Higher operating leverage results in income being more affected by changes in sales**

Source: Vasigh et al. (2008)

Economies of scale and scope

- **Economies of scale**
  - Occur when average cost decreases with increased quantity produced
    - Common in high fixed cost industries (aircraft manufacturers, electric power)

- **Economies of scope**
  - Cost-efficiencies from running multiple projects or processes together rather than separately
    - It is cheaper to produce TVs in a factory that also produces other electronic goods

Source: Vasigh et al. (2008)

Airline economies

- **Economies of Network size**
  - Adding more points to the network does not necessarily reduce the cost per passenger
    - Adding points simply replicates costs
      add a station manager, sales team, flight costs for daily flight

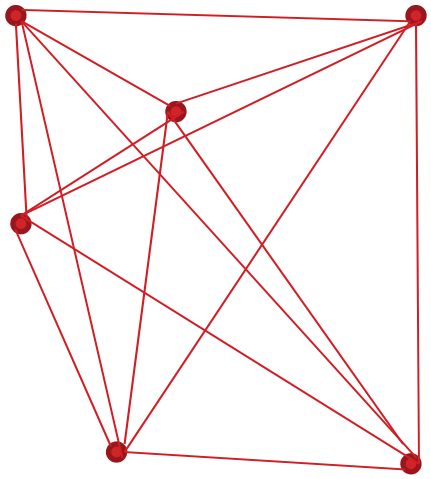
- **Economies of Traffic Density**
  - Serving more passengers on a give route
    has lower costs per passenger
    - Can use larger aircraft
    - Seat managers call sell a higher share of the seats while still protecting some seats for late booking high fare pax

Economies of density

- **Economies of density**
  - Consolidating operations to create cost efficiencies
    - Hub-and-spoke systems for airlines
      - Hub-and-spoke systems require fewer flights to connect Origin – destination airport pairs than point-to-point systems
        - $(n-1)$ flights for hub-and-spoke systems
        - $\frac{n \times (n-1)}{2}$ flights for point-to-point systems
      - This is a cost savings from reduced use of resources
      - Although average pax trip distances are longer and flight costs may be higher due to shorter stage length

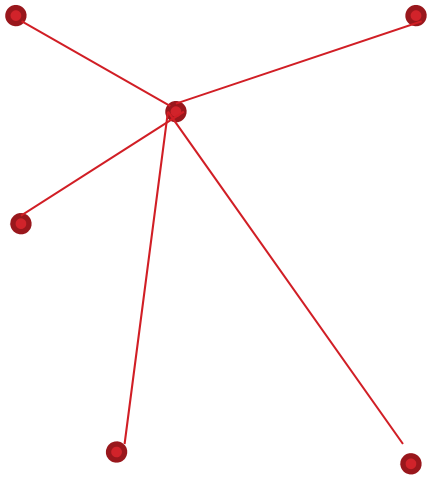
Source: Vasigh et al. (2008)

Hubs vs Point to Point



Point to Point
15 routes for 6 points

Hubs vs Point to Point



Hub & Spoke
5 routes for 6 points

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