Airline Operating Costs and Productivity

Tehran, 20-23 February 2017
Airline Economics: Costs and Productivity

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3. **Airline Cost and Productivity Comparisons**
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1. Airline Operating Costs

- DOT Form 41 traffic, financial, and operating cost data reported to the DOT by US Major airlines
  - Data is reported and published quarterly for most tables
  - Detail of reporting differs for different expense categories
    - Aircraft operating expenses by aircraft type and region of operation
    - Other expenses more difficult to allocate by aircraft type
- DOT Form 41 includes the following schedules:
  - P12 : Profit and Loss statement
  - P52 : Aircraft Operating Expenses
  - P6 : Operating Expenses by Objective Groupings
  - P7 : Operating Expenses by Functional Groupings
  - P10 : Employment Statistics
  - B1 : Balance Sheet
Objective Cost Categories

- **Salaries and related fringe benefits**
  - General management, flight personnel, maintenance labor, aircraft & traffic handling personnel, other personnel
- **Materials purchased**
  - Aircraft fuel & oil, maintenance materials, passenger food, other materials
- **Services purchased**
  - Advertising & promotions, communications, insurance, outside maintenance, commissions, other services
- **Separate categories for:**
  - Landing fees, rentals (including aircraft), depreciation (including aircraft), other expenses
Functional Cost Categories

- **Aircraft operating costs**
  - Expenses associated with flying aircraft, also referred to as “Direct Operating Costs” (DOC)
- **Aircraft servicing costs**
  - Handling aircraft on the ground, includes landing fees
- **Traffic service costs**
  - Processing passengers, baggage and cargo at airports
- **Passenger service costs**
  - Meals, flight attendants, in-flight services
- **Reservation and Sales costs**
  - Airline reservations and ticket offices, travel agency commissions
- **Other costs, including:**
  - Advertising and publicity expense
  - General and administrative expense
Total Airline Operating Cost Breakdown

- **US Major airline total operating costs**: 
  - 44% is aircraft operating expense, which includes fuel, direct maintenance, depreciation, and crew 
  - 29% is servicing expense 
    - Aircraft servicing (7%) 
    - Traffic servicing (11%) 
    - Passenger service (11%) 
  - 14% is reservations and sales expense 
    - This figure was 19.5% in 1993, but declined steadily throughout the 1990s 
  - 13% is overhead expense 
    - Advertising and Publicity (2%) 
    - General and Administrative (6%)
Functional Cost Comparison

- Adapted from Form 41, used by Boeing, MIT (and Aviation Daily) for more detailed comparisons
  - FLIGHT (DIRECT) OPERATING COSTS (DOC) = 50%
    - All costs related to aircraft flying operations
    - Include pilots, fuel, maintenance, and aircraft ownership
  - GROUND OPERATING COSTS = 30%
    - Servicing of passengers and aircraft at airport stations
    - Includes aircraft landing fees and reservations/sales charges
  - SYSTEM OPERATING COSTS = 20%
    - Marketing, administrative and general overhead items
    - Includes in-flight services and ground equipment ownership
- Percentages shown reflect historical “rules of thumb”.
Activity Drivers per Functional Category

• Aircraft Operating Costs
  – Per Block Hour (for example, $2550 for 185-seat B757-200)

• Aircraft Servicing Costs
  – Per Aircraft Departure (average $800)

• Traffic Servicing Costs
  – Per Enplaned Passenger (average $15)

• Passenger Servicing Costs
  – Per RPM (average $0.015)

• Reservations and Sales Costs
  – % of Total Revenue (average 14%)

• Other Indirect and System Overhead Costs
  – % of Total Operating Expense (average 13%)
Flight Operating Costs

- **Flight operating costs (FOC) by aircraft type:**
  - Reflect an average allocation of system-wide costs per block hour, as reported by airlines for each aircraft type
  - Can be affected by specific airline network or operational patterns
  - Collected by US DOT as Form 41 operating data from airlines

- **Typical breakdown of FOC for US carrier:**
  - CREW: Pilot wages and benefits
  - FUEL: Easiest to allocate and most clearly variable cost
  - MAINTENANCE: Direct airframe and engine maintenance cost, plus “burden” or overhead (hangars and spare parts inventory)
  - OWNERSHIP: Depreciation, leasing costs and insurance
Example: B757-200 FOC

- Costs per block-hour of operations (avg. 186 seats):
  - CREW $489
  - FUEL $548
  - MAINTENANCE $590
  - OWNERSHIP $923
  - TOTAL FOC $2550 per block-hr

- Based on 1252 mile average stage length and 11.3 block-hr daily utilization (average for US Major):
  - Different stage lengths and utilization by different airlines result in substantial variations in block-hour costs for same aircraft type
  - Also, differences in crew costs (union contracts, seniority), maintenance costs (wage rates), and ownership costs (age of a/c)
### Boeing 757-200 Flight Operating Costs

<table>
<thead>
<tr>
<th>Airline</th>
<th>Number of Aircraft</th>
<th>Seats</th>
<th>FOC per Block Hour</th>
<th>FOC per Seat Hour</th>
<th>Utilization (hrs/day)</th>
<th>Stage Length (Miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>American</td>
<td>101</td>
<td>188</td>
<td>$2,568</td>
<td>$13.66</td>
<td>10.3</td>
<td>1460</td>
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<tr>
<td>Continental</td>
<td>34</td>
<td>179</td>
<td>$2,568</td>
<td>$14.35</td>
<td>12.1</td>
<td>1860</td>
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<tr>
<td>Delta</td>
<td>101</td>
<td>182</td>
<td>$2,357</td>
<td>$12.95</td>
<td>11.6</td>
<td>984</td>
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<tr>
<td>America West</td>
<td>12</td>
<td>190</td>
<td>$2,065</td>
<td>$10.87</td>
<td>13.1</td>
<td>1167</td>
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<tr>
<td>Northwest</td>
<td>48</td>
<td>191</td>
<td>$2,260</td>
<td>$11.83</td>
<td>11.7</td>
<td>1137</td>
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<tr>
<td>Trans World Air</td>
<td>20</td>
<td>179</td>
<td>$2,656</td>
<td>$14.84</td>
<td>11.8</td>
<td>1405</td>
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<tr>
<td>United</td>
<td>98</td>
<td>186</td>
<td>$2,684</td>
<td>$14.43</td>
<td>11.2</td>
<td>1281</td>
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<tr>
<td>USAir</td>
<td>34</td>
<td>182</td>
<td>$3,069</td>
<td>$16.87</td>
<td>11.1</td>
<td>1254</td>
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<tr>
<td><strong>AVERAGE</strong></td>
<td>458</td>
<td>186</td>
<td>$2,481</td>
<td>$13.34</td>
<td>11.3</td>
<td>1252</td>
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</table>
Comparison of FOC Across Aircraft Types

- All else being equal, larger aircraft should have highest flight operating cost per hour, lowest unit cost per ASM:
  - There exist some clear economies of aircraft size (e.g., two pilots for 100 and 400 seat aircraft, although paid at different rates)
  - Also economies of stage length, as fixed costs of taxi, take-off and landing are spread over longer flight distance
- But, many other factors distort cost comparisons:
  - Pilots paid more for larger aircraft that fly international routes
  - Newer technology engines are more efficient, even on small planes
  - Reported depreciation costs are subject to accounting procedures
  - Aircraft utilization rates affect allocation of costs per block-hour
## FOC Comparison: Selected Aircraft

<table>
<thead>
<tr>
<th>A/C Type</th>
<th>Seats</th>
<th>FOC / block-hr</th>
<th>FOC / seat-hr</th>
<th>Average stage(mi)</th>
<th>Daily block-hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC9-30</td>
<td>100</td>
<td>$1973</td>
<td>$19.73</td>
<td>472</td>
<td>8.1</td>
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<tr>
<td>A320</td>
<td>148</td>
<td>$2270</td>
<td>$15.33</td>
<td>1191</td>
<td>11.7</td>
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<tr>
<td>B727-200</td>
<td>150</td>
<td>$2555</td>
<td>$17.03</td>
<td>704</td>
<td>8.4</td>
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<tr>
<td>B757-200</td>
<td>186</td>
<td>$2550</td>
<td>$13.71</td>
<td>1252</td>
<td>11.3</td>
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<tr>
<td>B747-400</td>
<td>375</td>
<td>$6455</td>
<td>$17.21</td>
<td>4065</td>
<td>12.4</td>
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</table>
FOC Comparisons (cont’d)

• Flight operating cost comparisons on previous slide provide insights into different aircraft characteristics:
  – Largest B747-400 aircraft has highest total FOC per block hour, while smallest DC9-30 has highest FOC per seat hour, as expected
  – However, lowest cost per seat hour (and in turn per ASM) provided by new technology mid-sized B757, followed by A320
  – B747-400 costs suffer from high wage rates paid to senior pilots who fly international services on this aircraft type
  – Comparisons of same-sized B727 and A320 show newer A320 with lower costs:
    • A320 more fuel efficient, with two pilots (vs 3 on B727)
    • A320 has higher daily utilization, due to longer stage length
Cost and Productivity Comparisons

- Average unit cost for 8 selected majors increased from 9.15 to 9.53 cents (4%) between 1993-1999
- The top four major carriers have very similar unit costs in this time period
- Unit cost increased dramatically between 1993 and 1999 for Continental (17%) and USAir (24%)
- Southwest and America West had the lowest unit cost, while USAir had the highest unit cost
Unit Cost (Total System Operating Expense/ASM)

- 8 Majors Average
- American
- Northwest
- Delta
- United
Unit Cost (Total System Operating Expense/ASM)

Unit Cost ($/ASM) 0.06 0.07 0.08 0.09 0.1 0.11 0.12 0.13 0.14 0.15

- US Air
- 8 Majors Average
- America West
- Continental
- Southwest
Aircraft Productivity

- Measured in ASMs generated per aircraft per day:
  \[ \text{ASMs} = \# \text{departures} \times \text{average stage length} \times \# \text{seats} \]
- Aircraft “utilization” measured in block-hours/day:
  - Block hours begin at door close (blocks away from wheels) to door open (blocks under wheels)
  - Gate-to-gate time, including ground taxi times
- Increased aircraft productivity achieved with:
  - More flight departures per day, either through shorter turnaround (ground) times or off-peak departure times
  - Longer stage lengths (average stage length is positively correlated with increased aircraft utilization = block hours per day)
  - More seats in same aircraft type (no first class seating and/or tighter “seat pitch”)
### Example: Boeing 737-500 Productivity

<table>
<thead>
<tr>
<th>Airline</th>
<th>Flights per Day</th>
<th>Block Hours</th>
<th>Stage Length</th>
<th>Seats</th>
<th>ASMs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continental</td>
<td>3.9</td>
<td>8.3</td>
<td>719</td>
<td>104</td>
<td>291,246</td>
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<tr>
<td>United</td>
<td>4.3</td>
<td>7.5</td>
<td>564</td>
<td>109</td>
<td>264,284</td>
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<tr>
<td>Southwest</td>
<td>8.2</td>
<td>10.2</td>
<td>400</td>
<td>122</td>
<td>399,746</td>
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</tbody>
</table>
Example: Boeing 737-500 FOC per block hour

<table>
<thead>
<tr>
<th>Airline</th>
<th>Crew</th>
<th>Fuel</th>
<th>Maintenance</th>
<th>Ownership</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continental</td>
<td>$510</td>
<td>$430</td>
<td>$651</td>
<td>$698</td>
<td>$2,291</td>
</tr>
<tr>
<td>United</td>
<td>$927</td>
<td>$487</td>
<td>$1048</td>
<td>$510</td>
<td>$2,974</td>
</tr>
<tr>
<td>Southwest</td>
<td>$388</td>
<td>$537</td>
<td>$251</td>
<td>$350</td>
<td>$1,526</td>
</tr>
</tbody>
</table>
Daily Aircraft Utilization (block hrs/day)
Top 3 Majors and Southwest
Unit Aircraft Operating Cost ($/ASM)

- AA
- UA
- DL
- WN
Employee Productivity

• Measured in ASMs per employee per period
• As with aircraft, employee productivity should be higher with:
  – Longer stage lengths (amount of aircraft and traffic servicing for each flight departure not proportional to stage length)
  – Larger aircraft sizes (economies of scale in labor required per seat for each flight departure)
  – Increased aircraft productivity due to shorter turnaround times (more ASMs generated by aircraft contribute to positive employee productivity measures)
• Yet, network airlines with long stage lengths and large aircraft have lower employee productivity rates
ASMs/employee and Average Stage Length

[Graph showing productivity and stage length for different airlines]
ASM/employee and Average A/C Size

<table>
<thead>
<tr>
<th>WN</th>
<th>HP</th>
<th>DL</th>
<th>AS</th>
<th>NW</th>
<th>AA</th>
<th>CO</th>
<th>US</th>
<th>UA</th>
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Summary: Costs and Productivity Challenges

• Unit cost differences not entirely due to labor costs:
  – Differences in aircraft productivity can account for up to one half of difference in aircraft operating expenses per ASM
  – Translates into about 25% of total unit cost difference between traditional carriers and LCCs

• Network carriers are exploring alternatives for increasing aircraft productivity to reduce unit costs:
  – Continuous connecting banks to reduce ground times at hubs
  – Higher density seating options (e.g. removal of First Class)
  – More “point-to-point” flying to increase aircraft utilization

• Successful new “business models” will depend on reducing both aircraft and labor unit costs
  – In addition to fine-tuning fare structures to maximize unit revenues
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https://www4.icao.int/newdataplus