Key Findings of 2011 ATRS Global Airport Performance Benchmarking Project

Tae Hoon Oum
Chunyan Yu
*Embry-Riddle Aeronautical University, yuc@erau.edu*

Yapyin Choo

Follow this and additional works at: [https://commons.erau.edu/publication](https://commons.erau.edu/publication)

Part of the Business Administration, Management, and Operations Commons, Finance and Financial Management Commons, and the International Business Commons

Scholarly Commons Citation

This Presentation without Video is brought to you for free and open access by Scholarly Commons. It has been accepted for inclusion in Publications by an authorized administrator of Scholarly Commons. For more information, please contact commons@erau.edu.
Key Findings of 2011 ATRS Global Airport Performance Benchmarking project

Prof. Tae Hoon Oum,
Prof. Chunyan Yu,
Dr. Yapyin Choo

The Air Transport Research Society (ATRS)
www.atrsworld.org

The ATRS Global Airport Benchmarking Task Force
Asia Pacific: P. Forsyth, Yeong-Heok Lee, Yuichiro Yoshida, Japhet Law, Shinya Hanaoka
Europe: Nicole Adler, Jaap de Wit, Hans-Martin Niemeier, Eric Pels
North America: Tae Oum, Bijan Vasigh, Jia Yan, Chunyan Yu
Middle East: Paul Hooper
Outline

- Objective of the ATRS Benchmarking Study
- Airports Included and ATRS Database
- Some Characteristics of Sample Airports
- Methodology
- Key Results on Efficiency and Costs
- User Charge Comparisons
Objective of the Benchmarking Study

- To provide a comprehensive, unbiased comparison of airport performance focusing on:
  - Productivity and Operating/Mgt Efficiency
  - Unit Cost Competitiveness
  - Comparison of Airport Charge Levels

- Our study does not treat service quality differentials across airports
Airports Included in the study

<table>
<thead>
<tr>
<th>Region</th>
<th>Number of Airports</th>
<th>Number of Airport Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada-US</td>
<td>63 airports</td>
<td></td>
</tr>
<tr>
<td>Europe</td>
<td>45 airports</td>
<td>2 New</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14 airport groups</td>
</tr>
<tr>
<td>Asia</td>
<td>32 airports</td>
<td>5 New</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 airport groups</td>
</tr>
<tr>
<td>Oceania</td>
<td>9 airports</td>
<td></td>
</tr>
<tr>
<td>Latin America</td>
<td>7 airports</td>
<td>All New</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>156 airports</strong></td>
<td><strong>19 airport groups</strong></td>
</tr>
</tbody>
</table>
The ATRS Database

- The ATRS Database contains historic information (since FY 2001) including financial data, traffic and capacity data of the major airports and airport authorities (groups) in the following geographic regions:
  - Asia Pacific
  - Europe
  - North America and Latin America (non-financial data only)

- The data in each regions is segregated into:
  - Airport Information (capacity, type of ownership etc)
  - Traffic
  - Aeronautical Revenue
  - Non-Aeronautical Revenue
  - Operating Expense
  - Balance Sheet
Data Sources: FY 2001-2009

- Airport’s Financial Statements, Annual Reports and direct data requests;
- US FAA, DOT statistics;
- Association of European Airlines (AEA) Statistics
- ICAO Digest of Statistics:
  - annual and monthly traffic data
  - annual financial data - not for all airports
- ACI; IATA
  - annual traffic statistics; capacity information; airport charges
  - general information surveys (Asia Pacific and Europe) occasional and not complete
- IMF and World Bank – various price indices including GDP deflators for service sectors and PPP
- US Census Bureau, Statistics Canada – regionally based Cost of Living Index
Outline

- Objective of the ATRS Benchmarking Study
- Airports Included and ATRS Database
- Some Characteristics of Sample Airports
- Methodology
- Key Results on Efficiency and Costs
- User Charge Comparisons

© Air Transport Research Society (ATRS)
Passengers Volume, 2009
(in ’000 passengers)

Asia Pacific  Europe  North America
Passenger Traffic - Top 10 Airports
(’000 passengers): 2009, 2007, 2005
Passengers per Aircraft Movements, 2009

© Air Transport Research Society (ATRS)
Air Cargo Traffic, 2009
(’000 metric tons)

© Air Transport Research Society (ATRS)
Air Cargo - Top 10 Airports (’000 metric tons)
2009, 2007, 2005

© Air Transport Research Society (ATRS)
% Non-Aero Revenue, 2009

Asia Pacific
Europe
North America

© Air Transport Research Society (ATRS)
Outline

- Objective of the ATRS Benchmarking Study
- Airports Included and ATRS Database
- Some Characteristics of Sample Airports

**Methodology**

- Key Results on Efficiency and Costs
- User Charge Comparisons
Methodology: Efficiency Measurement

• **Variable Factor Productivity (VFP) Index**
  – Total Factor Productivity (TFP) - Impossible because of capital input cost accounting problem

• VFP is essentially the ratio of total (aggregate) output index divided by total (aggregate) variable input index, namely labor and soft cost input (total non-labor variable inputs).

• In fact, we compute VFP using the **multilateral index** procedure proposed by Caves, Christensen and Diewert (1982).
Multilateral Aggregation Method

• This multilateral index procedure uses cost shares (revenue shares) to aggregate inputs (outputs).

\[
\ln \frac{X_i}{X_j} = \sum \frac{W_{ki} + \bar{W}_k}{2} \ln \frac{X_{ki}}{\bar{X}_k} - \sum \frac{W_{kj} + \bar{W}_k}{2} \ln \frac{X_{kj}}{\bar{X}_k}
\]
## Airport Productivity Index

<table>
<thead>
<tr>
<th>Outputs</th>
<th>Inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Aircraft movement</td>
<td>• Labour</td>
</tr>
<tr>
<td>• Passengers</td>
<td>• Other non-capital (soft cost) inputs</td>
</tr>
<tr>
<td>• Non-aeronautical revenues</td>
<td></td>
</tr>
</tbody>
</table>

18
Potential Reasons for the Measured Productivity (gross VFP) Differentials

Factors Beyond Managerial Control:

– Airport size (Scale of aggregate output)
– Average aircraft size using the airport
– Share of international traffic
– Share of air cargo traffic
– Extent of capacity shortage - congestion delay
– Connecting/transfer ratio

We compute ‘residual (Net) variable factor productivity (RVFP) measures after removing effects of these Factors
Outline

- Objective of the ATRS Benchmarking Study
- Airports Included and ATRS Database
- Some Characteristics of Sample Airports
- Methodology

- Key Results on Efficiency and Costs
- User Charge Comparisons
Gross Variable Factor Productivity (VFP)
Oceania (SYD=1.0), 2009
Gross Variable Factor Productivity (VFP)
Asia (HKG=1.0), 2009
### Gross Variable Factor Productivity (VFP)

**Europe (CPH=1.0), 2009**

<table>
<thead>
<tr>
<th>Airport</th>
<th>Gross Variable Factor Productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSL</td>
<td>1.35</td>
</tr>
<tr>
<td>ZRH</td>
<td>1.28</td>
</tr>
<tr>
<td>ATH</td>
<td>1.22</td>
</tr>
<tr>
<td>CPH</td>
<td>1.16</td>
</tr>
<tr>
<td>MAD</td>
<td>1.10</td>
</tr>
<tr>
<td>GVA</td>
<td>1.05</td>
</tr>
<tr>
<td>EDI</td>
<td>1.02</td>
</tr>
<tr>
<td>LIS</td>
<td>0.98</td>
</tr>
<tr>
<td>BCN</td>
<td>0.94</td>
</tr>
<tr>
<td>BRU</td>
<td>0.89</td>
</tr>
<tr>
<td>CIA</td>
<td>0.85</td>
</tr>
<tr>
<td>TLV</td>
<td>0.82</td>
</tr>
<tr>
<td>FCO</td>
<td>0.79</td>
</tr>
<tr>
<td>CDG</td>
<td>0.76</td>
</tr>
<tr>
<td>LGW</td>
<td>0.73</td>
</tr>
<tr>
<td>HAM</td>
<td>0.70</td>
</tr>
<tr>
<td>MAN</td>
<td>0.67</td>
</tr>
<tr>
<td>LUT</td>
<td>0.64</td>
</tr>
<tr>
<td>VIE</td>
<td>0.61</td>
</tr>
<tr>
<td>ARN</td>
<td>0.59</td>
</tr>
<tr>
<td>LHR</td>
<td>0.57</td>
</tr>
<tr>
<td>BUD</td>
<td>0.55</td>
</tr>
<tr>
<td>ORY</td>
<td>0.53</td>
</tr>
<tr>
<td>TLL</td>
<td>0.51</td>
</tr>
<tr>
<td>HEL</td>
<td>0.49</td>
</tr>
<tr>
<td>TXL</td>
<td>0.47</td>
</tr>
<tr>
<td>FRA</td>
<td>0.45</td>
</tr>
<tr>
<td>DUS</td>
<td>0.43</td>
</tr>
<tr>
<td>MUC</td>
<td>0.41</td>
</tr>
<tr>
<td>MLA</td>
<td>0.39</td>
</tr>
<tr>
<td>MLA</td>
<td>0.37</td>
</tr>
<tr>
<td>WAW</td>
<td>0.35</td>
</tr>
<tr>
<td>CGN</td>
<td>0.33</td>
</tr>
<tr>
<td>BTS</td>
<td>0.31</td>
</tr>
<tr>
<td>SOF</td>
<td>0.29</td>
</tr>
<tr>
<td>Mean</td>
<td>0.31</td>
</tr>
</tbody>
</table>

**© Air Transport Research Society (ATRS)**
Gross Variable Factor Productivity (VFP)
North America (YVR=1.0), 2009

© Air Transport Research Society (ATRS)
## Past Airport Efficiency Excellence Top Performers, 2006-2010

<table>
<thead>
<tr>
<th>Region</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>North America</strong></td>
<td>Hartsfield-Jackson Atlanta International Airport</td>
<td>Hartsfield-Jackson Atlanta International Airport</td>
<td>Hartsfield-Jackson Atlanta International Airport</td>
<td>Hartsfield-Jackson Atlanta International Airport</td>
<td>Large Airport Category Hartsfield-Jackson Atlanta International Airport</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Small/Medium Airport Category Raleigh-Durham International Airport</td>
</tr>
<tr>
<td><strong>Europe</strong></td>
<td>Copenhagen Kastrup International Airport</td>
<td>Oslo International Airport</td>
<td>Copenhagen Kastrup International Airport</td>
<td>Copenhagen Kastrup International Airport</td>
<td>Large Airport Category Oslo International Airport</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Small/Medium Airport Category Genève Aéroport</td>
</tr>
<tr>
<td><strong>Asia-Pacific</strong></td>
<td>Incheon International Airport</td>
<td>Hong Kong International Airport</td>
<td>Hong Kong International Airport</td>
<td>Hong Kong International Airport</td>
<td>Large Airport Category Hong Kong International Airport</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Small/Medium Airport Category Seoul Gimpo International Airport</td>
</tr>
</tbody>
</table>
After removing factors beyond managerial control such as capacity constraint, average aircraft size, % international traffic, etc, **CHC’s relative performance in term of Net VFP improved significantly.**
Residual (Net) Variable Factor Productivity: Asia (HKG=1.0)
Residual (Net) Variable Factor Productivity: Europe (CPH=1.0)
Residual (Net) Variable Factor Productivity:
N. America – Passengers > 15 million (YVR=1.0)
Residual (Net) Variable Factor Productivity:
N. America – Passengers < 15 million (YVR=1.0)
Top Efficiency Performers (2011)
(based on Net VFP index=operating/management efficiency)

Asia Pacific:
- Oceania Airports: **Sydney, Christchurch**
- Asian Airports: **Hong Kong, Singapore**

Europe:
- Large Airports (> 15 million pax): **Copenhagen and Oslo**
- Small/Medium Airports (< 15 millions Pax): **Geneva, Reykjavik-Keflavik**

North America (Canada/US):
- Large Airports (> 15 million pax): **Atlanta, Minneapolis/St Paul**
- Small/Medium Airports (< 15 millions Pax): **Raleigh-Durham, Reno**
Oslo is more efficient in terms of Labor Productivity. The figure implies that CPH handles most of the airport operation in-house as compared with OSL.

CPH is more efficient in terms of Soft-Cost Input Productivity. (soft cost = operating expenses-labor cost, divided by SC input price index)

Despite the difference in their business strategy, both airports achieved same level of operating efficiency.
Cost Competitiveness = Net VFP and Input Price Effect
Oceania (SYD=0.0) - the higher the better
Cost Competitiveness: = Net VFP and Input Price Effect
Asia (HKG=0.0) – the higher the better
Cost Competitiveness = Net VFP and Input Prices Effect
Europe (CPH=0.0) - the higher the better
Cost Competitiveness = Net VFP and Input Price Effect

N. America – Passengers > 15 million (YVR=0.0)
Cost Competitiveness = Net VFP and Input Price Effect

N. America – Passengers < 15 million (YVR=0.0)
Top Unit Cost Competitiveness Performers

- **Asia-Pacific:**
  - Oceania: Christchurch, Sydney
  - Asia: Haikou, AOT (Airport Authority of Thailand), APII (Angkasa Pura II, Indonesian Group)

- **Europe:**
  - Polish Airports, Reykjavik-Keflavik, Tallinn

- **N. America:**
  - Large Airports (> 15 million Pax): Atlanta, Charlotte, Tampa
  - Small/Med Airports (< 15 million Pax): Raleigh-Durham, Reno, Nashville

© Air Transport Research Society (ATRS) 38
Outline

- Objective of the ATRS Benchmarking Study
- Airports Included and ATRS Database
- Some Characteristics of Sample Airports
- Methodology
- Key Results on Efficiency and Costs
- User Charge Comparisons
Landing Charges: Basis for computing

- **Assumptions:**
  - (Use of signatory airlines)
  - Passenger aircraft
  - Peak and off-peak charges separately treated
  - International flights
  - Some airports have summer/winter rates – **these are averaged**
  - Assumed 2 hours aircraft parking

- **Exclusion:** Tax, Noise charges, lighting surcharge
Landing Charges for Boeing 767-400, 2010 (in US$)
Asia Pacific: Landing Charge for Airbus 320, 2010 (in US$)
Europe: Landing Charge for Airbus 320, 2010 (in US$)
North America: Landing Charge for Airbus 320, 2010 (in US$)
Summary – Landing/Takeoff Charges (Airbus 320)

- **Asia-Pacific Results:**
  - Highest charges: Haneda, Kansai, Narita
  - Lowest charges: *Kuala Lumpur*, Bangkok, Cairns

- **European Results:**
  - Highest charges: *London Gatwick peak*, Dusseldorf, Dublin
  - Lowest charges: *Riga (Latvia)*, Stockholm, Malta

- **North American Results:**
  - Highest charges: *Toronto*, LaGuardia, St. Louis
  - Lowest charges: *Charlotte*, Nashville, Raleigh-Durham,
Combined Landing and Passenger Charges

Given that it is difficult to separate landing and passenger charges for some airports, the *combined landing and passenger charge* may reflect a better picture.
Asia Pacific: Combined Landing and Passenger Charge
for Airbus 320, 2010 (in US$)
Summary – Combined Landing and Passenger Charges (Airbus 320)

- **Asia-Pacific Results:**
  - Highest charges: Kansai, Nagoya, Narita
  - Lowest charges: **Kuala Lumpur Low Cost Carrier Terminal**, Chennai (India), Mumbai (India)

- **European Results:**
  - Highest charges: **London Heathrow**, Prague (Czech Rep.), Paris Orly
  - Lowest charges: **Brussels South Charleroi**, Riga (Latvia), Manchester (Off-Peak)
Cost per Enplanement for Airlines (CPE)

• For N. American airports, the data allows us to compute *Cost per enplanement (CPE)*.

• CPE = *sum of landing fees, terminal arrival fee, rents and utilities, terminal apron charges/tiedowns, and passengers other aeronautical payments to airports divided by enplaned passengers*
North America: Total Charges per Enplaned Passenger, 2009 (in US$)
Summary – Cost per Enplaned Passenger (CPE)

North American Results:
- Highest charges: Toronto, New York JFK, Newark
- Lowest charges: Charlotte, Atlanta, Salt Lake City
ATRS Airport Benchmarking Report

- The ATRS Global Airport Performance Benchmarking Report: 3 volumes, over 500 pages of valuable data and analysis
- Can be purchased by visiting www.atrsworld.org
- Report sale finances our annual benchmarking research project
Thank You

2012 ATRS World Conference
(Taiwan in late June, 2012)