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Key Findings of 2012 ATRS Global Airport Performance Benchmarking Project

Tae Hoon Oum

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Key Findings of 2012 ATRS Global Airport Performance Benchmarking project

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Dr. Yapyin Choo
Prof. Chunyan Yu

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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

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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
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
## Airports Included in the 2012 Report

<table>
<thead>
<tr>
<th>Region</th>
<th>Total Airports</th>
<th>Airports Added</th>
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</thead>
<tbody>
<tr>
<td>Canada-US</td>
<td>77 airports</td>
<td>14 New</td>
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<tr>
<td>Europe</td>
<td>55 airports</td>
<td>11 New</td>
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<tr>
<td>Asia Pacific</td>
<td>9 airport groups</td>
<td>2 New</td>
</tr>
<tr>
<td></td>
<td>35 Asian airports</td>
<td>3 New</td>
</tr>
<tr>
<td></td>
<td>16 Oceania airports</td>
<td>7 New</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>183 airports</strong></td>
<td><strong>35 New</strong></td>
</tr>
<tr>
<td></td>
<td><strong>25 airport groups</strong></td>
<td><strong>5 New</strong></td>
</tr>
</tbody>
</table>

© Air Transport Research Society (ATRS)
The ATRS Database

- The ATRS Database contains historic information (since FY 2002) 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

- The data in each region is segregated into:
  - Airport Information (capacity, type of ownership etc)
  - Traffic
  - Aeronautical Revenue
  - Non-Aeronautical Revenue
  - Operating Expense
  - Balance Sheet

## Data Sources: FY 2002-2010

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

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Passengers Traffic, FY2010
(in ’000 passengers)
Passenger Traffic - Top 10 Airports
(’000 passengers) :FY2006, 2008, 2010
**Top and Bottom 3:**

**Change in Passenger Traffic FY2009-10**

**Asia Pacific** +8.6%
- REP +21.4%
- PVG +21.3%
- PEN +20.2%
- NRT -28.2%
- MFM -4.2%
- NTL -4.0%

**Europe** +3.4%
- ISG +74.7%
- LED +24.9%
- RIX +14.7%
- DUB -10.1%
- STN -6.9%
- BHX -5.8%

**North America** +1%
- YQB +34.3%
- MKE +23.9%
- YQR +9.6%
- CVG -24.9%
- PVD -10.5%
- ONT -8.8%
Aircraft Movements, FY2010 (’000 ATM)

Asia Pacific
Europe
North America

© Air Transport Research Society (ATRS)
Passengers per Aircraft Movements, FY2010
Air Cargo Traffic, FY2010
(‘000 metric tons)
% Non-Aero Revenue, 2010

Asia Pacific
Europe
North America

© Air Transport Research Society (ATRS)
Outline

Objective of the ATRS Benchmarking Study

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Key Results on Efficiency and Costs

User Charge Comparisons
Airport Productivity Index

Outputs

- Aircraft movement
- Passenger
- Non-aeronautical revenue
- Cargo

Inputs

- Labour
- Other non-capital (soft-cost) input
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).

\[
\ln \frac{X_i}{X_j} = \sum \frac{W_{ki} + \bar{W}_k}{2} \ln \frac{X_{ki}}{\bar{X}_k} - \sum \frac{W_{kj} + \bar{W}_k}{2} \ln \frac{X_{kj}}{\bar{X}_k}
\]
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
- 2010 Iceland volcano ash cloud (For European airports)

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

<table>
<thead>
<tr>
<th>Country</th>
<th>Coefficients</th>
<th>Standard Error</th>
<th>t Stat</th>
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<tbody>
<tr>
<td>Asia Pacific</td>
<td>-2.050</td>
<td>1.325</td>
<td>-1.55</td>
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<tr>
<td>% Non-Aeronautical</td>
<td>0.530</td>
<td>0.113</td>
<td>4.69</td>
</tr>
<tr>
<td>% International</td>
<td>-0.011</td>
<td>0.007</td>
<td>-1.45</td>
</tr>
<tr>
<td>% Cargo</td>
<td>0.048</td>
<td>0.019</td>
<td>2.53</td>
</tr>
<tr>
<td>Capacity Constraint</td>
<td>0.140</td>
<td>0.076</td>
<td>1.84</td>
</tr>
<tr>
<td>Aircraft Size</td>
<td>0.143</td>
<td>0.132</td>
<td>1.08</td>
</tr>
<tr>
<td>Airport Size</td>
<td>-0.073</td>
<td>0.062</td>
<td>-1.18</td>
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<tr>
<td>Oceania</td>
<td>0.969</td>
<td>0.069</td>
<td>13.96</td>
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<tr>
<td>2010</td>
<td>0.039</td>
<td>0.098</td>
<td>0.39</td>
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<td>2009</td>
<td>0.016</td>
<td>0.097</td>
<td>0.16</td>
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<td>2008</td>
<td>0.061</td>
<td>0.099</td>
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<td>2007</td>
<td>0.114</td>
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<td>1.14</td>
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<tr>
<td>2006</td>
<td>0.096</td>
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<td>2005</td>
<td>0.085</td>
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<td>0.84</td>
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<td>2004</td>
<td>0.057</td>
<td>0.100</td>
<td>0.57</td>
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<tr>
<td>2003</td>
<td>-0.021</td>
<td>0.101</td>
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<tr>
<td>Intercept</td>
<td>-1.590</td>
<td>0.752</td>
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<tr>
<td>% Non-Aeronautical</td>
<td>0.673</td>
<td>0.083</td>
<td>8.070</td>
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<td>% International</td>
<td>-0.333</td>
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<tr>
<td>% Cargo</td>
<td>0.021</td>
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<td>0.690</td>
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<td>Capacity Constraint</td>
<td>0.105</td>
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<td>Aircraft Size</td>
<td>0.246</td>
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<td>Airport Size</td>
<td>-0.052</td>
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<td>-1.060</td>
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<td>Volcano Ash</td>
<td>-0.336</td>
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<td>-0.016</td>
<td>0.174</td>
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<td>2009</td>
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<td>0.095</td>
<td>-1.160</td>
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<td>-0.350</td>
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<td>2003</td>
<td>0.040</td>
<td>0.103</td>
<td>0.390</td>
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R Square 0.711
Observations 195
### Regression Model

#### North America

<table>
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<tr>
<th></th>
<th>Coefficients</th>
<th>Standard Error</th>
<th>t Stat</th>
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<tr>
<td>Intercept</td>
<td>0.346</td>
<td>0.945</td>
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<tr>
<td>% Non-Aeronautical</td>
<td>0.561</td>
<td>0.105</td>
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<tr>
<td>% Connecting Traffic</td>
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<tr>
<td>% International</td>
<td>-0.016</td>
<td>0.005</td>
<td>-3.190</td>
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<tr>
<td>% Cargo</td>
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<td>-1.440</td>
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<td>1.490</td>
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<td>Aircraft Size</td>
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<td>1.780</td>
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<td>-0.006</td>
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<td>-0.190</td>
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<td>2009</td>
<td>0.019</td>
<td>0.027</td>
<td>0.690</td>
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<tr>
<td>2008</td>
<td>-0.029</td>
<td>0.027</td>
<td>-1.080</td>
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<td>2007</td>
<td>-0.010</td>
<td>0.025</td>
<td>-0.390</td>
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<td>2006</td>
<td>-0.013</td>
<td>0.025</td>
<td>-0.550</td>
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<td>R Square</td>
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<td>Observations</td>
<td>584</td>
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</table>
Gross Variable Factor Productivity vs. Residual Variable Factor Productivity

Asia (HKG=1.0), 2010
Residual (Net) Variable Factor Productivity: (after removing factors beyond managerial control) :

**Asia (HKG=1.0)**
Residual (Net) Variable Factor Productivity

Oceania (SYD=1.0)
Residual (Net) Variable Factor Productivity:
Europe – Passengers > 15 million (CPH=1.0)
Residual (Net) Variable Factor Productivity:
Europe – Passengers < 15 million (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 (2012)
(based on Net VFP index=operating/management efficiency)

Asia Pacific:
- **Asian Airports:**
  - Gimpo, Incheon, Hong Kong
- **Oceania Airports:**
  - Sydney, Queenstown

Europe:
- **Large Airports (> 15 million pax):**
  - Copenhagen, Oslo, Zurich
- **Small/Medium Airports (< 15 millions Pax):**
  - Geneva, Nice, Edinburgh

North America (Canada/US):
- **Large Airports (> 15 million pax):**
  - Atlanta, Charlotte, Minneapolis/St Paul
- **Small/Medium Airports (< 15 millions Pax):**
  - Raleigh-Durham, Richmond, Oklahoma City
Top Efficiency Performers (2012)
(based on Net VFP index=operating/management efficiency)

Asian Airport Category:

Gimpo International Airport

<table>
<thead>
<tr>
<th></th>
<th>GMP</th>
<th>Mean</th>
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</thead>
<tbody>
<tr>
<td>Labour Productivity (HKG=1.0)</td>
<td>0.538</td>
<td>0.343</td>
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<tr>
<td>Soft Cost Productivity (HKG=1.0)</td>
<td>1.240</td>
<td>0.963</td>
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<tr>
<td>Residual VFP (HKG=1.0)</td>
<td>1.133</td>
<td>0.631</td>
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</table>

Runner up: Incheon International Airport
Top Efficiency Performers (2012)
(based on Net VFP index=operating/management efficiency)

Oceania Airport Category:

**Sydney Airport**

<table>
<thead>
<tr>
<th></th>
<th>SYD</th>
<th>Mean</th>
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<tbody>
<tr>
<td>Labour Productivity</td>
<td>1.000</td>
<td>0.548</td>
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<tr>
<td>Soft Cost Productivity</td>
<td>1.000</td>
<td>0.684</td>
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<tr>
<td>Residual VFP</td>
<td>1.000</td>
<td>0.695</td>
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</tbody>
</table>

Runner up: Queenstown Airport

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Top Efficiency Performers (2012)
(based on Net VFP index=operating/management efficiency)

Europe Large Airports (> 15 million pax) Category:

**Copenhagen Airport Kastrup**

<table>
<thead>
<tr>
<th></th>
<th>CPH</th>
<th>Mean</th>
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</thead>
<tbody>
<tr>
<td>Labour Productivity</td>
<td>1.000</td>
<td>1.263</td>
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<tr>
<td>Soft Cost Productivity</td>
<td>1.000</td>
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<tr>
<td>Residual VFP</td>
<td>1.000</td>
<td>0.660</td>
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</tbody>
</table>

Runner up: Oslo Airport
Top Efficiency Performers (2012)
(based on Net VFP index=operating/management efficiency)

Europe Small/Medium Airports (< 15 million pax) Category:

Genève Aéroport

<table>
<thead>
<tr>
<th></th>
<th>GVA</th>
<th>Mean</th>
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<tbody>
<tr>
<td>Labour Productivity (CPH=1.0)</td>
<td>1.375</td>
<td>1.263</td>
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<tr>
<td>Soft Cost Productivity (CPH=1.0)</td>
<td>0.580</td>
<td>0.439</td>
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<td>Residual VFP (CPH=1.0)</td>
<td>0.844</td>
<td>0.541</td>
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Runner up: Nice Cote D’Azur Airport
Top Efficiency Performers (2012)
(based on Net VFP index=operating/management efficiency)

N. America Large Airports (> 15 million pax) Category:

Hartsfield-Jackson Atlanta International Airport

<table>
<thead>
<tr>
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<th>ATL</th>
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<tr>
<td>Labour Productivity (YVR=1.0)</td>
<td>1.546</td>
<td>0.553</td>
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<tr>
<td>Soft Cost Productivity (YVR=1.0)</td>
<td>1.481</td>
<td>0.875</td>
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<tr>
<td>Residual VFP (YVR=1.0)</td>
<td>1.251</td>
<td>0.712</td>
</tr>
</tbody>
</table>

Runner up: Charlotte Douglas International Airport
Top Efficiency Performers (2012)
(based on Net VFP index=operating/management efficiency)

N. America Small/Medium Airports (< 15 million pax) Category:

Raleigh-Durham International Airport

<table>
<thead>
<tr>
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<th>Mean</th>
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<tbody>
<tr>
<td>Labour Productivity (YVR=1.0)</td>
<td>0.594</td>
<td>0.553</td>
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<tr>
<td>Soft Cost Productivity(YVR=1.0)</td>
<td>1.308</td>
<td>0.875</td>
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<tr>
<td>Residual VFP (YVR=1.0)</td>
<td>1.210</td>
<td>0.712</td>
</tr>
</tbody>
</table>

Runner up: Richmond International Airport
Cost Competitiveness: = Net VFP and Input Price Effect

Asia (HKG=0.0) – the higher the better

Airport Groups

Airports

Cost Competitiveness

Mean
Cost Competitiveness = Net VFP and Input Price Effect
Oceania (SYD=0.0) - the higher the better
Cost Competitiveness = Net VFP and Input Prices Effect
Europe – Passengers > 15 million (CPH=0.0)
Cost Competitiveness = Net VFP and Input Prices Effect

Europe – Passengers < 15 million (CPH=0.0)
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:**
  - **Queenstown**, Dunedin
- **Asia:**
  - **Airports Authority of India**, Jakarta Soekarno-Hatta

Europe:
- **Large Airports (> 15 million Pax):**
  - **Istanbul Ataturk**, Athens
- **Small/Med Airports (< 15 million Pax):**
  - **Tallinn**, Riga

N. America:
- **Large Airports (> 15 million Pax):**
  - **Charlotte**, Atlanta
- **Small/Med Airports (< 15 million Pax):**
  - **Richmond**, Raleigh-Durham
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, 2011 (in US$)
Asia Pacific: Landing Charge for Airbus 320, 2011 (in US$)
Europe: Landing Charge for Airbus 320, 2011 (in US$)
North America: Landing Charge for Airbus 320, 2011 (in US$)
Summary – Landing/Takeoff Charges for Airbus 320, 2011

Asia-Pacific:
- Highest charges: Tokyo Haneda, Sydney
- Lowest charges: Kuala Lumpur, Guam

Europe:
- Highest charges: London Gatwick-peak, London Heathrow
- Lowest charges: Stockholm, Malta

North America:
- Highest charges: Toronto, LaGuardia
- Lowest charges: Charlotte, Atlanta

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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 Boeing 767, 2011 (in US$)
Europe: Combined Landing and Passenger Charge for Boeing 767, 2011 (in US$)
Summary – Combined Landing and Passenger Charges (Boeing 767)

Asia-Pacific:
- Highest charges: Nadi (Fiji), Kansai
- Lowest charges: Kuala Lumpur Low Cost Carrier Terminal, Dunedin (New Zealand)

Europe:
- Highest charges: London Heathrow, Ben Gurion (Tel Aviv)
- Lowest charges: Riga, Luxembourg
Cost per Enplanement for Airlines (CPE)

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

• $\text{CPE} = \frac{\text{sum of landing fees, terminal arrival fee, rents and utilities, terminal apron charges/tiedowns, and passengers other aeronautical payments to airports}}{\text{divided by enplaned passengers}}$
North America: Cost per Enplaned Passenger, 2010 (in US$)
Summary – Cost per Enplaned Passenger (CPE)

United States:

- Highest CPE: **New York JFK**, Newark Liberty
- Lowest CPE: **Bob Hope**, Dallas Love Field

Canada

- Highest CPE: **Toronto**, Montreal
- Lowest CPE: **Victoria**, Regina,
The ATRS Global Airport Performance Benchmarking Report: 3 volumes, over 600 pages of valuable data and analysis.

Can be purchased by visiting www.atrsworld.org

Report sale finances our annual benchmarking research project
Thank You

2013 ATRS World Conference
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