Font Sizes

Headings: 36 points, Arial

• Level 1 bullets: 32 points, bold
  • Level 2 bullets: 28 points
    • Level 3 bullets: 24 points
Font Sizes

There is a reason why many societies have evolved cultures where the elders sit at the front of the room.
Overview

A major focus of the paper is on different purposes for benchmarking

• And how this guides the choice of methodology for benchmarking
Overview

Issues associated with benchmarking:

• Availability and quality of data
• Adjusting the data to provide meaningful comparisons
• Residual benchmarking, with reference to the ATRS study
Uses of Benchmarking

Assess managerial or firm performance

Price regulation

National policy assessment

Collaborative benchmarking
TO Make Best Use of Limited Time

I will focus on two key issues

• #1 – the role of the airport in the aviation value chain
  • And what this means for airport benchmarking

• #2 – some issues in the ATRS benchmarking measure
Airport in the Value Chain
Airports in Aviation Value Chain

Airport services are an input into the airline production function

- KLEM/KLES models of production
  - Capital, labour, energy, materials (manufacturing)
  - Capital, labour, energy, outside services (services)
- Airport services
  - Conceptually could be vertically integrated with airline
  - One of the largest outside services for an airline
  - Is a service which has major impact on other airline inputs
Airport services are an input into the airline production function

Production can be modelled by:

- Production function
- Dual Cost function
  - With or without the cost share equations (input demand equations)
- Total Factor Productivity function
  - With certain restrictions, TFP and Cost function equivalence
    - Reveals a subset of parameters of production
Airports in Aviation Value Chain

• Airport services are an input into the airline production function
  • Firms optimise at the firm level, not at the level of individual inputs
  • The firm will substitute between factors of production depending on
    • Prices, technology, scale of output
      • Ex) high energy price induces energy saving capital investment
  • Substitution extends to airport services
    • Airlines can substitute between their own labour and capital vs airport services
Airports in Aviation Value Chain

• **Airport services are an input into the airline production function**
  - Substitution extends to airport services
    - Airlines can substitute between their own labour and capital vs. airport services
  - Example:
    - Congested airport requires more airline labour and capital
    - Airline may be willing to substitute higher airport resource (which produces less congestion) in order to reduce other airline costs
      - It will optimise the balance between KLE and M/S
Airports in Aviation Value Chain

Airport services are an input into the airline production function

• Example:
  Airport A – average 20 minutes delay
  • Lower airport capital
  • Lower airport charges
  • Will be found to be an efficient airport
    • For a given level of airport output it uses fewer inputs than airport B
Airports in Aviation Value Chain

Airport services are an input into the airline production function

• Example:
  Airport B – average 5 minutes congestion
  (an improvement of 15 minutes per movement)
  • Higher airport capital
    Much higher airport charges!
  • Will be found to be an inefficient airport
    • For a given level of airport output it requires more inputs than airport A
Airports in Aviation Value Chain

Airport services are an input into the airline production function

- Impact of Airport B on airline
- Hub airline
  - 1000 flights per day
  - Reducing 15 minute delay per aircraft:
    - Saves 90,000 block hours per annum
    - Equivalent to adding 40 aircraft to fleet or reducing fleet by 40 aircraft
    - Annual savings of $350 million (annual capital and operating expense)
Airports in Aviation Value Chain

Airport services are an input into the airline production function

- How do we deal with this?
- As in any industry, we can model via
  - quality of output, or
    - production of externalities
- Because airport congestion is so critical to the production and costs of airlines
- … the measure of airport output must include a measure of delay/congestion
Airports in Aviation Value Chain

Airport services are an input into the airline production function

• … the measure of airport output must include a measure of delay/congestion

• Consequences of not doing so:
  • Congested airports will always be found to be the most efficient
  • Airports that invest to reduce airline delay and costs will be found to be inefficient
  • And residual productivity measures, represented as managerial efficiency measures, will find the airport to have poor management (non-frontier)
Airports in Aviation Value Chain

Airport services are an input into the airline production function

• What about airport profit maximisation
  • Profit maximising airports will optimise
    • Costs of investment (and operations) to expand capacity
    • Willingness to pay of its airline customers for higher quality output
    • The level of output that will materialise
      • At the higher prices
      • At the higher quality
Airports in Aviation Value Chain

Airport services are an input into the airline production function

• What about non-profit airport
  • Depends on its “objects” in letters patent
    • Economists are often lazy in not inspecting the charter objects of non-profit organisations
  • A personal observation
    • Most non-profit airports are strongly motivated to reduce congestion
    • Congestion is perceived as an organisational failure
Airports in Aviation Value Chain

Airport services are an input into the airline production function

- Key point:

- ... Airports cannot be benchmarked
  - Either for managerial purposes
  - Or for social welfare maximisation

- Unless congestion/delay is somehow included in the measurement of airport output
Airports in Aviation Value Chain

Airport services are an input into the airline production function

- How to measure delay
  - a) US and some other airports report delay statistics
  - b) most airport master plans report delay statistics
    - Interpolate between measurements based on traffic
  - c) survey of airline dispatchers
    - Ask to rate airports on 5 point scale
      - Would be a major step ahead
ATRS
Peter Drucker:

• “That which is measured, Improves”

• You can’t manage what you don’t measure”
Mike Tretheway

- “That which is measured incorrectly, never improves”
Residual Benchmarking

Example ATRS Airport Benchmark

ATRS relates raw Variable Factor Productivity to:*

- Passenger traffic volumes
- % of International traffic
- % non-aviation revenues
- % air cargo
- Capacity constraints

*Global Airport Performance Benchmarking Report, Air Transport Research Society 2004 (based on pooled model)
The ATRS study includes computation of residual productivity

- Based on VFP
  - (variable factor productivity)
- Residual productivity computed
  - Based on regressions of VFP
  - Residual from regression is put forward as a measure of managerial efficiency
ATRS VFP regressions

ATRS regressions are incompatible with economic theory

- **Total Cost Function**
  - Total Cost = f( output, input prices, time/technology, other dimensions)
  - Assumes firm is in long run equilibrium

- **Alternative: TFP regression**
  - A Cobb-Douglass TFP equation is equivalent to a Cobb-Douglass total cost function
Neoclassical theory

• Variable Cost Function
  • Variable Cost = f( output, input prices of variable inputs, level of capital stock, time/technology, other dimensions)
  • Does not assume firm is in long run equilibrium
Neoclassical theory

• Variable Cost Function
  • VCF must include the level of capital stock
    • Unless technology is separable between capital and variable inputs
    • This is unlikely, and has not been found in empirical studies of a wide range of industries
  • A VCF which excludes the level of capital has no economic interpretation
    • NO ECONOMIC INTERPRETATION!
ATRS VFP regressions

Neoclassical theory

• Variable Cost Function
  • VCF *must include* the level of capital stock
  • The lack of capital data does not justify use of VFP (or soft factor productivity)
ATRS VFP regressions

VFP regressions

• A VFP regression which excludes the level of capital
  • Is incompatible with the neoclassical theory of the firm
  • Has no economic interpretation
  • Is likely to produce non-robust results
  • Is dangerous
    • For management
    • For policy making
Residual Benchmarking

The ATRS results do not appear to be robust, e.g., economies of scale:

<table>
<thead>
<tr>
<th>Study Year</th>
<th>Elasticity of Productivity with respect to Airport Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>0.35</td>
</tr>
<tr>
<td>2003</td>
<td>0.15</td>
</tr>
<tr>
<td>2004</td>
<td>-0.18*</td>
</tr>
</tbody>
</table>

*Based on pooled data

Newark Airport (EWR)

- goes from 4th most productive airport in 2002
- to 2nd worst by 2004
Is it possible to measure airport capital stock?

• Yes

• But it may require considerable work by the economist
  
  • Don’t blame airport accountants!

• Method
  
  • Christensen-Jorgenson perpetual inventory
  
  • Must gather airport investment from range of sources (financial stmts, AIP/AIF accounts, …)
Managerial Performance

Has been used to assess various aspects of airport performance:

- Pricing
- Service quality/customer satisfaction
- Unit cost
- Productivity/efficiency (TFP/VFP)

Can also be used to assess specific services:

- Ground handling
- Cargo services
- Retail (e.g., vs High Street)
Collaborative Benchmarking

Voluntary participation of a group of airports

Examples - learning processes:

• IATA Customer Satisfaction (AETRA)
• CAC Small Airports (customer satisfaction)
  • Conducted by InterVISTAS Consulting
• EUROCONTROL (delays, cost, safety)
Collaborative Benchmarking

Voluntary participation of a group of airports

Some use for promotion:

- E.g., Number 1 Airport in the World / North America / Europe, etc.
- Highest score on Question 17b
Price regulation

Has potential to overcome information asymmetry issues

Examples:

- Irish Airports - used in determination of the X-Value for price cap regulation of Dublin, Cork, Shannon
- Also has been used in price regulation of electricity in Canada, UK, Chile, Sweden, …
Price regulation

Has potential to overcome information asymmetry issues

Critically Important:

• Data quality, performance indicators, comparators

• can make millions of dollars difference
Benchmarking can be used to inform policy, for example:

- Australia International Benchmarking (1995)
  - Covered utilities, rail, road, aviation, ports
  - Impact was largely indirect (informing the debate)
Benchmarking can be used to assess policy changes:

- North American rail (Canada vs. U.S.)
  - Canada enacted reforms before U.S.
  - Canadian success with regulatory reform became basis for US Staggers Act (1980)
<table>
<thead>
<tr>
<th>Purpose</th>
<th>Types of Measure</th>
<th>Level of Aggregation</th>
<th>Comparators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assess performance</td>
<td>• Price</td>
<td>Airport or individual</td>
<td>• Best in class</td>
</tr>
<tr>
<td></td>
<td>• Customer satisfaction</td>
<td>services</td>
<td>• Natural competitors</td>
</tr>
<tr>
<td></td>
<td>• Service quality</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Unit cost</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Efficiency (TFP, VFP, etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collaborative benchmarking</td>
<td>• Price</td>
<td>Airport or individual</td>
<td>• Other group members</td>
</tr>
<tr>
<td></td>
<td>• Customer satisfaction</td>
<td>services</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Service quality</td>
<td></td>
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<tr>
<td></td>
<td>• Efficiency (TFP, VFP, etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price regulation</td>
<td>• Efficiency (TFP, VFP, etc.)</td>
<td>Airport</td>
<td>• Best in class or similar peer airports</td>
</tr>
<tr>
<td>Assess policy</td>
<td>• Price</td>
<td>National or airport</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Service quality</td>
<td></td>
<td>To inform policy:</td>
</tr>
<tr>
<td></td>
<td>• Unit cost</td>
<td></td>
<td>• Best in class</td>
</tr>
<tr>
<td></td>
<td>• Efficiency (TFP, VFP, etc.)</td>
<td></td>
<td>• Competitor countries</td>
</tr>
<tr>
<td></td>
<td>• Investment</td>
<td></td>
<td>• Countries that have enact major policy reform</td>
</tr>
<tr>
<td></td>
<td>• Throughput or take-up</td>
<td></td>
<td>To assess policy outcomes:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Control group of counties that have not</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>enacted policy change</td>
</tr>
</tbody>
</table>
Issues in Benchmarking Airports

Availability and quality of data

Adjusting data to provide meaningful comparisons

Use of residual benchmarking, with reference to the ATRS study
Availability/Quality of Data

Differing reporting standards around the world:

• Private and not-for-profit airports publish detailed financial accounts
• Public sector airports may report very little data (buried in govt. accounts)

Differing accounting practices:

• U.S. PFCs vs. Canadian AIFs
• Depreciation of infrastructure e.g. BAA runways = 100 years
• Can be adjusted but requires detailed data
Availability/Quality of Data

Lack of national airport statistics available from government or associations

Not the case in all transport sectors:

- U.S. airline data is very comprehensive
- North America rail statistics

This type of data would be highly valuable for national policy benchmarking in particular
Adjusting the data

Need to understand the true causes for observed differences in performance:

- Managerial or policy performance?
- Data inconsistencies?
- External factors outside control of managerial (or policy maker)?
Adjusting the data

Various factors can impact benchmarking comparisons:

• Degree of outsourcing
• Weather
• Government subsidy/assistance
• Traffic mix
• Capacity constraints
• Cost of living
• Service quality
• Economies of scale
• Congestion
Adjusting the data

TRL approach: (Airport Performance Indicators)

- Based on a core set of activities - runways, terminals and retail / food&beverage
- Strip out non-core activities such as baggage handling, parking, other non-aviation activities
- Requires judgement and detailed data
- Some factors hard to adjust for (e.g., economies of scale, traffic mix)
  - Could be handled by selection of comparators

Not always necessary to adjust

- Economies of scale could be a policy objective
Residual Benchmarking

Another approach to control for differences

Econometric/statistical analysis of indicators

In general, residual benchmarking can be useful but has limitations:

- Can be biased by incorrect specification or selection of “external” factors
- Can be distorted by the selection of sample airports/countries in the study (true of benchmarking in general)
Residual Benchmarking

Explanation given for 2004 results:

- Economies of scales exhausted in North American and European airports (in just one year!)
- More likely explanation is that there are problems with data or specification

Other coefficients also unstable year-on-year, e.g., % cargo

Results are specious and should be treated with caution or disregarded
Other Issues with ATRS

Does not provide access to data

- for scientific verification

ATRS conclusion

- statistical results specious
- data unavailable, results cannot be replicated
- does not meet a scientific standard at this time
Conclusion

Is benchmarking with limitations better than no benchmarking?

- Certainly not without value: can identify best practice, spur competition and shake up conventional thinking
- Also, depends on the use:
  - Price regulation requires a high degree of accuracy
  - In policy analysis, an imprecise measure giving scale and direction may be sufficient
- Benchmarking can be an effective decision-aid tool but users should be aware of the limitations and the analysis must demonstrate sufficient robustness