A Balanced Scorecard for Railway System Efficiency?

OECD/ITF Railway Efficiency Roundtable
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What IS “Efficiency”? 

• Like porn: we know it when we see it?
• Basically, outputs vs inputs: net difference or ratio
• Unusually complex for railways
  – Multi-product: many types of both passenger and freight service, infrastructure access
  – Multiple inputs (labor, track, trains), most not differentiated by output product
  – Varying attitudes toward reporting
Measures of Efficiency

- Technical: physical outputs and inputs.
  - Outputs: e.g. tonnes, passengers, tonne-km, train-km
  - Consumed inputs: labor, materials, energy
  - Asset inputs: ROW, Rolling Stock
- Financial: measured in currency (€ or $)
  - Cost: e.g. value of output/value of labor
  - Market/Customer: prices (€/tonne-km) or modal share
- Economic: Social outputs (urban form, improved safety, green energy) versus social inputs (increased noise or pollution)
Dimensions of Efficiency Measures

• Cross-Section – comparisons at one point in time
  – Can’t use a single index as railways are quite different in many ways, always argue “we’re different”
  – Better with multiple indices – not just temperature, also blood pressure, Xrays, Blood tests, etc.

• Time-series also critical – improvement versus deterioration

• Benchmark(s) always needed
Issues with Indices

• Defining the indices – what are we trying to do with them?
  – Analysis or research
  – Investment
  – Public policy and budgeting
  – Regulation (e.g. US STB uses R/VC)

• Availability and public use of data

• Data quality – accuracy, consistency and completeness limit number and value of indices

• Feedback: cut sails according to cloth
Data Collected
(81 railways, 26 countries, 41 years)

• Data on inputs and assets*: Staff, Line Km, locomotives, coaches, MUs, wagons

• Data on Outputs:
  – Passengers: pax, pax-km, revenue, gross tonne-km, train-km
  – Freight: tonnes, tonne-km, freight revenue, gross tonne-km, train-km
  – Total operating cost and total operating revenue
  – Modal shares
  – Copy of all data available on request

* Note: Asset values not available.
Indices Developed

- **Basic use characteristics: Scope and Scale.** Staff, Km of line, Passenger-km and Tonne-km, average length of trip and haul and passenger share of TU*, GT-Km and Train-km
- **Productivity ratios of line density.** TU/Km, GT-Km/Km and Train-Km/Km
- **Productivity ratios of rolling stock.** Pax-Km/(Coach+MU), Tonne-Km/Wagon and TU/(Locomotive+adjusted MU)
- **Productivity ratios of staff.** TU/staff, GT-Km/staff and Train-Km/staff
- **Financial: Operating Ratio** (revenue/operating cost)
- **Average revenues:** Avg. passenger fare and Avg. freight tariff in 2011 PPP US $/pax-km and 2011 PPP US$/per tonne-km
- **Rail modal share** of surface pax-km and surface tonne-km (all surface and rail versus truck only)
- **Time series presented:** in report Pax-km, tonne-km, Operating Ratio, TU/employee, avg. pax and frt revenue, market shares. Available for all indices

* TU is sum of Pax-Km + Tonne-Km
What about the data?

- Data quality has real problems: accuracy, comparability, completeness, enforcement, “confidentiality” restrictions
- US STB (“Statistics of Class I Railroads” and “Carload Waybill Sample”) good model. Clear specification, long time frame, filing mandatory and sworn to be accurate
- Industry sources (AAR, RAC) are useful. ORR data useful, but doesn’t cover freight operators. Franchise changes complicated
- UIC data format is good but has gaps (waybill needed) and railways often do not comply.
- EU has no central source of data, does not enforce reporting mandates to support policy. Not a new problem: see Thompson 2007 “Railway Accounts for Effective Regulation” Analysis also hindered by changes in system and national railway structure
What Did This Tell Us, Step 1?

- There are very efficient freight railways: US Class I, Canada, China. High volumes, high indices, low prices, strong modal share trends. Note that Amtrak and VIA are very different.
- There are very efficient passenger railways: Japan
- Mixed traffic railways are in the middle. SBB (Switzerland) relatively strong in most areas
- OSE (Greece) and CIE (Ireland) at the bottom of most indices
- Nothing in the time trends that would foster optimism about most EU railways
Can Efficiency be Changed?

- Deregulation of US freight
- Privatization of CN (and US deregulation) in Canada
- Breakup and privatization in Japan
- Restructuring and franchising in UK
- EU results mixed: UK had clearest results. Not clear whether EU Directives have actually been implemented (Kirchner)
US Class I Railroads
All Commodity Average Revenue/Ton-Mile
(cents/ton-mile) and Operating Ratio

Operating Ratio

Deregulation

Constant 2010 $

Current $

Source: Analysis of Class I Railroads and Bureau of Economic Analysis (GDP Deflator)
Japanese National Railways Breakup and Privatization

Breakup and Privatization (1987)

Source: Author’s analysis and UIC, Railway Time Series 1970-2000
Rail Traffic in the U.K.
(000,000 passenger-km and tonne-km)

Source: SRA 2002c and SRA, 2003a, WDI, UIC, ORR
UK Passenger-Km, Tonne-Km and GDP
(Index, 1994=100, GDP index constant £1994-1995)

Has EU Rail Reform Actually Been Implemented?

Rail Liberalization Index for EU Railways

<table>
<thead>
<tr>
<th>Country</th>
<th>Overall Liberalization*</th>
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| Sample | 17 | 25 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 |

| EU 15 | 484 | 520 | 681 | 718 | 769 | 592 | 608 | 670 | 613 | 574 | 744 | 807 | 507 | 498 | 665 | 695 |
| EU 10 | - | 405 | 688 | 690 | 759 | 62 | 785 | 634 | - | 490 | 760 | 790 | - | 371 | 670 | 664 |
| EU 25 | 480 | 683 | 706 | 765 | 604 | 799 | 655 | 545 | 751 | 800 | 454 | 667 | 683 | - | 191 | 346 | 425 |

What Did This Tell Us Step 2?

• Broad indices can be developed and are useful but detailed analysis needed for individual countries
• Results are indicative, not dispositive
• MUST HAVE BETTER DATA. Define objectives more clearly, complete and mandatory reporting.
• Add socioeconomic data?
• EU mandated data with/without UIC?