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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

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* Note: Asset values not available.

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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

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

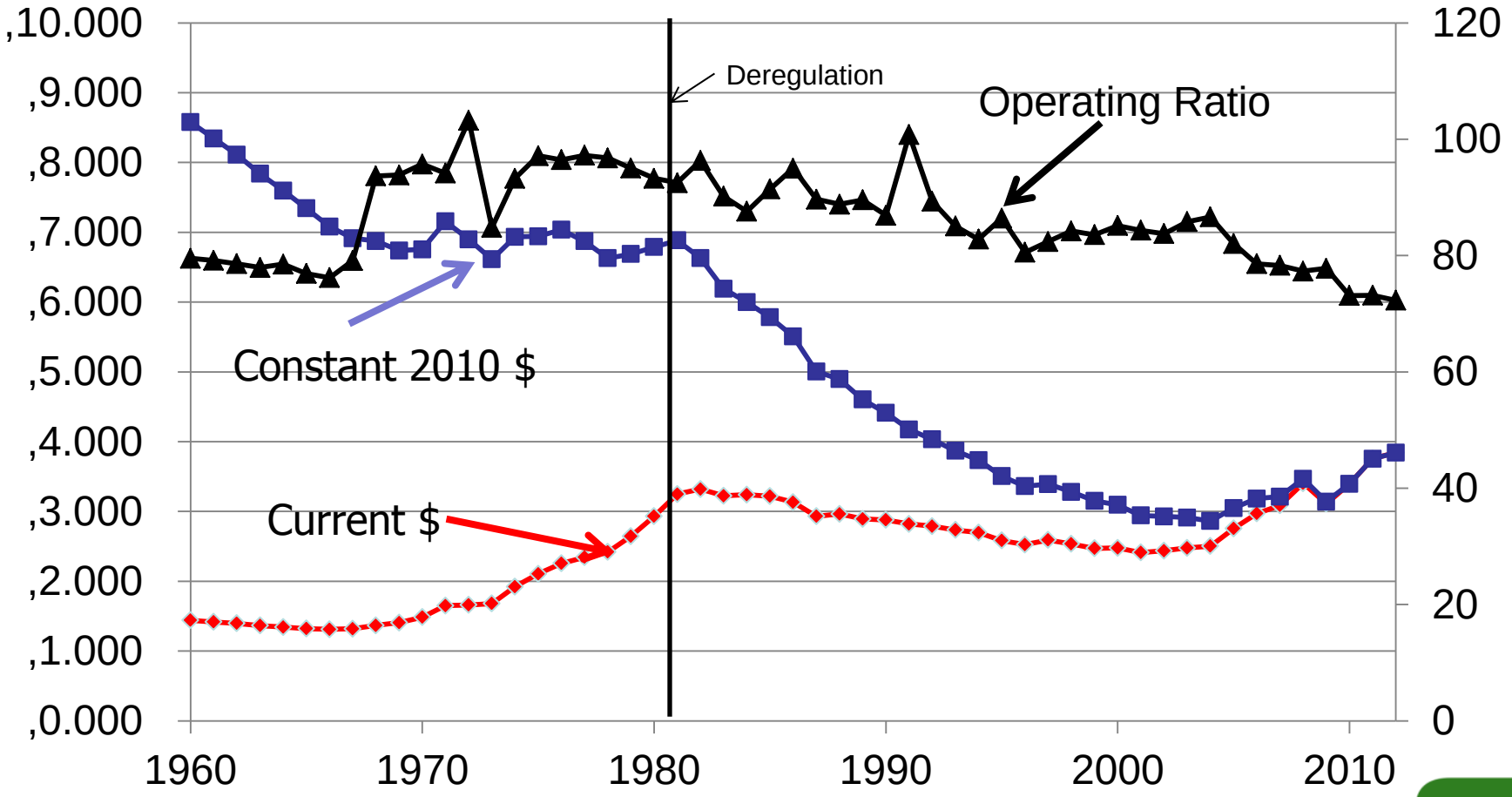
What Did This Tell Us, Step 1?

- 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



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Source: Analysis of Class I Railroads and Bureau of Economic Analysis (GDP Deflator)

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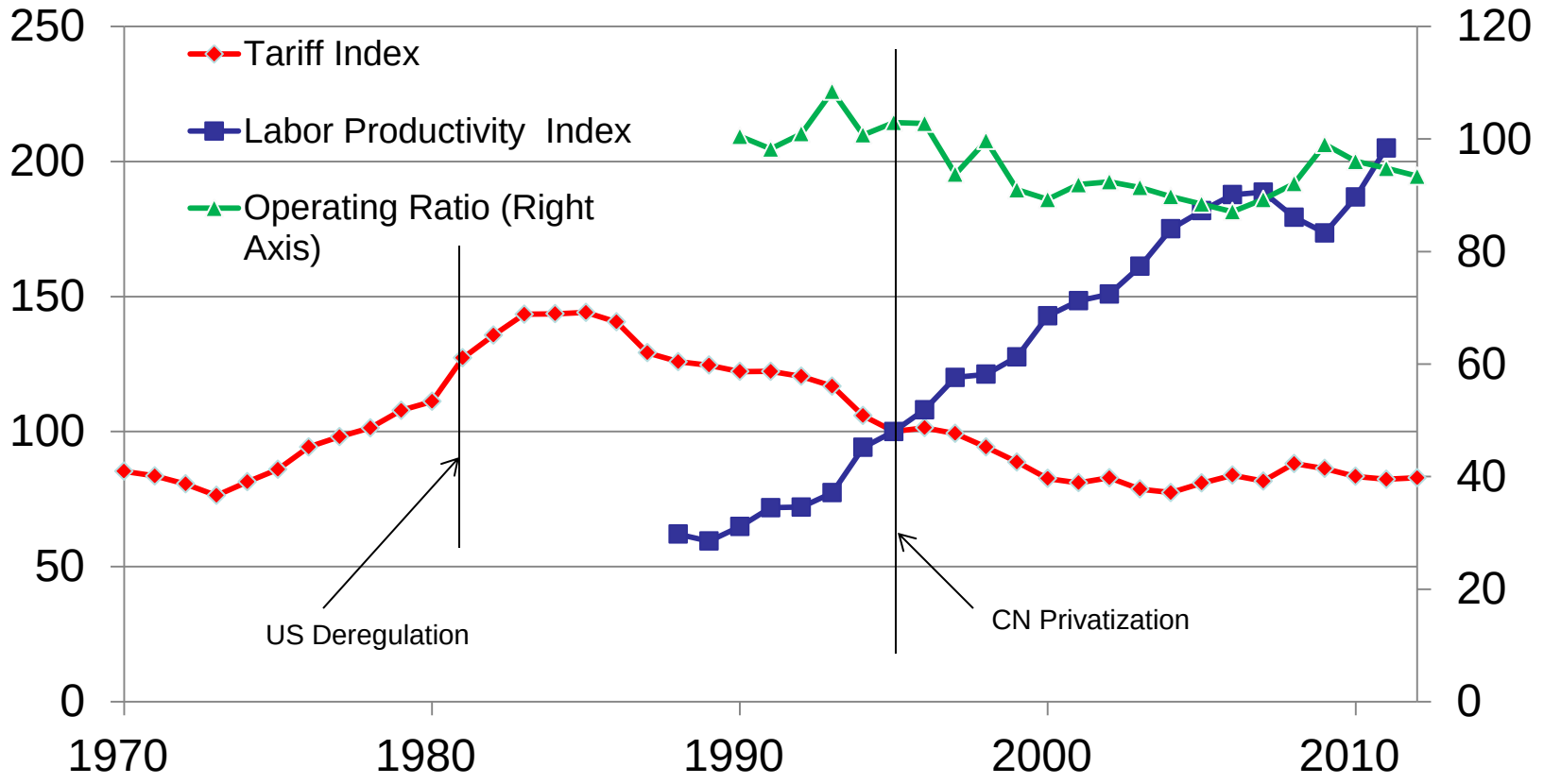
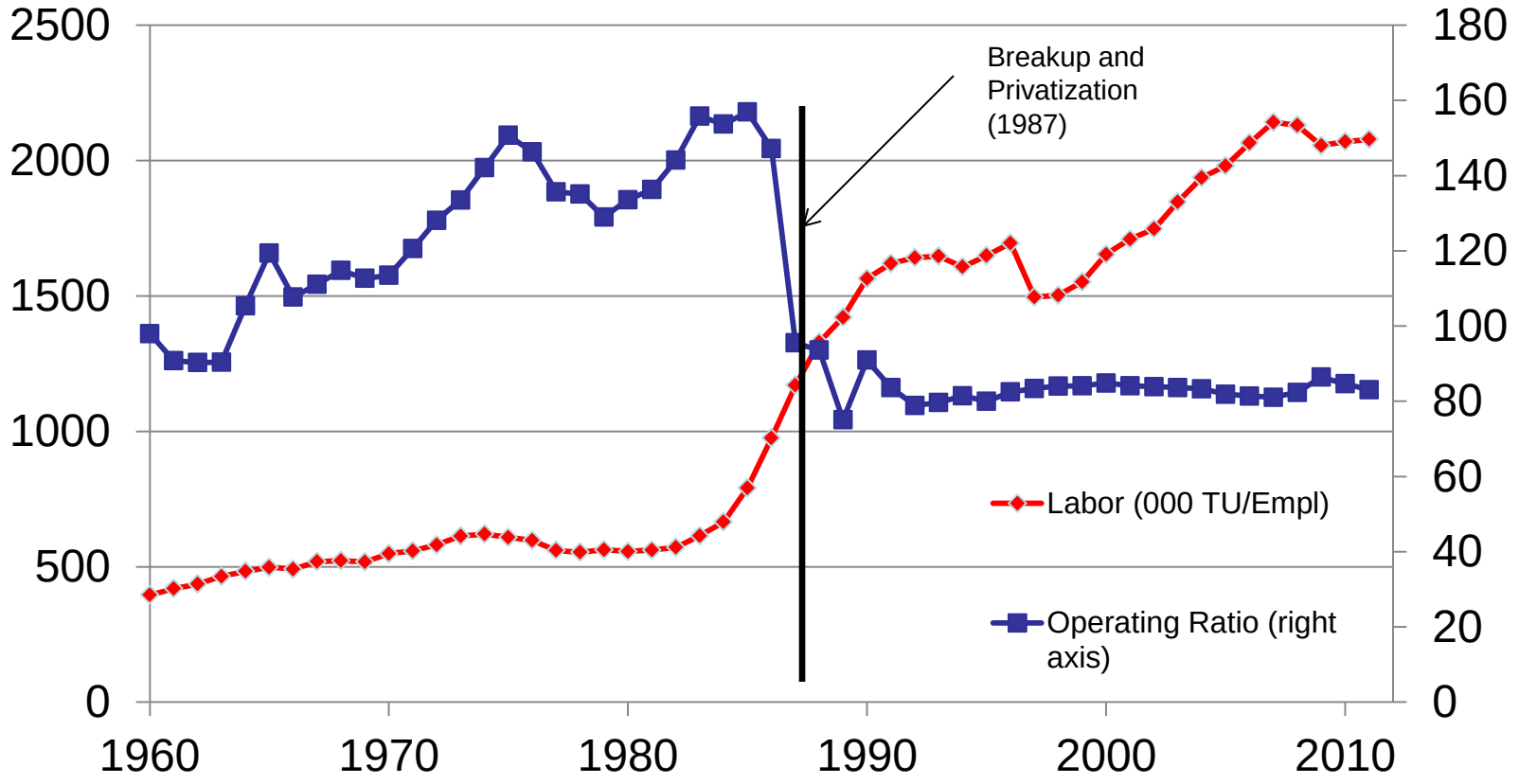
Canadian Freight Railways

(Tariff Index and Labor Productivity Index 1995=100)



Source: Railway Association of Canada

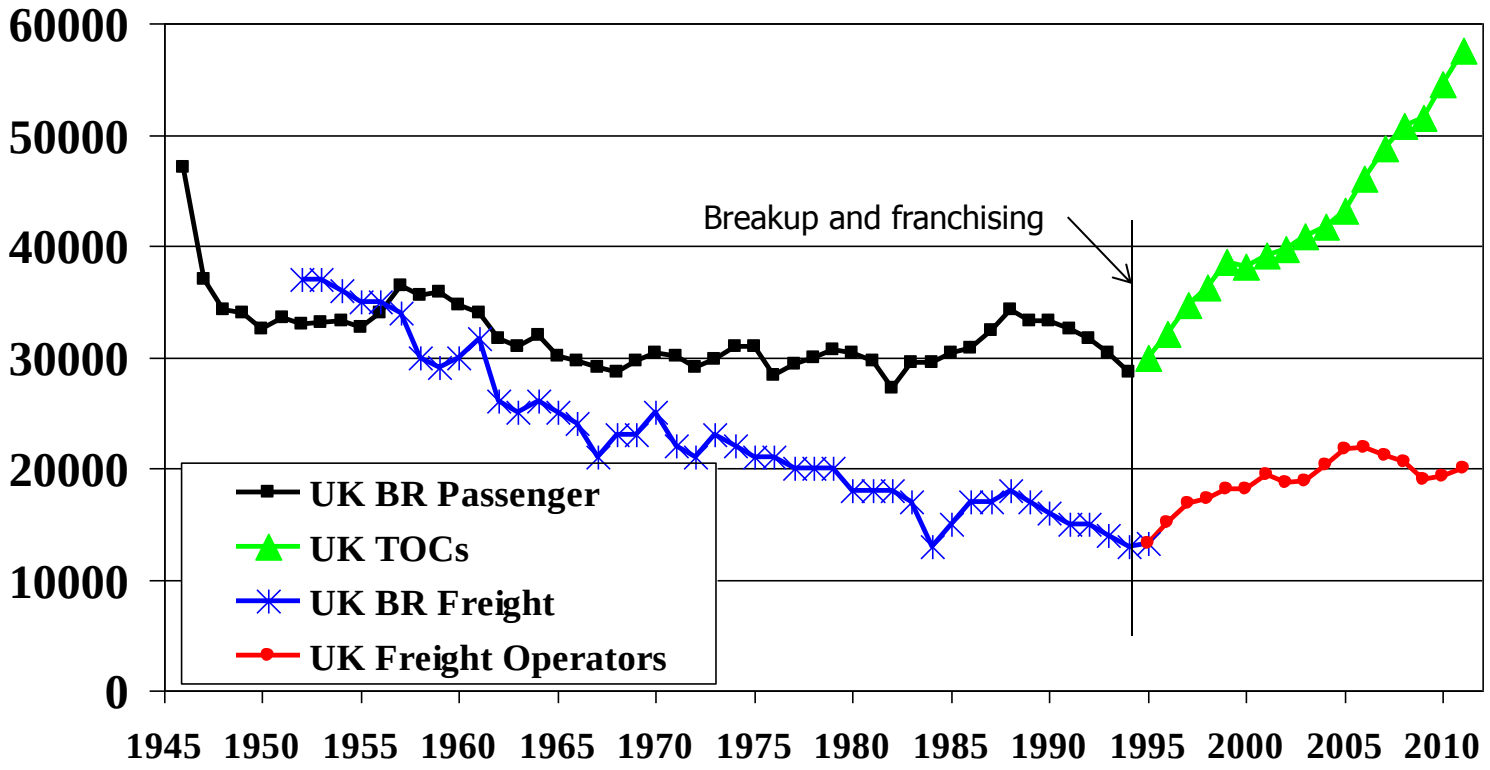
Japanese National Railways Breakup and Privatization



Source: Author's analysis and UIC, Railway Time Series 1970-2000

Rail Traffic in the U.K.

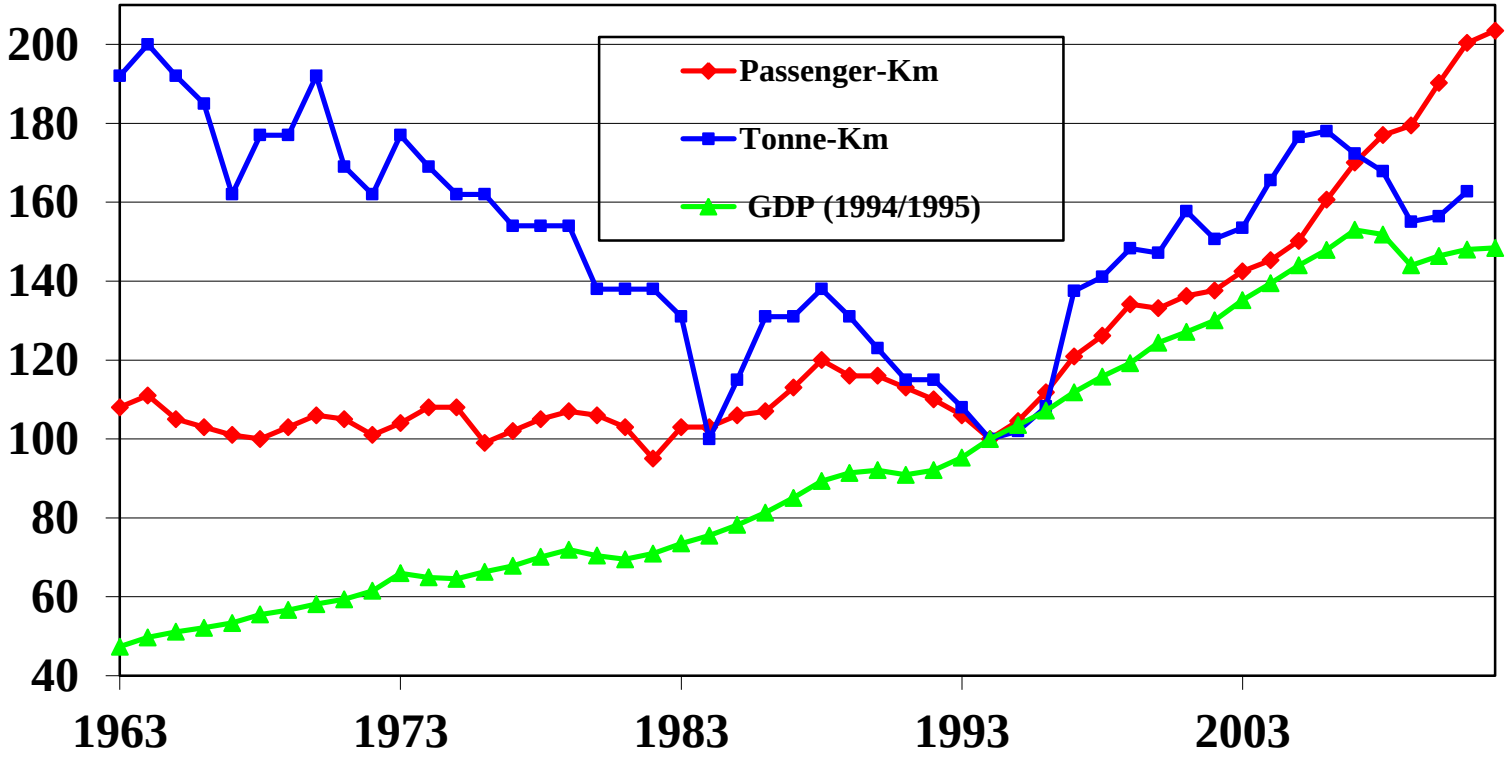
(000,000 passenger-km and tonne-km)



Source: SRA 2002c and SRA, 2003a, WDI, UIC, ORR

UK Passenger-Km, Tonne-Km and GDP

(Index, 1994=100, GDP index constant £1994-1995)



Source: SRA, ORR, U.K. Treasury website and World Bank.

Has EU Rail Reform Actually Been Implemented?

Rail Liberalization Index for EU Railways

>800	Advanced
600 to 800	On Schedule
300 to 600	Delayed
<300	Pending Departure
	No data

	Overall Liberalization*				2007		2011		LEX				ACCESS				COM			
Country	2002	2004	2007	2011	Frt.	Pass.	Frt.	Pass.	2002	2004	2007	2011	2002	2004	2007	2011	2002	2004	2007	2011
UK	805	781	827	865	848	798	862	852	960	940	969	980	740	715	791	837	780	580	793	866
DE	760	728	826	842	844	809	875	814	840	750	905	935	840	720	807	819	520	505	555	615
SE	760	729	825	872	908	742	896	855	800	680	857	960	760	760	817	850	720	510	633	577
NL	720	695	809	817	887	732	884	779	760	670	865	887	820	710	795	799	460	455	509	680
AT	430	579	788	806	852	727	873	761	680	530	819	895	410	600	781	784	240	232	349	575
DK	720	693	788	825	811	757	851	808	860	790	821	925	770	650	780	800	480	390	498	655
CH	650	677	757	741	848	662	850	680	600	605	670	678	770	710	778	756	440	495	459	509
PL		549	739	737	786	692	826	699		600	783	803		530	728	720		175	490	518
CZ		549	738	738	798	679	783	705		530	839	786		560	713	726		215	279	422
RO			722	726	797	650	834	650			822	783			697	711			440	487
PT	380	668	707	737	797	619	847	676	700	820	829	884	290	605	676	701	220	190	200	434
SK		458	700	738	756	643	793	702		535	853	857		430	662	708		260	381	381
NO	390	589	698	729	836	574	861	652	580	570	777	769	410	595	679	719	140	135	274	482
EE		257	691	729	727	667	781	701		380	728	840		205	680	702		245	704	629
LT		222	684	592	744	624	703	530		260	820	730		210	650	558		165	184	120
IT	560	688	676	737	734	617	809	706	660	740	819	795	680	670	640	722	240	225	293	470
SI		326	665	672	743	585	799	590		550	622	655		230	675	676		120	153	337
BG			652	718	761	557	806	668			722	839			635	688			241	421
LV		516	650	587	733	576	747	500		580	683	780		485	642	539		225	313	411
BE	395	461	649	753	780	518	881	663	380	425	740	820	500	475	626	737	180	180	201	424
HU		366	637	658	740	533	780	592		485	731	822		320	613	616		125	275	522
FI	410	542	636	672	732	540	753	661	620	640	732	729	440	505	612	657	160	140	145	156
ES	195	148	630	583	785	486	770	485	300	250	711	701	180	105	610	554	140	110	151	333
LU	280	467	581	585	688	474	742	508	520	530	551	669	220	440	588	564	152	120	115	104
FR	340	305	574	612	727	431	772	521	340	360	595	650	430	280	568	602	152	130	178	334
GR	210	162	559	592	690	429	698	559	260	305	619	859	240	100	544	525	100	100	133	136
IE	295	149	333	467	458	206	603	399	520	180	332	414	280	130	338	481	100	100	115	120
Sample	17	25	27	27	27	27	27	27	17	25	27	27	17	25	27	27	17	25	27	27
EU 15	484	520	681	718	769	592	808	670	613	574	744	807	507	498	665	695	310	264	325	432
EU 10	-	405	688	690	759	621	785	634	-	490	760	790	-	371	670	664	-	191	346	425
EU 25		480	683	706	765	604	799	655		545	751	800		454	667	683		239	333	429

UK

DE

NL

DK

EE

FR

Source: Kirchner 2002,2004,2007 and 2011

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?