Phare Multi Country Programme

Improvement of Competitiveness of Rail Transport in the CEECs

Adaptability and Efficiency Analysis

October 1999

Halcrow Transmark

Contents

0 Introduction

This Report contains the Comparative Efficiency and Adaptability Analysis carried out during the Phare project: Improvement of Competitiveness of Rail Transport in the CEECs.

Section 1 evaluates the relative efficiency of the railways in the CEECs. This work forms a key part of the study, in particular by quantifying key aspects of rail performance and providing a series of benchmarks for measuring the effectiveness of improvement measures. It also forms a key input into the adaptability analysis.

Section 2 describes the theoretical underpinnings of the adaptability analysis. This theory relates the powers of a railway company together with the responsibility and accountability to its economic efficiency.

Section 3 then examines the relationship between adaptability and efficiency in order to quantify the potential cost savings available to the railway companies in the CEECs.

1 Comparative Efficiency Analysis

1.1 Introduction

This section examines the relative efficiency of the railways in the CEEC. This work forms a key part of the study, in particular by quantifying key aspects of rail performance and providing a series of benchmarks for measuring the effectiveness of improvement measures. It also forms a key input into the adaptability analysis.

1.2 Glossary

BDZ	Chemins de fer d l'Etat bulgare	Bulgaria
CD	Ceské drahy	Czech Republic
CFARYM	Makedonski Zeleznici	FYROM
CFR	Societea Nationala a Cailor Ferate Romane	Romania
EVR	Riigiettevote "Eesti Raudtee"	Estonia
HSh	Hekurudhat Shqiptare	Albania
LDZ	Valsts Akciju Sabiedriba "Latvijas Dzelzcels"	Latvia
LG	SPAB "Lietuvos Gelezinkeliai"	Lithuania
MÀV	Magyar Allamvasutak	Hungary
PKP	Polskie Koleje Panstwowe	Poland
SZ	Slovenske Zeleznice	Slovenia
ZBH/ZRS	Zeljeznice Bosne I Hercegovine Zeljeznice Republika Srpska	Bosnia and Herzegovina
ZSR	Zeleznice Slovenskej Republiky	Slovak Republic

1.3 Methodology

Given that railways are complex, in that they produce a multi-dimensional output through the use of many inputs, under different operating environments, we have used three different methods to describe the comparative efficiency of the railways in Central and Eastern Europe. This chapter examines the results of the following methods of analysis:

- Partial Productivity Analysis
- Total Factor Productivity Analysis
- Cost Frontier Analysis

The principal drawbacks of Partial Productivity Analysis are that:

1. The method does not allow for potential trade-offs between individual indicators (for instance between labour productivity and capital productivity)

2. It is extremely difficult to collate all the findings from numerous partial measures into an objective conclusion

3. The analysis does not explicitly allow for variations in each company's operating environments.

The problems that arise through the use of partial productivity measures have been addressed through the use of total factor productivity analysis and the use of cost frontier analysis. The methodology employed in each of the analyses is presented within the appropriate section.

Using total factor productivity analysis allows us to address points 1 and 2 above. This method effectively compares each company to a hypothetical company with average levels of input and output, and produces a single measure of the level of productivity of the firm.

Using cost frontier analysis allows the introduction of exogenous factors into the analysis, addressing point 3 above. However it should be noted that any measure of productivity is only as reliable as the quality of the data used in the analysis. All 3 measures have been examined to give an overall view of the level of productivity of the various railway companies.

1.4 Data Source

The main data source for the analysis of the comparative efficiency of the railways in Central and Eastern Europe is the Union Internationale des Chemins de Fer (UIC), of which all of the study countries' railway companies are members. We have used data from the 1997 version of International Rail Statistics in order to minimise any differences in definitions that would affect our results. In addition, where gaps have been identified in the UIC data, other data has been used from the World Bank Railways Database and the annual reports of the individual railway companies. In addition we have utilised data gathered through the local consultants in the CEECs and through country visits by consultants. Revenue and cost measures have been converted from local currency measures using Purchasing Power Parity (PPP) exchange rates[1]. This allows us to take

[1] PPP exchange rates were calculated using data from the 1997 and 1998 EBRD Transition Reports.

into account the lower labour costs in the CEECs that may not be reflected in market exchange rates. The PPP exchange rate is the most suitable way to convert costs from different currencies to a comparable base. The same exchange rate has been used for revenue conversions. Financial performance measures place costs in relation to revenues and thus the two elements need to be compared to the same base. It should be noted that in a number of the study countries there has been a great deal of economic instability which may affect the PPP exchange rates used in the analysis.

1.5 Data Issues

It has proved extremely difficult to acquire accurate data for the Balkan countries. There is some data missing from HSh and CFARYM. In addition there is very little information available concerning the railways in Bosnia and Herzegovina. This has necessarily limited the extent of the analysis. In addition to the Balkans, difficulty has been encountered in the acquisition of cost and revenue data from Lithuania which has necessitated the use of 1995 UIC data for some of the analysis.

In addition to the lack of data for some of the countries, during the course of the analysis it has become clear that there are substantial difficulties in comparing the accounts of so many different companies, each with a different accounting system. This problems means that it is possible that some of the companies have hidden subsidies within the accounts, for example within the passenger receipts. The effect that this problem has on the analysis is discussed later in the chapter.

1.6 Quality of output

In addition to assessing the efficiency of the railways, it is necessary to also consider the quality of the output. A higher quality of output may result in a higher level of costs that is not reflected in some of the productivity measures. However it is extremely difficult to obtain an objective measure of overall quality of service. Measures that could be considered include the percentage of lines electrified or the ability of the railway to satisfy peak demand, which could be proxied, by denominating output by land area, population or GDP.

1.7 Partial Productivity Analysis

Analysis has been made in order to closely examine the strengths and weaknesses of the various railway companies. Measures have been calculated using various measures of output including gross tonne kilometres. Gross tonne kilometres include the weight of freight and the rolling stock, and have also been calculated for passenger traffic by the UIC. Measures using train kilometres may be less reliable as they may benefit railway companies running lots of small trains. Using gross tonne kilometres provides a more accurate way to quantify the efficiency of railway companies, as it takes into account, not only the number of train kilometres run but also the size of the trains. It is recognised that neither measure is above criticism and, therefore, both measures have been used in the analysis.

It should be noted that despite the problems associated with partial productivity analysis, and the concerns expressed about the quality of the data it is nevertheless a very useful tool which allows us to compare, in some detail, the relative performance of the various railway companies.

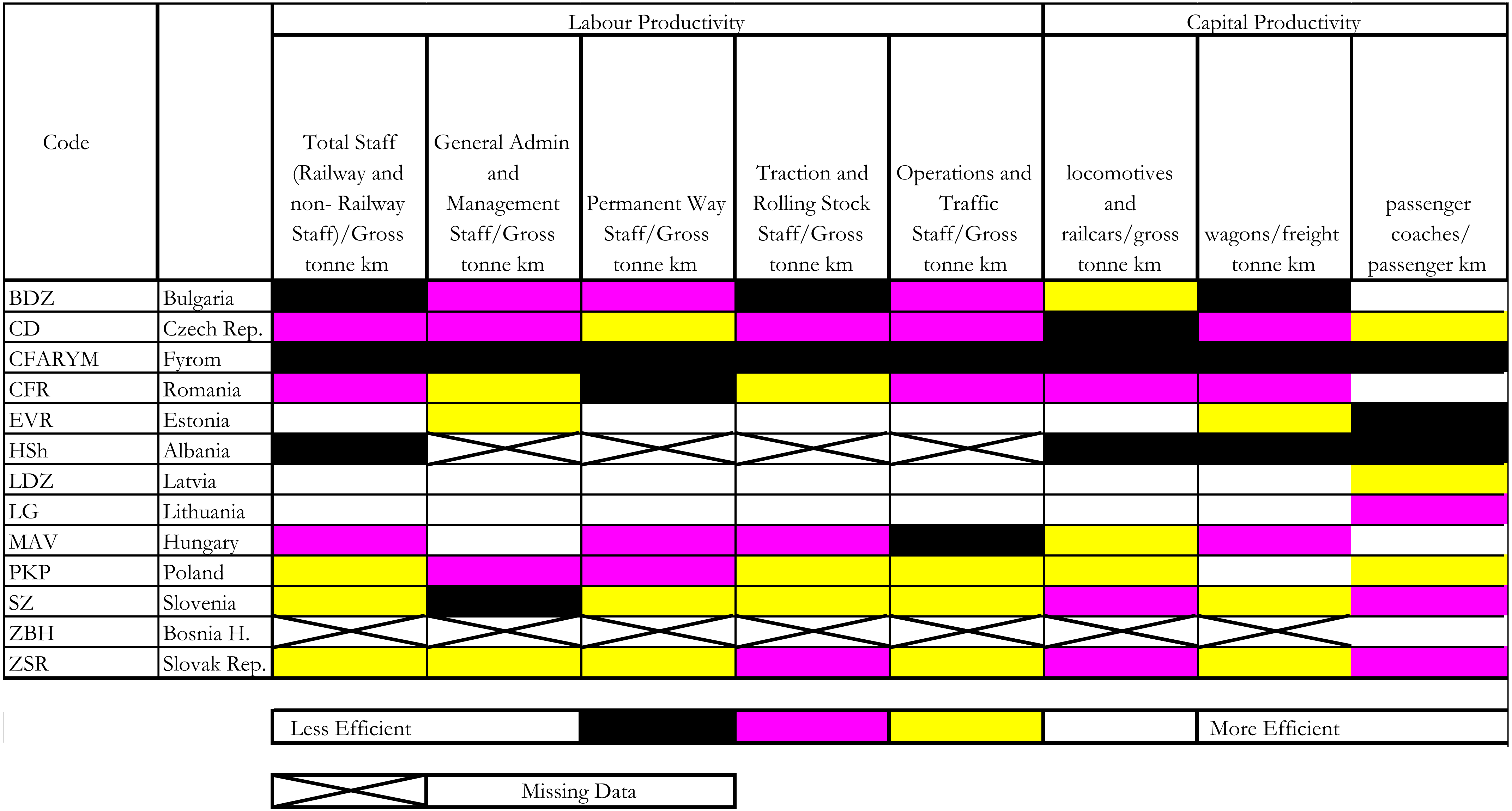
1.7.1 Operating Performance

Measuring the operating performance allows us to ascertain how well the railway is utilising assets and staff in relation to the resultant output produced, given the system configuration and its constraints. Capital and labour inputs are bench-marked/denominated by measures of output in order to produce partial productivity measures. Figures 1.1 and 1.2 present measures of labour and capital productivity. The results are summarised in terms of performance quartiles, based on performance rankings achieved by each company within the sample with respect to the performance measures analysed. This summary allows a clear representation of the strengths and weaknesses of the various railways within the sample with regard to their operating performance.

Figure 1.1 presents results in terms of gross tonne kilometres, and figure 1.2 a number of other measures; some calculated using train kilometres. The results upon which these figures are based upon are shown in the tables following each figure.

It is important to note that a low level of capital or labour productivity on its own is not necessarily an indication of a low level of efficiency, as that company may be a labour intensive or capital intensive company respectively. However, if a company has low levels of both labour and capital productivity then this can be seen as an indicator of poor overall performance.

Figure 1.1 - Partial Labour and Capital Productivity Measures using gross tonne kilometres



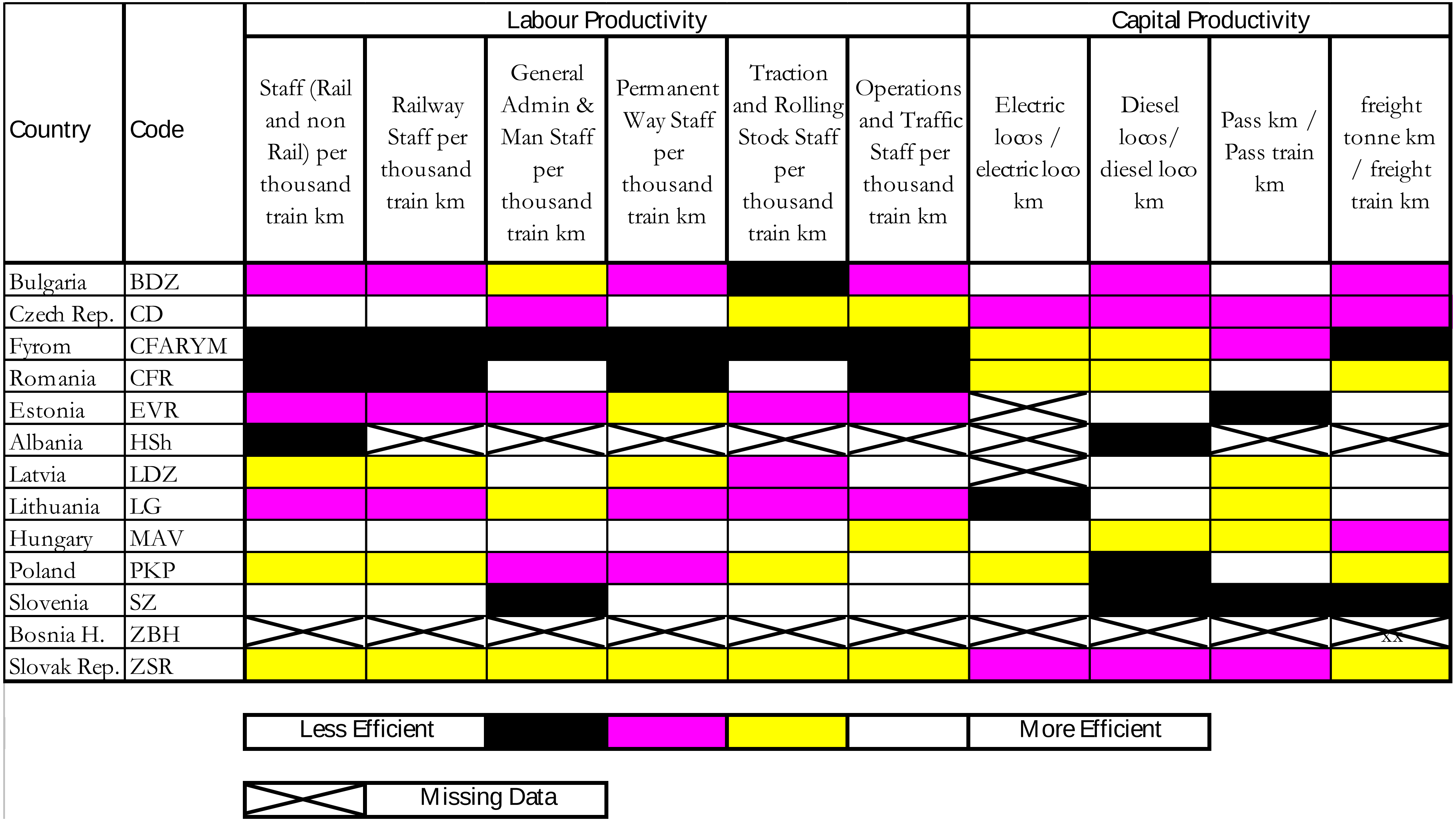
Partial Labour and Capital Productivity using gross tonne kilometres - Results

Country	Code	Labour Productivity					Capital Productivity		
		Total Staff (Railway and non- Railway Staff)/Gross tonne km	General Admin and Management Staff/Gross tonne km	Permanent Way Staff/Gross tonne km	Traction and Rolling Stock Staff/Gross tonne km	Operations and Traffic Staff/Gross tonne km	locomotives and railcars/ gross tonne km	wagons/ millions freight tonne km	Passenger coaches/ millions passenger km
BDZ	Bulgaria	1.99	0.06	0.54	0.54	0.81	0.036	4.953	0.370
CD	Czech Rep.	1.52	0.08	0.31	0.41	0.71	0.059	3.533	0.764
CFARYM	FYROM	4.23	0.43	1.12	1.29	1.36	0.099	8.682	1.199
CFR	Romania	1.74	0.03	0.61	0.22	0.80	0.053	4.544	0.390
EVR	Estonia	0.71	0.03	0.15	0.21	0.28	0.020	1.673	1.305
HSh	Albania	14.15					0.330	11.522	0.821
LDZ	Latvia	0.63	0.01	0.18	0.18	0.16	0.018	0.758	0.710
LG	Lithuania	0.84	0.02	0.21	0.21	0.26	0.023	1.566	0.777
MÀV	Hungary	1.94	0.02	0.40	0.43	0.84	0.040	3.401	0.469
PKP	Poland	1.15	0.05	0.37	0.31	0.36	0.037	1.510	0.552
SZ	Slovenia	1.27	0.11	0.33	0.28	0.51	0.044	2.606	0.779
ZBH/ZRS	Bosnia & H.								
ZSR	Slovak Rep.	1.30	0.04	0.37	0.32	0.49	0.044	2.319	0.818
	mean	2.62	0.08	0.42	0.40	0.60	0.067	3.922	0.746

Rank of productivity measures

Country	Code	Labour Productivity					Capital Productivity		
		Total Staff (Railway and non- Railway Staff)/Gross tonne km	General Admin and Management Staff/Gross tonne km	Permanent Way Staff/Gross tonne km	Traction and Rolling Stock Staff/Gross tonne km	Operations and Traffic Staff/Gross tonne km	locomotives and railcars/ gross tonne km	wagons/mil lions freight tonne km	Passenger coaches/ millions passenger km
BDZ	Bulgaria	10	8	9	10	9	4	10	1
CD	Czech Rep.	7	9	4	8	7	10	8	6
CFARYM	FYROM	11	11	11	11	11	11	11	11
CFR	Romania	8	4	10	4	8	9	9	2
EVR	Estonia	2	5	1	3	3	2	4	12
HSh	Albania	12					12	12	10
LDZ	Latvia	1	1	2	1	1	1	1	5
LG	Lithuania	3	3	3	2	2	3	3	7
MÀV	Hungary	9	2	8	9	10	6	7	3
PKP	Poland	4	7	7	6	4	5	2	4
SZ	Slovenia	5	10	5	5	6	7	6	8
ZBH/ZRS	Bosnia & H.								
ZSR	Slovak Rep.	6	6	6	7	5	8	5	9

Figure 7.2 – Partial Labour and Capital Productivity Measures using Train Kilometres



Partial Labour and Capital Productivity using train kilometres - Results

		Labour Productivity						Capital Productivity			
Country	Code	Staff (Rail and non Rail) per thousand train km	Railway Staff per thousand train km	General Admin & Man Staff per thousand train km	Permanent Way Staff per thousand train km	Traction and Rolling Stock Staff per thousand train km	Operations and Traffic Staff per thousand train km	Electric locos / electric loco km	Diesel locos/ diesel loco km	Pass km / Pass train km	freight tonne km / freight train km
Bulgaria	BDZ	1.04	1.01	0.03	0.28	0.28	0.42	0.011	0.055	190.578	501.535
Czech Rep.	CD	0.67	0.66	0.03	0.14	0.18	0.31	0.016	0.064	79.151	446.361
Fyrom	CFARYM	1.55	1.54	0.16	0.41	0.47	0.50	0.012	0.052	66.983	389.430
Romania	CFR	1.10	1.04	0.02	0.38	0.14	0.50	0.014	0.051	194.606	553.217
Estonia	EVR	0.89	0.84	0.04	0.19	0.27	0.35		0.024	61.953	1314.192
Albania	HSh	4.09							0.095		
Latvia	LDZ	0.86	0.73	0.02	0.25	0.24	0.22		0.023	97.335	1500.215
Lithuania	LG	1.03	0.86	0.03	0.26	0.26	0.32		0.027	88.198	1190.720
Hungary	MAV	0.58	0.50	0.01	0.12	0.13	0.25	0.008	0.033	92.653	459.351
Poland	PKP	0.78	0.74	0.03	0.25	0.21	0.25	0.012	0.076	117.595	614.643
Slovenia	SZ	0.51	0.50	0.04	0.13	0.11	0.21	0.011	0.069	55.762	391.489
Bosnia & H.	ZBH/ZRS										
Slovak Rep.	ZSR	0.80	0.74	0.02	0.22	0.20	0.30	0.017	0.055	80.528	521.175
	mean	1.16	0.83	0.04	0.24	0.23	0.33	0.013	0.052	102.304	716.575

Rank of productivity measures

		Labour Productivity						Capital Productivity			
Country	Code	Staff (Rail and non Rail) per thousand train km	Railway Staff per thousand train km	General Admin & Man Staff per thousand train km	Permanent Way Staff per thousand train km	Traction and Rolling Stock Staff per thousand train km	Operations and Traffic Staff per thousand train km	Electric locos / electric loco km	Diesel locos/ diesel loco km	Pass km / Pass train km	freight tonne km / freight train km
Bulgaria	BDZ	9	9	5	9	10	9	2	7	2	7
Czech Rep.	CD	3	3	7	3	4	6	7	9	8	9
Fyrom	CFARYM	11	11	11	11	11	10	5	6	9	11
Romania	CFR	10	10	3	10	3	11	6	5	1	5
Estonia	EVR	7	7	9	4	9	8		2	10	2
Albania	HSh	12							12		
Latvia	LDZ	6	4	2	6	7	2		1	4	1
Lithuania	LG	8	8	6	8	8	7		3	6	3
Hungary	MAV	2	2	1	1	2	4	1	4	5	8
Poland	PKP	4	6	8	7	6	3	4	11	3	4
Slovenia	SZ	1	1	10	2	1	1	3	10	11	10
Bosnia H.	ZBH										
Slovak Rep.	ZSR	5	5	4	5	5	5	8	8	7	6

1.7.2 *Labour Productivity*

From figures 1.1 and 1.2 it is clear that a significantly different result is obtained when using gross tonne kilometres rather than train kilometres as a basis for output comparisons. When using gross tonne kilometres, the 3 Baltic companies, EVR, LG and LDZ are the top ranked countries. This compares to SZ, MÀV and CD when using train kilometres. The worst affected railway by the switch to gross tonne kilometres is MÀV which, as can be seen from figure 1.2 was ranked in the top quartile for aggregate staff productivity and falls into the 3rd quartile when gross tonne kilometres are used.

In addition to examining aggregate productivity measures, subdivisions of staff have also been considered. Productivity measures are fairly consistent across these sub divisions of staff with a few notable exceptions. SZ has relatively high numbers of general administration and management staff, although it is in the top half for the rest of the measures including aggregate labour productivity. This is in contrast to MÀV, which performs well in this measure of labour productivity, and poorly in the rest of the measures. These results may be due to differences in definition among the various companies.

There are a number of companies that clearly have low levels of labour productivity, regardless of the measure used. The consistently worst performing railway in terms of labour productivity is HSh in Albania which employs more than twenty times more staff per gross tonne kilometre than the most highly ranked railway. Lack of data means more detailed analysis of the sub divisions of labour is not possible. In addition CFARYM has very low levels of staff productivity, and is ranked in the bottom two for all gross tonne kilometre measures of labour productivity.

If we consider figure 1.1, with gross tonne kilometre measures, three of the companies, BDZ, CFR and MÀV have very similar levels of aggregate staff productivity and are ranked towards the bottom of the study countries.

The companies that are ranked 4 to 7, PKP, SZ, ZSR and CD are some of the most economically advanced economies. These companies have aggregate staff productivity measures substantially better than the mean for the study countries. These companies are ranked consistently highly across the majority of the sub-divisions of labour productivity considered.

The large improvements in the relative productivity of the Baltic countries when using gross tonne kilometres can be explained by the large amounts of transit freight that the Baltic railways carry from their borders with the former Soviet Union to ports on the Baltic sea. The wide gauge track used in the Baltic States allows large quantities of freight to be transported on each of the very long trains that are used. If we examine the raw figures it is clear that not only do they rank higher than the rest of the countries in terms of labour productivity, but also that their performance is significantly better than any of the other countries for 3 of the 4 subdivisions of labour considered. This serves to emphasise the benefits to a railway company of having big trains and a captive market with large quantities of freight to transport. The high ranking of the Baltic countries may however be misleading. It would perhaps be unrealistic to expect that the personnel running the Baltic railway systems would be able to deliver similar levels of productivity if they were given the opportunity to run a railway in a different country. On the other hand, given these advantages, the Baltic railways deliver a high output per unit of input, i.e. a high level of efficiency.

The highest ranked companies behind the Baltics are PKP, SZ, ZSR and CD. These all share the characteristics that they are in the most economically advanced countries and also have large railway networks. BDZ, MÀV and CFR perform generally poorly and are ranked 8,9 and 10. The poor performance of MÀV in the gross tonne kilometre measures suggests that MÀV run a large number of under-utilised services. This is likely to be related to the large number of branch lines and rural services identified elsewhere in this project. In addition CD also has a large number of branch lines, which may explain why it is ranked behind PKP, ZSR and SZ in this analysis.

Some companies may have incentives to run more trains than are necessary to meet demand due to the structure of the subsidies. This may explain the poor performance of MÀV/CD in the gross tonne kilometre measures of productivity.

1.7.3 Capital Productivity

In general the Baltic companies perform well in terms of capital productivity, and not surprisingly, this is especially evident when examining the freight sector. In terms of the number of locomotives and railcars per gross tonne kilometre the Baltic states are ranked 1 to 3 with significantly better results than the other countries. This again is a function of the use of gross tonne kilometres, which benefits the Baltics in all measures of productivity. As the Baltics run very long trains, they need relatively few locomotives to haul a large amount of freight. This may be a contributory factor to the low average speeds of freight trains in the Baltics.

The two worst performing railways for capital productivity measures are the same as the two lowest ranked in terms of labour productivity, CFARYM and HSh. These companies are ranked bottom for wagons per freight tonne kilometre and locomotives and railcars per gross tonne kilometre. In addition both companies are in the lower quartile for passenger coaches per passenger kilometre.

In contrast to the poor performance of BDZ in labour productivity measures, the measures of capital productivity are more promising. BDZ ranks 4 out of the 12 countries with available data for locomotives and railcars per gross tonne km and also performs very well in terms of the passenger capital productivity measure where it is ranked 1. BDZ has an over capacity of wagons, which results in a low ranking for wagons per freight tonne kilometre. This is not surprising when you consider that since 1989 freight traffic has fallen by considerably more than half with a resultant surplus of freight wagons.

If we examine locomotives and railcars per gross tonne kilometre companies the 5 highest ranked companies after the Baltic States, BDZ, PKP, MÀV, SZ and ZSR all have very similar values. CD and CFR perform significantly worse than these 5 companies and, as mentioned above, CFARYM and HSh are by far the least productive.

Examining wagons per freight tonne kilometre shows that the Baltic States do not occupy all of the top three ranking places. PKP is ranked 2, due to the extremely large quantities of freight that the network carries (some three times higher than the next ranked railway). SZ and ZSR perform fairly well, with poor results for MÀV, CD, CFR and BDZ. Again CFARYM and HSh perform very poorly.

If we look at passenger coaches per passenger kilometre, there is a sharp contrast to the freight productivity measures. In this measure BDZ and CFR are the most highly ranked railway companies by some distance. MÀV and PKP are the next highest ranked companies. LDZ, CD, LG, SZ and ZSR all have values that are very close, with CFARYM and HSh again the worst performing companies. This however does not give any indication of the quality of the passenger coaches that are utilised by the various companies although it has been noted that CFR is currently undergoing a refurbishment programme.

The overall picture is that HSh and CFARYM perform poorly in all measures of capital productivity. PKP performs well for passenger and freight capital productivity and the three Baltic companies perform very well in terms of freight wagon productivity, with mixed results between freight and passenger sectors for the other companies.

1.8 Conclusions

So the following general trends, based on partial productivity measures can be suggested:

- The Baltic States benefit from the generous gauge and the high level of transit freight flows. These benefits are less clear when calculating partial productivity measures based on train kilometres due to the small size of the countries.

- Three of the companies from more advanced economies PKP, SZ and ZSR consistently display above average levels of efficiency in all areas considered, whereas CD does not perform well in capital productivity.

- CFARYM and HSh are by some distance the least efficient railways for all measures considered. These are both very small railway networks in poor countries.

- MÀV and CD are ranked significantly lower for partial labour productivity measures when using gross tonne kilometres. MÀV has been identified clearly as exhibiting an over supply of poorly utilised services.

- BDZ, CD, CFR and MÀV are ranked in the lower half of the sample for most of the staff productivity measures calculated using gross tonne kilometres. The poor labour productivity measures is likely to be a significant problem in the future, as labour costs in the CEECs rise towards the level of those in the EU

- Many of the countries have suffered a sharp contraction in the quantity of freight transported over the last decade. This helps to explain the general over capacity of wagons.

1.9 Commercial Performance

The following measures have been calculated in order to evaluate the relative commercial performance of the various railway companies.

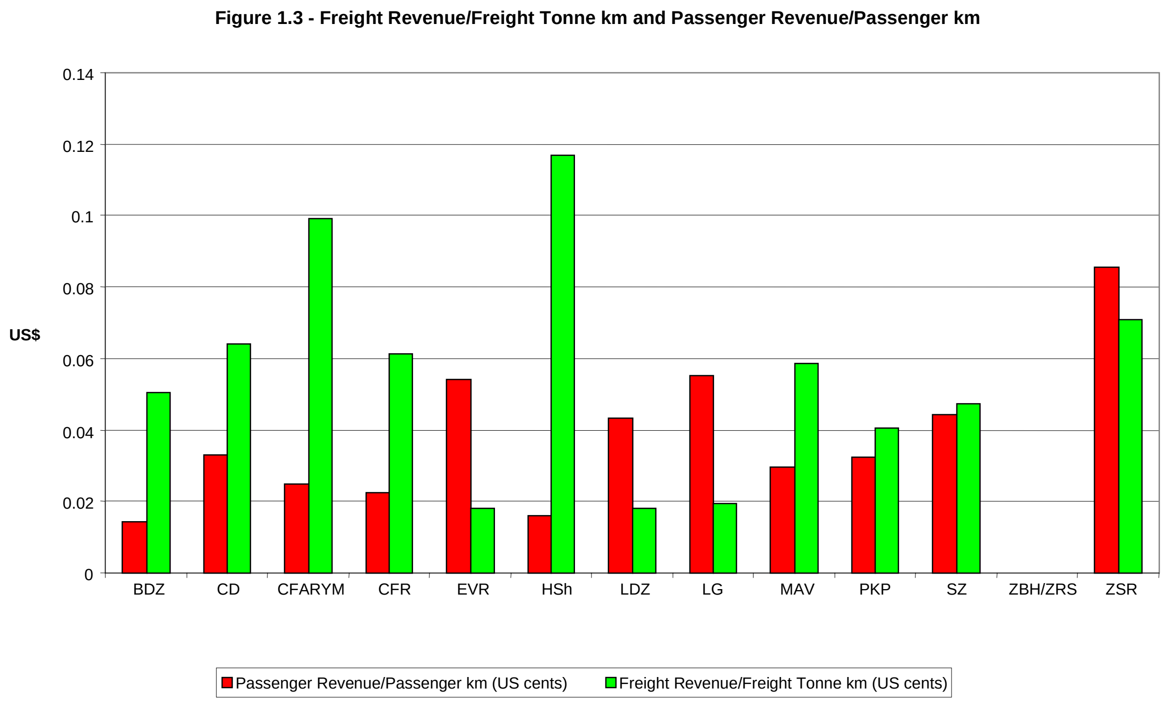
- The monetary return per output achieved
- The percentage of income from freight and passenger traffic exclusive of subsidies

Table 1.1 – Freight Receipts/Passenger Receipts

Country	Code	Freight Receipts/Passenger Receipts
Bulgaria	BDZ	4.41
Czech Rep.	CD	5.22
FYROM	CFARYM	7.89
Romania	CFR	3.84
Estonia	EVR	6.16
Albania	HSh	1.77
Latvia	LDZ	5.07
Lithuania	LG	4.00
Hungary	MÀV	2.42
Poland	PKP	4.26
Slovenia	SZ	4.94
Bosnia & H.	ZBH/ZRS	
Slovak Rep.	ZSR	3.31
Mean		4.44

The table above shows the importance of freight traffic to railways in the CEECs. On average, freight accounts for more than four times as much revenue as passenger and baggage traffic, a figure far higher than in the EU. A large number of the railways are principally freight operation with only limited revenue through passenger traffic.

Measures of monetary return have been calculated for both the freight and passenger sectors, using freight revenue/freight tonne kilometres and passenger revenue/passenger kilometres respectively. The revenues have been converted to US dollars using PPP exchange rates. US dollars have been used, as they are the most widely used basis for PPP calculations. Converting the values from dollars would introduce further exchange rate variations and reduce the power of the analysis. The results are presented in the graph below.



From the graph it is clear that the Baltic countries receive a very low level of freight revenue per freight tonne kilometre, as would be expected due to the extremely large quantities of freight that they transport. The highest revenue per tonne kilometre is for CFARYM and HSh. These companies both have extremely limited networks with very little traffic. A number of the countries have very similar levels of revenue per freight tonne kilometre, and in general, there is not a great deal of variation in the revenue per freight tonne kilometre, with ZSR slightly higher than the other countries. Poland has the fourth lowest level of revenue per freight tonne kilometre.

Passenger revenue per passenger kilometre varies quite a lot among the study countries, with the highest figures recorded for ZSR, and the three Baltic countries. It appears that the greater the economic prosperity of a country, the higher the revenue per passenger kilometre, through higher passenger fares.

This analysis is revealing, in that it suggests that railways in the most economically advanced of the study countries may have failed to increase their revenues per passenger kilometre and freight tonne kilometre in line with rises in costs elsewhere in the company, especially with regard to the level of staff costs. This is an important point to bear in mind, as in the future the less advanced economies are likely to experience large increases in staff costs as the economies improve. For the commercial success of the railways it is necessary for staff costs to be affordable. This can be achieved through further reductions in staff numbers, and/or increases in charges to reflect the higher labour costs involved in the provision of the service.

One might expect that higher charges would improve commercial performance, however, they would also reduce the level of traffic. It is possible that a relationship does exist between the size of the revenue generated by passenger and freight traffic and the productivity of the companies, with SZ having high levels of revenue per freight tonne kilometre and passenger kilometre and performing reasonably well at partial labour and capital productivity measures, whereas a company such as BDZ with low revenue has worse results overall in the partial productivity analysis. In addition the Baltic states also have low charges, but perform well in the analysis, though as noted before this is due to the high levels of freight transported across the countries.

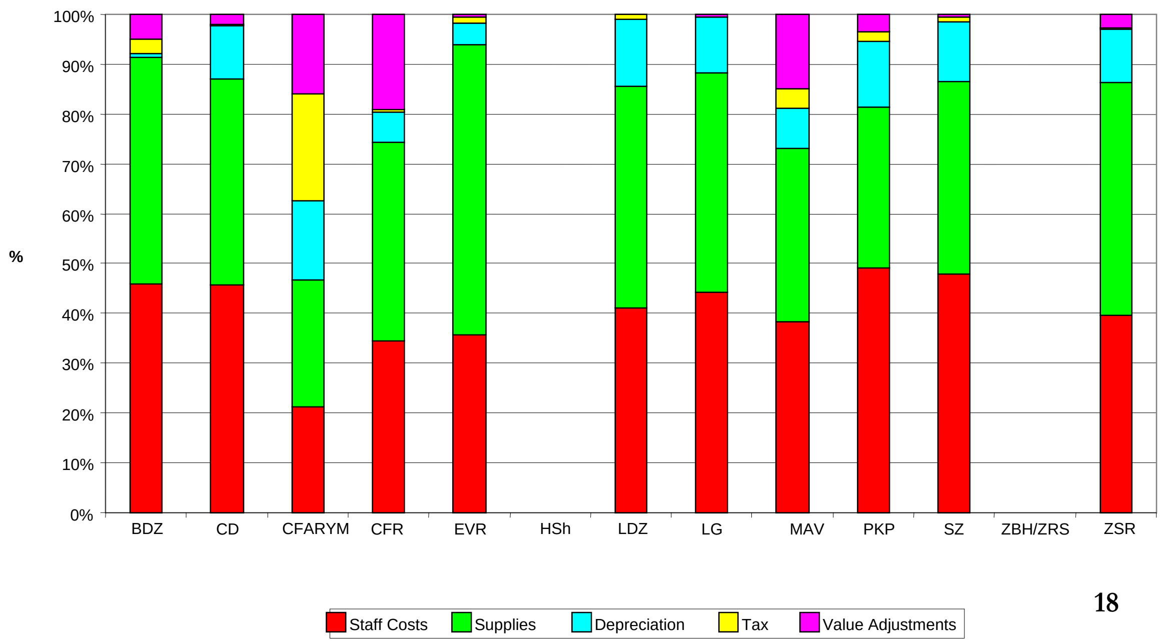
1.10 Financial Performance

This section examines the composition of operating expenses, the level of subsidy that each railway receives as well as investigating the percentage of cost which is covered by business income and financial support through the calculation of cost recovery ratios.

Figure 1.4 below shows the composition of operating expenses. It illustrates what percentage of total operating expenses is attributable to depreciation, staff costs, value adjustments, tax and supplies (material purchases and external charges).

This chart gives detail on the level of staff costs within each railway company (Complete data for HSh not available). It is clear from the chart that staff costs as a percentage of operating expenses vary across the study countries. This may de due to data variations, but it seems to show that the poorer countries have lower staff costs as a percentage of operating expenditure.

Figure 1.4 - Composition of Operating Expenditure



The chart also illustrates some of the problems inherent in comparing so many various companies. The percentage of operating expenses attributed to depreciation is very low for BDZ (less than one per cent) when compared to other companies. This suggests that a different treatment of depreciation has been used in the various company accounts. In the Table 1.2 below, the level of depreciation as a percentage of total fixed assets has been calculated for each of the countries. This shows the variation in the treatment of depreciation

Table 1.2 – Depreciation as a Percentage of Fixed Assets

Country	Code	Depreciation as a percentage of Total Fixed Assets
Bulgaria	BDZ	0.24%
Czech Rep.	CD	4.49%
FYROM	CFARYM	
Romania	CFR	4.68%
Estonia	EVR	6.56%
Albania	HSh	
Latvia	LDZ	14.09%
Lithuania	LG	7.85%*
Hungary	MÀV	2.51%
Poland	PKP	6.48%
Slovenia	SZ	4.72%
Bosnia & H.	ZBH/ZRS	
Slovak Rep.	ZSR	4.45%
Mean		5.61%

** 1995 UIC Data*

Table 1.3 gives a further illustration of the level of staff costs within the CEECs. This table gives the average cost per member of staff (rail and non-rail operations) at PPP exchange rates, calculated as total staff costs divided by total staff numbers, based on UIC data.

This table shows that average total staff labour costs (including social security and pension costs) are highest by some distance in Slovenia. However, if we compare the figure recorded for Slovenia to the level of staff costs in the EU[2] it is clear that even allowing for low labour costs through the use of Purchasing Power Parity exchange rates, the most expensive railway staff in the CEECs are roughly half the price of the mean in

[2] Based on 1995 PRORATA report

the EU[3]. Low labour costs are prevalent in a number of CEECs countries, and they are especially low for the railway companies in FYROM and Albania and also below the mean of the sample in Bulgaria, Hungary, Romania and the Baltics. The low cost of labour will also be an important factor when looking at total productivity measures.

Table 1.3 – Average Staff Costs

Country	Code	Average Staff Costs (US $ at PPP)
Bulgaria	BDZ	5,063
Czech Rep.	CD	11,556
FYROM	CFARYM	2,728
Romania	CFR	7,507
Estonia	EVR	6,895
Albania	HSh	1,939
Latvia	LDZ	6,851
Lithuania	LG	8,035*
Hungary	MÀV	8,418
Poland	PKP	10,939
Slovenia	SZ	17,783
Bosnia & H.	ZBH/ZRS	
Slovak Rep.	ZSR	12,467
Mean		8,348

*1995 data from UIC

It is also extremely interesting to examine the level of subsidy that is provided to each railway. Table 1.4 below compares the levels of subsidy that each railway receives according to the UIC data.

1997 figures for ZSR and LDZ are not available, however data gathered through local consultants and country visits suggests that subsidies to passenger transport in ZSR amount to slightly less than 10% of total operating income. In addition 1995 UIC data gives a figure of 8.5%. Subsidies to LDZ in 1995 amounted to 20% of operating income. However, the 1997 annual report does not give any figure for the total level of subsidy that the railway company receives. Table 1.4 shows that SZ has by far the largest recorded level of subsidy, which amounts to 45% of the total level of operating income. This is in stark contrast to the low level of state subsidy recorded for some of the other companies. It appears likely that some of the state subsidy for other companies is not

[3] The 1995 PRORATA report gives average EU staff costs as $34,800 (based on PPP exchange rates)

clearly accounted for and may not have been accurately separated from the passenger revenue figures.

Table 1.4 – Support to Railway Company

Country	Code	Total Support (US dollars)	Support from Govt/Other Public Bodies as % of Operating Income	Support for Infrastructure Costs as % of Operating Income	Total Support as % of Operating Income
Bulgaria	BDZ	56,915,520	6%	4%	10%
Czech Rep.	CD	362,435,999	17%	0%	17%
FYROM	CFARYM	0	0%	0%	0%
Romania	CFR	226,876,217	0%	8%	8%
Estonia	EVR	8,798,272	3%	3%	6%
Albania	HSh	5,868,085			67%
Latvia	LDZ		20%	0%	20%*
Lithuania	LG	48,797,116	10%	6%	16%
Hungary	MÀV	343,078,611	28%	0%	28%
Poland	PKP	634,237,594	13%	0%	13%
Slovenia	SZ	159,410,930	20%	25%	45%
Bosnia & H.	ZBH/ZRS				
Slovak Rep.	ZSR	130,324,427**			8.5%*
Mean		197,674,277	11%	5%	21%

*Figure from 1995 UIC data, **Figure from 1997 annual report

It is likely that to some degree the companies with the clearest and most transparent accounts are penalised in this analysis. It has not proved possible to gain alternative figures for all of the companies and it has therefore been decided to use, where possible, the UIC data as it stands in order to minimise discrepancies between methods of measurement. It is important to note that this assumption may have consequences for the results in the rest of the analysis. An illustration of the size of the discrepancies is that the 1997 revenue figures for CFR from the UIC data are more than 30% greater than those collected by the local consultant. This suggests that some government subsidy for CFR is not stated in the UIC figures. In addition it should be noted that this table does not include the profits/losses made by the companies. It is likely that for many of the companies, any losses made will be met by the government, therefore being equivalent to a subsidy. These figures are not included in these tables.

Table 1.5 below shows the total level of support that each railway receives as a percentage of the GDP of the country. This helps to illustrate the savings that the countries could make if the railway companies were able to reduce their dependence on subsidies. The lower level of government support could benefit the economy as a whole through lower taxes and/or higher capital investment.

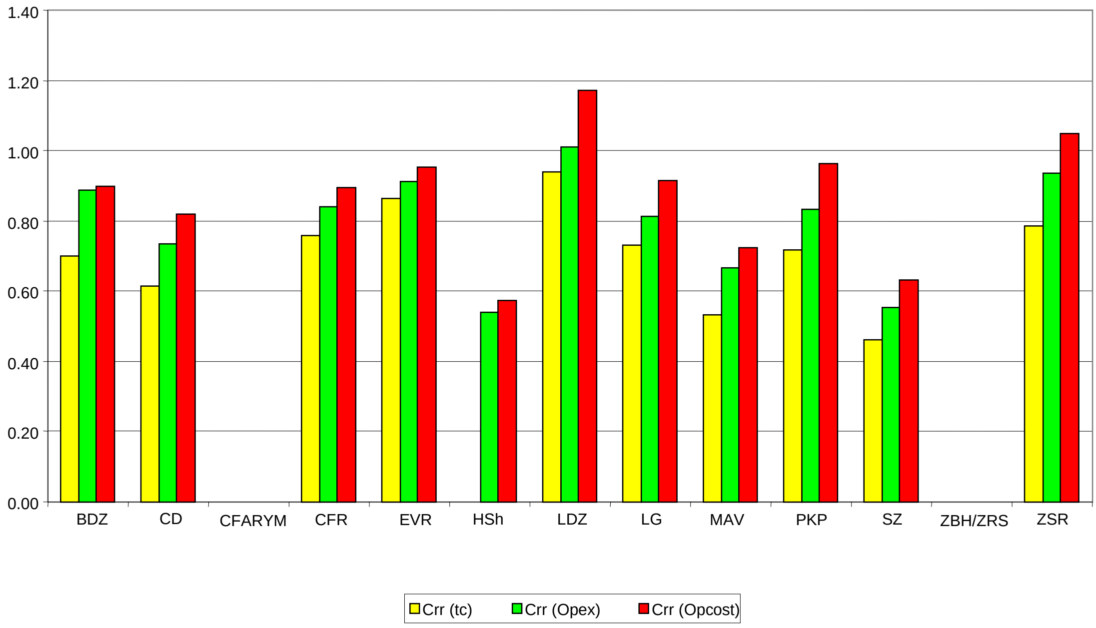
Table 1.5 - Total Support as a Percentage of GDP

Country	Code	Total Support as a percentage of GDP
Bulgaria	BDZ	0.18%
Czech Rep.	CD	0.34%
FYROM	CFARYM	0.00%
Romania	CFR	0.24%
Estonia	EVR	0.12%
Albania	HSh	0.14%
Latvia	LDZ	
Lithuania	LG	0.24%
Hungary	MÀV	0.50%
Poland	PKP	0.27%
Slovenia	SZ	0.70%
Bosnia & H.	ZBH/ZRS	
Slovak Rep.	ZSR	0.33%
Mean		0.28%

States with the higher GDP/capita (Czech Republic, Hungary, Slovak Republic, and Slovenia) have the highest relative support. This provides further evidence of the threat to financial viability of economic growth and rising costs – if not accompanied by major structural reforms.

In order to evaluate the financial performance of the various railway companies cost recovery ratios have been calculated. These have been calculated in three different ways in order to gain an overall feel for the relative ability of the companies to recover their costs, and to address data issues. The three different methods used are operating cost, operating expenditure and total cost. Operating costs includes total staff costs and materials and supplies, operating expenditure also includes depreciation and total cost includes capital costs and depreciation. Concerns have been noted about the figures given within the UIC data for depreciation, and in addition, the UIC data does not give figures for the level of capital costs. Therefore for the purpose of this analysis the capital cost component of total costs has been assumed to be equal to 8% of total fixed assets. It should be noted that this is a somewhat arbitrary value, hence the need for the calculation of a number of different cost recovery ratios in order to effectively analyse the performance of the railways. Whilst operating expenditure and total cost provide greater explanatory power, the measure of operating cost is regarded as being the more reliable. The results are shown in Figure 1.5.

Figure 1.5 - Cost Recovery Ratios (not including profits/losses)



From the Cost Recovery Ratios, it is clear that again the Baltics perform very well.[4] LDZ is recorded as making a profit using the operating expenditure and operating cost measures of cost recovery, and EVR is ranked towards the top for all of the measures calculated. However, as noted above, in 1995 LDZ received a subsidy equivalent to 20% of subsidy, while the accounts from 1997 suggest that there is no subsidy. If the railway does receive a subsidy than its performance in the relative efficiency analysis would suffer accordingly. LG does not perform as well, but this analysis is based on 1995 UIC data. The 1997 annual report from LG shows a small profit for 1995 and 1997, but does not give any data on the level of subsidy. The railway with the worst cost recovery ratios is SZ, which receives by far the greatest level of subsidy as a percentage of operating income. Another poorly performing railway is MÀV, which recovers in the order of 60% of its costs depending on the measure used.

The cost recovery ratios presented in the chart above do not include profits or losses. These have been included in figure 1.6 below.

---

[4] No financial data is available from Lithuanian railway, hence no CRR could be calculated

Figure 1.6 - Cost Recovery Ratios (including profits/losses)

The overall ranking of the companies has changed little, with CD and ZSR recording the greatest falls in the cost recovery ratios. It is worth noting once more that these figures are likely to not be entirely accurate due to the possibility of hidden subsidies.

1.11 *Total Factor Productivity Analysis*

In addition to looking at measures of partial productivity, measures which compare total inputs to total outputs have been calculated. Here, the index number approach has been used, which measures the growth rate of an aggregate output index compared to the growth rate of an aggregate input index. In this analysis, again three measures have been calculated for the same reasons given in the section about cost recovery ratios.

1.11.1 *Methodology*

The box below gives a description of the method used.

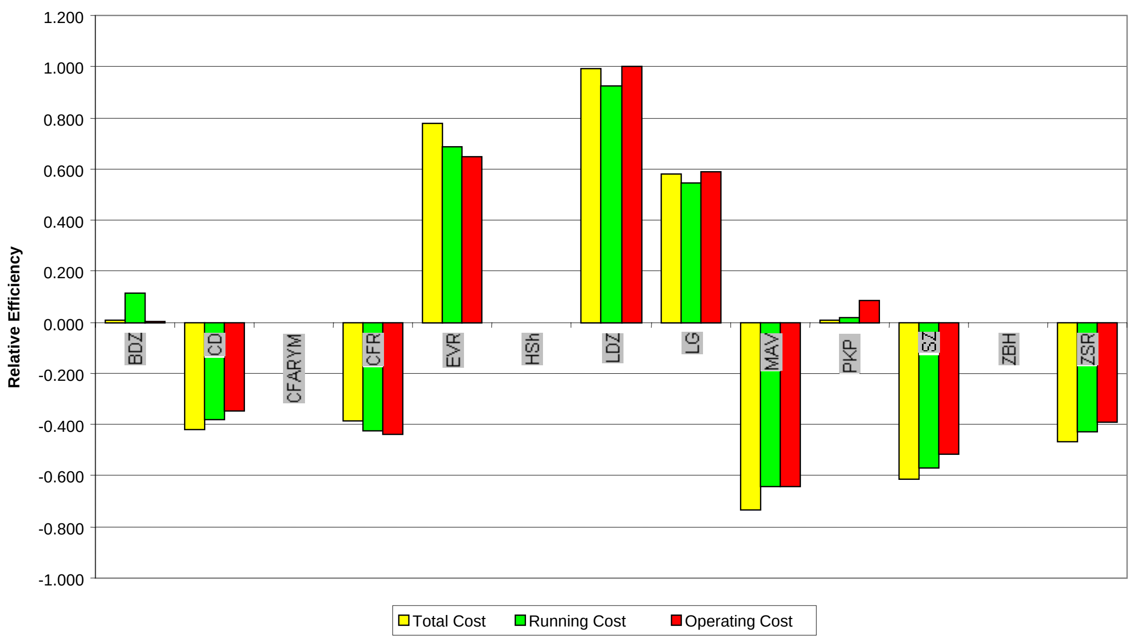
Total Factor Productivity Analysis

- This method produces a single measure of efficiency by comparing total output to total inputs. In this analysis the Tornqvist-Theil-translog index was used, as it provides a useful tool for making bilateral comparisons of input, output and productivity for the neoclassical structure of production.
- This method allows for potential trade-offs between individual indicators.
- It allows for an objective overall conclusion to be made of the relative efficiency of the railway companies.
- The method effectively compares the productivity of a company to that of a company with mean levels of output and input. This method therefore compares solely the **relative** productivity of the companies and does not quantify the actual level of productivity.
- In this analysis passenger and freight gross tonne kilometres have been used as the output measure.

1.11.2 *Results*

The chart below shows the results of the total factor productivity analysis. It is extremely interesting to compare the results to that of the partial productivity measures.

Figure 1.7 - Total Factor Productivity of Railways in CEEC



Again, as with the partial productivity measures, the Baltic states are ranked higher than the other countries, and have recorded much higher relative levels of productivity than the other railway companies. This is, as with the partial measures due to the large quantities of freight transported, and the relatively small size of the countries allowing a low cost of transporting the freight. The next two highest ranked railways are BDZ and PKP, which have very similar levels of relative productivity for the three measures, although it is worth noting that PKP ranks above BDZ when considering the operating cost measure, whereas BDZ is ranked above PKP for the other two measures, due in part to the very low level of depreciation given in the UIC data for BDZ.

However, if we consider the likely upward trend in staff costs in the CEECs, it is likely that BDZ will encounter a major problem. It is clear from the partial productivity measures that BDZ is overstaffed compared to other CEECs countries, and would suffer greatly if staff costs were to rise sharply. This is supported by the analysis of CD, SZ and ZSR. Each of these companies is in one of the more economically successful CEECs countries, where labour costs have risen quickly and each performs poorly in the total factor productivity analysis.

Looking at CD as the most extreme example, labour costs as a percentage of operating expenses have risen from 29% in 1995 to 46% in 1997 (based on UIC data), and the average staff cost per member of staff has risen by almost 20 per cent over the same period. These are very dramatic increases, and there have also been rises in these proportions, though of smaller magnitude, for ZSR and SZ. It is clear that the sharp rise for CD has not been matched by rises in the level of tariffs. Freight forms more than 60 per cent of CD's operating income, compared to less than 12 per cent for passenger revenue and comparing 1995 and 1997 UIC data shows that freight revenue per freight tonne kilometre has only risen by less than 4 per cent. Passenger revenue per passenger kilometre has risen sharply, but due to the small proportion of operating income constituted by passenger revenue, the overall level of revenue has failed to rise in line with staff costs. This is likely to be a recurring theme throughout the CEECs as countries become more advanced, pushing labour costs up. Supporting this analysis is the position of BDZ in the total factor productivity analysis. BDZ is ranked fourth, behind the Baltic States, in this analysis due to the low costs prevalent in Bulgaria. Average staff costs are among the lowest in the CEECs for BDZ.

1.12 *Cost Frontier Analysis*

1.12.1 *Methodology*

The following box gives a description of the methodology.

Cost Frontier Analysis

- This method allows the inclusion in the analysis of exogenous factors that may affect the efficiency of railway companies.

- In addition this method allows the quantification of potential savings through increased efficiency.

- This method involves the assumption that there is a railway cost function of the form

$$C = f(X,Z) + e$$

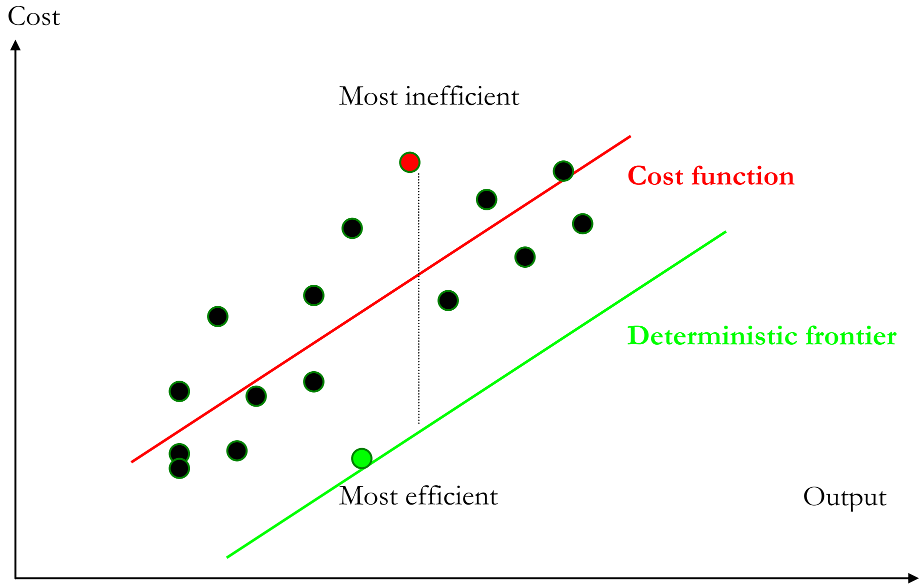
where total cost (C) is a function of measures of output (X) as well as exogenous factors (Z).

- The cost function is then adjusted until it embraces the most efficient firm(s) only as shown in the diagram below. This is done by taking **e** as an index of efficiency with the largest negative value corresponding to the most efficient companies.

- The firms can then be ranked according to their distance from the efficient frontier. Cost savings which would arise through increased efficiency can then be calculated.

Data from 1997 as well as 1995 data where available has been used in the estimation of the cost function. It is recognised that the size of the sample used in the analysis is limited and that further data would be necessary to improve the estimation. Data from companies not in the CEECs could be used in order to increase the size of the sample; however, such railway companies would be likely to have different cost structures which would affect the analysis.

Figure 1.8 – Deterministic Cost Frontier



The box below shows the final simple log-linear calculated cost function.

Cost Function

Dependent Variable = log of operating expenditure (PPP)

Variable	Coefficient	t-ratio
Constant	-6.936	-6.174
Log of gross tonne kilometres	0.755	12.336
Log of mean passenger distance travelled	1.220	4.516
Sparsity (total line length/area)	0.01932	5.447

R bar squared 0.96

SE of Regression 0.3364

Each of the explanatory variables is statistically significant. Sparsity has been used as an exogenous factor here. The coefficient of sparsity reflects the impact of sparsity on operating expenditure. The coefficient on the log of gross tonne kilometres gives an estimate of the returns to density (economics of density). This suggests that a 10% increase in gross tonne kilometres leads to a 7.5% increase in operating expenditure. Economics of traffic density stems from a high level of fixed costs, mainly capital and maintenance expenses. The table below shows the ranking and percentage efficiency scores achieved by the various companies.

Table 1.6 – Cost Frontier Results

Country		Score (percentage efficiency)	Rank
Bulgaria	BDZ	85.88%	3
Czech Rep.	CD	85.49%	4
FYROM	CFARYM	72.64%	7
Romania	CFR	56.25%	10
Estonia	EVR	73.91%	6
Albania	HSh	62.72%	9
Latvia	LDZ	92.04%	2
Lithuania	LG	100.00%	1
Hungary	MÀV	65.75%	8
Poland	PKP	74.01%	5
Slovenia	SZ	45.53%	11
Bosnia & H.	ZBH/ZRS		
Slovak Rep.	ZSR	44.98%	12

The results from the cost frontier analysis support the general results from the analysis. The top two ranking companies are LG and LDZ, and the third Baltic company EVR is ranked 6, just behind the 5th ranked company. The main difference is the high ranking of CD in the cost frontier analysis. The two worst performing companies are SZ and ZSR. This is likely to be due to the higher level of costs in Slovenia and the Slovak Republic as well as the relatively dense networks in these countries. It is likely that a more accurate cost function could be calculated with a larger sample size, however the difference between the results using cost frontier techniques and total factor productivity is not that great.

If we assume that each of the railways can operate at the same level of efficiency as Lithuania did in 1997 then the potential cost savings amount to almost 5 billion Euros per annum at PPP exchange rates (this figure does not include ZBH/ZRS). However, it is accepted that this figure over estimates the potential cost savings, as most of the other countries do not have access to such large freight markets. If we assume that the other countries can reach the level of efficiency of PKP, the median railway, then the potential cost savings are more than 1.5 billion Euros per annum. As labour costs increase towards EU levels, this potential saving could increase by up to a factor of three.

1.13 Correlations

This section examines the rankings from each of the methods used above to assess the relative efficiency of the railway companies, to see whether consistent results have been obtained for each of the methods. Correlation coefficients have been calculated with a higher figure representing a higher correlation between the respective rankings. These are presented in the table below.

Table 1.7 – Correlations between Productivity Measures

Correlations	Total Staff/Gross tonne km	wagons/freight tonne km	passenger coaches/ passenger km	TFP Total Cost	TFP Running Cost	TFP Operating Cost	Cost Frontier Analysis
Total Staff/Gross tonne km	1.00						
wagons/freight tonne km	0.94	1.00					
passenger coaches/passenger km	-0.08	0.04	1.00				
TFP Total Cost	0.54	0.44	-0.22	1.00			
TFP Running Cost	0.55	0.44	-0.13	0.99	1.00		
TFP Operating Cost	0.62	0.55	-0.22	0.96	0.98	1.00	
Cost Frontier Analysis	0.36	0.36	0.25	0.74	0.78	0.75	1.00

There is a high level of correlation between the total factor productivity measures and the cost frontier analysis rankings, which gives weight to the results, suggesting that they have been consistent. It is clear from the correlation analysis that there is little correlation between the level of passenger capital productivity and the other measures used. This is due to freight traffic being the most important sector for railways in the CEECs by some distance. The correlation between the rankings for total factor productivity analysis and the aggregate partial labour productivity measure used is more than 0.5 for all of the TFP measures. The correlation between TFP and wagons per freight tonne kilometre is less clear with two of the correlations falling below 0.5.

1.14 *Conclusions*

The figure below shows the rankings from total factor productivity (operating cost), cost frontier analysis, aggregate labour productivity and measures of passenger and freight capital productivity.

Figure 1.9 – Overall Ranking of Measures of Productivity

Country	Code	Total Staff (Railway and non-Railway Staff)/ Gross Tonne km	Wagons freight tonne	Passenger coaches/ passenger km	TFP Total Cost	Cost Frontier Analysis
Bulgaria	BDZ	10	10	1	5	3
Czech Rep.	CD	7	8	6	7	4
Fyrom	CFARYM	11	11	11	6	7
Romania	CFR	8	9	2	9	10
Estonia	EVR	2	4	12	2	6
Albania	HSh	12	12	10		9
Latvia	LDZ	1	1	5	1	2
Lithuania	LG	3	3	7	3	1
Hungary	MAV	9	7	3	11	8
Poland	PKP	4	2	4	4	5
Slovenia	SZ	5	6	8	10	11
Bosnia & H.	ZBH/ZRS					
Slovak Rep.	ZSR	6	5	9	8	12

Less Efficient — More Efficient

Missing Data

- Despite data problems and small sample size, most of the results from the analysis are consistent with our observations made through country visits and local consultants.

- The Baltic states benefit from the wide gauge network, which allows the transportation of large amounts of freight. Each of the Baltic companies performs well in all measures of productivity, except for passenger coach productivity.

- PKP consistently performs well in all measures considered and is ranked after the Baltic States for many of the measures considered.

- ZSR and SZ, which are railway companies in two of the most advanced economies, perform well in measure of labour productivity, but less well in terms of total measures of productivity. This is related to the higher levels of costs that are prevalent in the Slovak Republic and Slovenia.

- Despite low levels of staff productivity, BDZ performs well when measures of total productivity are considered. This is due to the low costs in Bulgaria, especially for staff. If BDZ does not reduce staff numbers and improve overall levels of productivity, then it is likely to suffer as costs rise.

- CD generally performs poorly, despite the economic strength of the Czech Republic. This is in part due to the sharp increases in staff costs in the Czech Republic. This is likely to be a recurring problem as staff costs rise throughout the CEECs as they prepare for accession to the EU.

- CFARYM and HSh are by some distance the least efficient railways for all measures considered. These are both very small railway networks in poor countries.

- MÀV and CD are ranked significantly lower for partial labour productivity measures when using gross tonne kilometres. MÀV has been identified clearly as exhibiting an over supply of poorly utilised services.

- BDZ, CD, CFR and MÀV are ranked in the lower half of the sample for most of the staff productivity measures calculated using gross tonne kilometres. The poor labour productivity measures is likely to be a significant problem in the future, as labour costs in the CEECs rise towards the level of those in the EU

Many of the countries have suffered a sharp contraction in the quantity of freight transported over the last decade. This helps to explain poor levels of wagon productivity in many of the countries.

A large number of different measures of efficiency have been evaluated in this analysis. These measures are used as an input in chapter 3 where the potential cost savings based on the adaptability analysis and the various efficiency measures are quantified.

2 Adaptability Analysis

2.1 *Introduction*

Previous research from the PRORATA[5] project shows a strong relationship between the economic efficiency of a railway and the regulatory framework, the latter controlling the adaptability of the railway. The theory developed, with strong empirical support when tested, focuses the powers invested with the railway, the responsibility and the accountability of the railway together giving the degree of adaptability. It is relevant to analyse adaptability and economic efficiency as part of this project as this will give a measure of how well a railway is able to cope with changing market conditions and helps determine where measures to improve competitiveness should be focussed.

2.2 *A Short Description of the Adaptability Concept*

2.2.1 *Adaptability to Market Signals*

Any commercial or institutional organisation that manages to stay in business for any length of time has clearly found an efficient survival strategy. Most railways in Europe have now survived for more than 100 years, their survival strategy generally involving a monopolistic situation and a tradition of detailed government control / regulation, compensated for with financial support.

However, in modern society competition in the transport market has grown stronger. Customer focus and market orientation, as well as economic efficiency, are now parts of the survival strategy of most successful enterprises. With increasing use of private (road) transport and the de-regulation and privatisation of airlines and bus companies, most of rail's competitors in the transport market are now also in this category.

The continuing survival of traditional railways indicates that they have developed an ability to adapt to the political signals inherent in detailed governmental control. But are such railway organisations adaptable to the new, market oriented, demands for survival?

The expression 'a market oriented organisation' implies an organisation, which supplies products designed to optimise the market's willingness to pay against the costs of

---

[5] Profitability of Rail Transport and Adaptability of Railways (PRORATA) prepared for DGVII of the European Commission, Halcrow Fox, February 1999

supplying them. Customer focus and market orientation are thus necessary conditions for economic efficiency (profitability) and even for survival in modern society.

In the following analysis, 'Adaptability' is used in the restricted sense of 'adaptability to demands of economic efficiency in a competitive market environment'.

2.2.2 *Definition of an Adaptability Index*

The first requirement of any organisation in order to adapt itself to changing market conditions and demands is the **power** to do so. An organisation which does not have the power to:

- withdraw from unprofitable market sectors;
- set the price of its products and services;
- change its organisational structure; or
- control its own organisation,

is unlikely to be able to adapt to changed circumstances. One dimension to consider in defining adaptability is thus the powers available to railway management.

In general, organisations that are granted powers to carry out certain activities are subject to a general responsibility for economic efficiency. However, this will not ensure economic efficiency if performance is not measured, targeted and monitored.

Arguably, when responsibilities are matched by performance measures, the organisation becomes **accountable** for its performance. When responsibility for economic efficiency is matched with appropriate measures of economic efficiency it creates an organisation accountable for its economic performance.

The hypothesis is thus advanced that:

Adaptability is a function of **Power** and **Accountability**

Both are necessary conditions for adaptability. An organisation cannot adapt if it does not have the power to do so. But even when granted sufficient powers, the organisation may not adapt unless it has reason to do so, i.e. it is accountable for its performance.

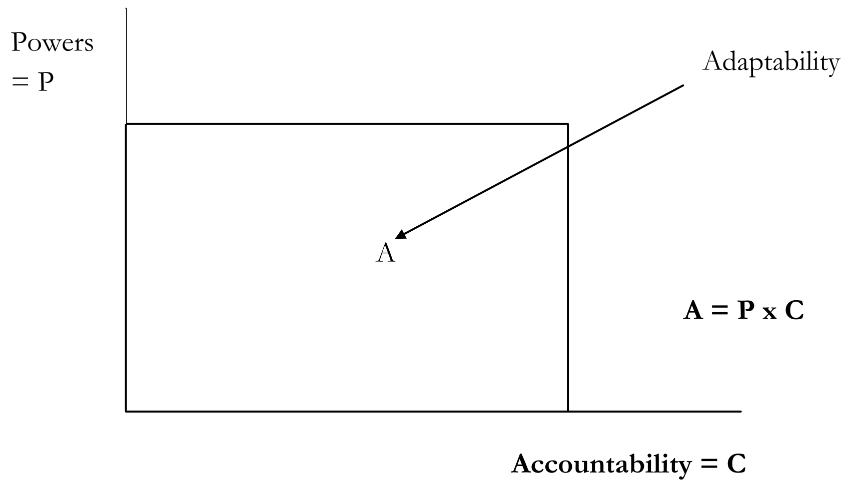
Assuming that 'power' and 'accountability' can be measured, an initial adaptability index can be defined as:

$$A = P * C$$

Where:

A = an index of adaptability

P = an index of power



C = an index of accountability

This concept of a two-dimensional adaptability space is illustrated in the figure below.

Figure 2.1 - Dimensions of Adaptability Space

2.2.3 *Accountability, Responsibility and Performance*

The foregoing assumes that accountability can be related to responsibility, performance measures and targets. Further assuming that measurement of performance implies quantifiable targets, the equation can be simplified by relating accountability solely to responsibility and performance measures. For this exercise this is equated to a general responsibility for economic efficiency and for measures of economic performance.

A successful limited company, quoted on the stock exchange, is often presented as the paradigm of adaptability. Its success is measured in terms of dividends paid and/or the growth of its share price, both being the outcome of actual and expected profit. Its economic responsibility [R] to its owners / shareholders, and the measures / targets [T] by which its performance is judged by the stock market, almost completely coincide. Here the ratio T/R is thus close to 1.

Most public authorities and publicly owned companies also have economic responsibility. However, these responsibilities are frequently accompanied by very weak or incomplete measurements of economic performance. Under these circumstances the ratio T/R can be very low, but always above zero.

This ratio, T/R, is defined here as the degree of accountability, C.

It is noted that, in the real world, performance is often related to incentives, both positive (bonuses) and negative (penalties), and to the performance of the competition. These aspects are not explicitly incorporated in the present formulation, but could be added following further research to establish the form of their relationship with accountability.

2.2.4 Operationalisation of the Adaptability Index

Following from the above, calculation of the compound adaptability index (A) requires two indices, representing: the powers (P); and the accountability (C), of the organisation. If each sub-index is measured on a scale from 0 to 1, the Adaptability Index itself will also have a scale from 0 to 1.

2.2.5 Powers

The powers of a railway organisation are broadly determined by the regulatory and legal framework (organisational structure), within which it operates. It is, however, not necessary to incorporate the whole of the regulatory framework in the index, only those parts which have a bearing on adaptability with respect to economic efficiency.

Table 2.1 shows the components selected for the Power Index, and the weights to be applied to each power to calculating it on a scale from 0 to 1.

Clearly, not all topics on the list have the same importance in determining the level of power of a railway's management, and thus the degree of adaptability of their organisation. Weights are assigned to both the main headings and the sub-issues.

Table 2.1 – Power Index

POWER	Weight: Main Heading	Weight: Sub Issues	Score
Appointments	1.2		
Board		0.15	
Director General		0.25	
Management		0.40	
Staff		0.20	
Organisational Structure	1.2		
Main		0.40	
Regional/Second Level		0.60	
Annual Budgets	0.9		
Operational		0.7	
Investment		0.3	
Long Term Plans	0.6		
Business Plan		0.50	
Investment Plan		0.50	
Pricing	1.5		
Passenger		*	
Freight		*	
Finance	1.0		
Borrow/Lend Money		0.35	
Leasing		0.10	
Sell Assets, Keep Profit		0.20	
Go Bankrupt		0.35	
Competitive Procurement	0.8**		
Operations	0.8**		
Total	**8.0**		

* weight in proportion to revenue

** no subclasses are defined

For each railway organisation, each sub-issue is assigned a score between 0 and 1, where:

- '1' indicates that the Board, Director General, or private owner (shareholders) have a complete formal right to make decision on the issue

- '0' indicates that a non-railway body, e.g. government, makes the final decisions on that issue, i.e. has the power of veto.

It should be noted that this is a necessarily simplified list of powers to which scores could easily be allocated within the timeframe and resources of this project. There may be subtle differences between railways' organisational structures or regulatory frameworks that cannot be expressed using only the categories listed.

Some of the listed sub-issues might themselves need to be sub-divided (e.g., management has powers to set long distance fares but not the rates for commuter / social travel) to capture the full range of differences between organisations.

For this exercise, the score under such circumstances should also lie between 0 and 1, the level depending on the relative importance of the (sub) powers management does or does not have. It is acknowledged that this brings a degree of subjectivity into the analysis.

The contribution to the adaptability index for sub-issue 'k' is then calculated as:

$$C_k = p_k * wh_k * wi_k$$

where:

p_k is the individual sub-issue score;

wh_k the main heading weight; and

wi_k the sub-issue weight,

for issue 'k'.

The Power Index is then calculated as the total of the weighted sub-issue scores divided by the maximum attainable total, 8, to give a score between 0 and 1.

2.3 ***Accountability***

The definition of an Accountability Index proved more problematic, partly because of the wide range (and, in some cases, nebulous nature) of the issues on which the sample set of railways are currently set targets or held accountable by their "owners".

Two possible measures of economic performance have been identified:

- Profitability; and
- Solidity (equity : total asset ratio, debt : equity ratio or equivalent).

While a measure of profit (loss) is produced for some of the railways in the sample[6], the concept of solidity is only applicable to those railways that are partly financed by loans. It is therefore more a binding restriction than a target.

If a railway has total responsibility for its own economic efficiency, e.g. via a requirement to equal or better a specific profit level as defined in the Profit and Loss (P&L) account, without any other responsibilities, then its accountability index (C = T/R) will be 1.

However, many railway organisations also have non-commercial responsibilities or areas of operation. These responsibilities can include social service obligations or the management of the infrastructure. The later is often the case when infrastructure is managed separately from train operations, and is partly or wholly financed by grants, rather than access charges on operators. Under these circumstances the infrastructure agency may be seen as providing a social service to the train operator(s).

The inclusion of non-commercial obligations in rail activities covered by the P&L account blurs the concept of profit normally associated with a "market oriented organisation", and reduces its value as a measure of economic performance. The importance of a well-defined zero-point - financial break even - is lost as a basis for setting financial targets.

This situation is exacerbated when the non-commercial obligations are not well defined, either operationally or financially. Such obligations reduce the relevance of the profit target and thus the accountability of the railway for its economic performance. Their inclusion means that R in the accountability ratio grows but T is unchanged.

An approach to quantifying the importance of an organisation's commercial and non-commercial obligations on a common basis is to use the operating costs incurred in each. Total responsibility can then be measured as:

---

6 Although, with a number of different definitions and accounting practices are currently in use, these are not strictly comparable between railways

$$R = Rc + Rs$$

where

$Rc = T =$ The costs of the commercial operations

$Rs =$ The costs of the non-commercial operations

Where social discounts are included in the obligations, Rs shall include the revenue cost of the discount, measured as the average discount per discounted trip factored by the number of discounted trips.

The Accountability Index can then be calculated as:

$$C = T / R,$$

And by eliminating T and R we arrive at

$$C = Rc / (Rc + Rs)$$

Applying this to the adaptability index is as defined above ($A = P * C$), and substituting for C, the adaptability index then becomes:

$$A = P * (Rc / (Rc + Rs))$$

A degree of subjectivity is thus involved in both sub-indices, both in the selection of the components of the indexes and in their weighting against the other components to arrive at the output value.

2.4 Measuring the Adaptability in the CEECs

The adaptability analysis has been based on annual reports of the railways as well as data collected during visits to the study railways and the legal and regulatory reviews undertaken as part of this project.

Table 2.2 shows the values of the power and adaptability indices for each of the countries where sufficient data is available as well as the calculated accountability index.

Table 2.2 – Power Index, Accountability Index and Adaptability Index

Power	**Sub-Issue**		Weights	ALB	BOS	BUL	CZE	FYR	HUN	ROM	SLOK	SLOV	POL	EST	LIT	LAT	Avr
Appointments			**1.20**	--													
	Board		0.15	0.00	0.30	0.00	0.00	0.30	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.08
	Director General		0.25	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.00	0.23
	Management		0.40		1.00	0.00		0.00	0.00	0.00	1.00		1.00	1.00	1.00	1.00	0.60
	Staff		0.20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Organisational Structure			**1.20**	--													
	Main		0.40			0.00	0.00	0.00	0.00	0.00	1.00		1.00	1.00	0.00	1.00	0.40
	Regional/second level		0.60			1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	0.00	1.00	0.90
Annual budgets			**0.90**	--													
	Operational		0.70	0.00	0.00	0.00	0.00		0.00	0.00	0.00		1.00	0.00	0.00	0.00	0.09
	Investment		0.30	0.00	0.00	0.00	0.00		0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
Long term plans			**0.60**	--													
	Business Plan		0.50	0.00	1.00	0.00	0.00		0.00	0.00	0.00		0.00	0.00	0.00		0.10
	Investment plan		0.50	0.00	1.00	0.00	0.00		0.00	0.00	0.00		0.00	0.00	0.00		0.10
Pricing			**1.50**	--													
	Passenger	Share	1.00	0.00	0.00	0.10	0.00	0.00	0.00	0.08	0.00	0.20	0.17	0.20	0.00	0.00	0.06
	Freight	Share	1.00	0.00	0.75	0.41	0.00	0.00	0.24	0.79	0.16	0.40	0.80	0.80	0.80	0.80	0.46
Finance			**1.00**	--													
	Borrowing/ lending money		0.35	0.00	1.00	0.00	0.80		1.00	1.00		1.00	0.00	0.00	0.00	1.00	0.53
	Leasing		0.10			0.00			1.00	1.00			0.00	1.00	0.00	1.00	0.57
	Selling assets		0.20	0.00		0.00			1.00				1.00	0.00	0.00	1.00	0.43
	Go bankrupt		0.35	0.00	1.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00	0.46
Operations			**0.80**	0.00	0.70	0.70	0.80		0.00	0.80		0.90	1.00	1.00	0.00	1.00	0.63
Procurement			**0.40**														
Power Index			**7.20**	**0.03**	**0.47**	**0.32**	**0.28**	**0.13**	**0.25**	**0.46**	**0.27**	**0.33**	**0.66**	**0.58**	**0.24**	**0.65**	0.36
	Non-commercial %			0.98		0.29	0.13		0.29	0.51	0.51	0.38	0.29	0.24	0.27	0.34	
Accountability				**0.02**		**0.71**	**0.87**		**0.71**	**0.49**	**0.49**	**0.62**	**0.71**	**0.76**	**0.73**	**0.66**	0.62
Adaptability Index				**0.00**		**0.23**	**0.24**		**0.17**	**0.23**	**0.13**	**0.20**	**0.47**	**0.44**	**0.17**	**0.43**	0.25

2.5 *Summary*

Estonia, Poland and Latvia demonstrate the highest levels of powers available to railways in the CEECs. Bosnia and Herzegovina also has a perhaps surprisingly high power index. The other Balkan countries of Albania and FYROM have the lowest power indices. The Czech Republic, Hungary, Lithuania and Slovak Republic also have low scores. Romania, Slovenia and Bulgaria have slightly higher scores.

It appears on the whole that the legal and regulatory frameworks prevalent throughout the CEECs do not give the railways much power to manage their own operations and businesses. Therefore, they are unable to respond to changing market needs and given current organisations and structures are unlikely to respond to the changing market conditions and expectations that were highlighted in the preceding sections. The railways face becoming increasingly uncompetitive without changes to their regulatory environment.

The accountability indices are surprisingly high. This suggests an attempt to focus railways on commercial issues, and possibly, reflects the intense strategic planning activities within most railways over the past decade. The low power indices, however, suggest a low ability to implement many commercial strategies.

The adaptability analysis provides cause for both optimism and pessimism. The relatively high accountability scores suggest that progress is being made in providing a strategic commercial framework for many railways. However, the lack of power for management to exploit this framework and implement commercial processes indicates a significant barrier to competitiveness and efficiency.

It should be noted that very little information was available for powers relating to Procurement. The weight of procurement in the calculation of the power index has therefore been set at a relatively low figure of 0.4 to reflect the uncertainty in the potential cost savings relating to this group of powers.

3 Economic Efficiency and Adaptability

3.1 Data Issues

This Section derives cost savings for the railway companies based on the relationship between adaptability and economic efficiency. The analysis carried out is presented below.

Due to unreliable and missing data it was necessary to remove Fyrom, Albania and Bosnia and Herzegovina from the analysis. In addition the railways of the Baltic countries were also excluded due to their very special traffic structure which is dominated by the freight routes from the former USSR to ports on the Baltic Sea. In order to make the sample as large as possible and to include railways over as wide a range of institutional frameworks as possible the data from the PRORATA study was updated to 1997 where possible and included in the analysis.

The final data set contained the following countries:

- UK
- Portugal
- Denmark
- Italy
- The Netherlands
- Sweden
- Belgium
- Germany
- Greece
- Bulgaria
- Czech Republic
- Romania
- Hungary
- Poland
- Slovenia
- Slovakia

Due to differences in accountancy practices between the countries it was decided to use operating costs (i.e. total costs less depreciation and interest) in the analysis. There are significant differences in the treatment of depreciation among the railway companies, so in order to compare 'like for like' as far as possible it was decided not to include depreciation or interest. In addition gross tonne kilometres have been used as the unit of output when comparing railway companies as it allows for passenger and freight transport to be easily combined and analysed together.

All costs in the analysis have been converted to US dollars using purchasing parity exchange rates in order to allow for the lower costs that are prevalent in the countries in the CEEC.

3.2 Regression Analysis

Initial work involved examining the relationship between operating costs per gross tonne kilometre and adaptability. It was decided to extend the analysis to try and find and include factors producing statistical noise, thereby reducing the effectiveness of the analysis. The method and results of this extended analysis is presented here.

One very significant variable contributing to operating costs is clearly labour costs. Figure 1.4 in the Section on comparative efficiency shows that staff costs account for close to half of operating costs in each of the CEEC railways. The following linear equation was estimated relating labour costs (LC) per gross tonne kilometre to operating costs (OC) per gross tonne kilometre (GTkm).

$$OC/GTkm = \alpha_1 + \beta_1 (LC/GTkm)$$
$$\alpha = 0.01239$$
$$\beta = 1.4328$$
$$R^2 = 0.84$$

The results of the regression indicate a very strong dependence. This is not a surprising result when you consider that labour costs account for such a high proportion of total costs and an even higher proportion of operating costs.

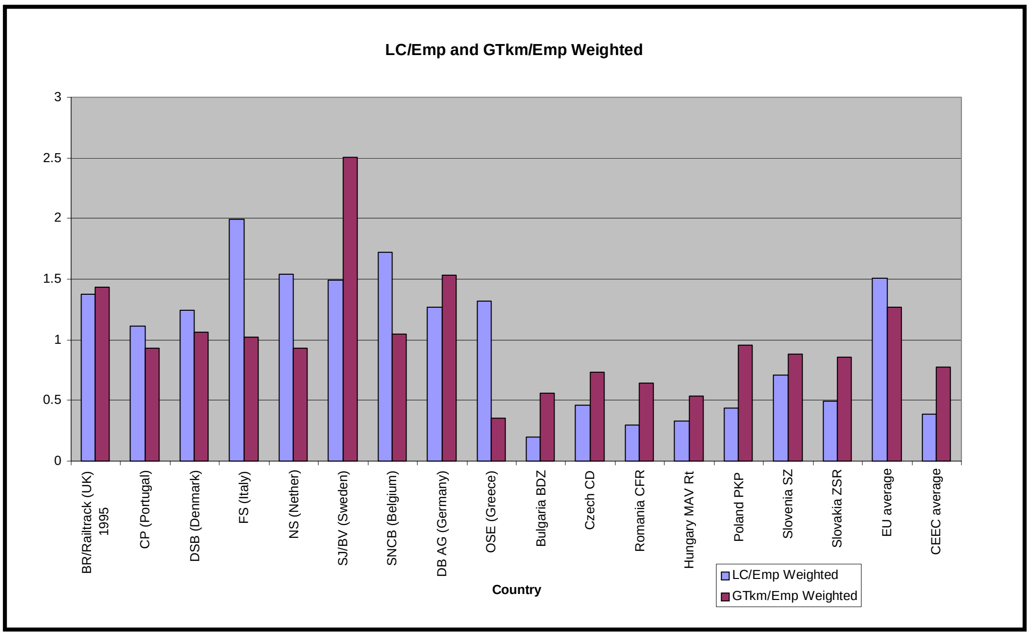
The next step was to examine which variables had a significant affect on the level of LC/GTkm. We tested if the variations in LC/GTkm were explained by variations in labour productivity (LP), i.e. GTkm per employee, and labour costs per employee (LC/Emp). The following equation was estimated:

$$LC / GTkm = \alpha_2 + \beta_2 (LP) + \chi_2 (LC / Emp)$$
$$\alpha_2 = -0.0490$$
$$\beta_2 = 0.0331$$
$$\chi_2 = 1.3310$$
$$R^2 = 0.87$$

Again this equation resulted in a good fit and a high level of R squared and multiple R. It is clear from the results of the regression that most of the variations in labour costs per GTkm are explained by labour productivity and labour costs per employee.

The next step was to examine more closely labour productivity and labour costs per employee. The average labour productivity and labour cost per employee were calculated for each of the countries in the sample. These figures were then indexed so that 1 was the mean figure for both productivity and labour costs per employee in the entire sample. The results are presented in figure 3.1 below:

Figure 3.1 – Labour cost/employee and GTkm per employee



It is striking that productivity and labour costs are much lower in the CEEC than in the EU. This helps to illustrate the wages time bomb. It is clear that if labour costs in the CEEC railways were to rise to the average level within the EU then the railways would experience dramatic increases in operating costs. Average labour costs in the CEEC are, overall, less than a third than in the EU.

In addition to the different levels in the CEEC and EU, it is also clear that there is a significantly different relationship between average labour costs and productivity in the EU and CEEC.

- In each of the CEEC countries the level of indexed productivity is substantially higher than the average labour costs.

- The reverse relationship is true in the EU countries. With the exception of Sweden and the UK indexed productivity levels are lower than indexed average labour costs.

This can be most easily seen by comparing the values of the ratio (GTkm/Emp)/(LC/Emp), which simplifies to GTkm/LC. For the CEEC companies this ratio it was 2, and for the EU 0.84.

In effect the employees in the CEEC railway companies are not paid wages that reflect their level of productivity. If wages were to rise to the same level, relative to productivity, as in the EU then operating costs would rise substantially in the CEEC railways.

It is clear that if the raw data was used in the analysis the CEEC railway companies would perform very well due to their very low labour cost per employee. In order to extend the analysis labour costs in the CEEC were increased by a factor of 2 in each of the CEEC railway companies and by 0.84 for each of the EU companies. In doing so we have assumed that the ratio GTkm/LC is the same in the EU and CEEC and that the difference in this ratio in our data is another independent factor affecting the regression analysis undertaken earlier. If we compensate the OC/GTkm for the influence of this factor there is a good chance that the analysis will improve.

These factors were applied to the model. The results are described below:

$$(OC/GTkm)_r^{Adj} = \alpha_1 + \beta_1 (LC/GTkm)_r^{Adj}$$
$$(LC/GTkm)_r^{Adj} = \alpha_2 + \beta_2 (LP)_r + \chi_2 R_n (LC/Emp)_r$$

where

$(LP)_r$ = GTkm per employee for railway r

R_n = 1.99 for CEEC railways and 0.84 for EU railways

$(LC/Emp)_r$ = labour cost per employee for railway r

$(LC/GTkm)_r^{Adj}$ = the labour cost per GTkm for railway r adjuested by R_n

$(OC/GTkm)_r^{Adj}$ = the operating cost per GTkm for railway r adjusted for R_n

Using these formulas the operating cost per gross tonne kilometre adjusted by the factor R_n, was calculated for each railway.

Using the method described in the Adaptability and Efficiency Report and an extended data set including EU railways the following logarithmic equation was calculated relating operating costs per gross tonne kilometre to the adaptability index.

$$(OC/GTkm)_r^{Adj} = 0.0166 - 0.0294 Ln(A)$$
$$R^2 = 0.71$$

where A is the adaptability index score and OC the operating cost. For each country the relationship between productivity and average labour costs has been equalised. The high level of R^2 shows that the logarithmic equation fits the data well. There is a clear relationship between the adaptability of a railway and its economic efficiency.

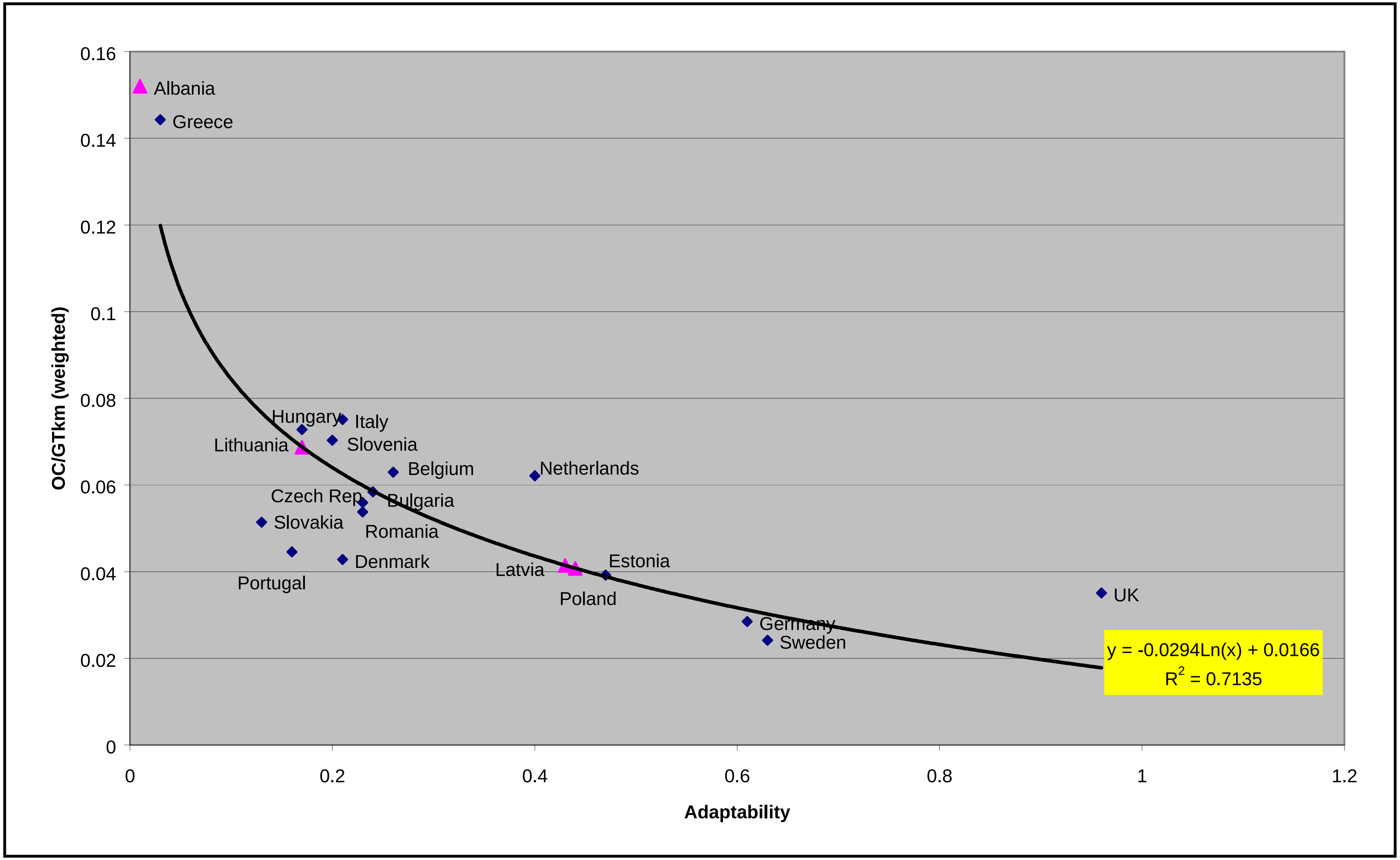
This illustrates a clear relationship between the adaptability of a rail organisation and cost efficiency. Put simple, the more progressive the rail institutions, the greater the apparent efficiency of the operations.

Figure 3.2 shows the countries and the derived relationship. This equation was estimated without Albania, Fyrom and Bosnia and Herzegovina due to the data limitations detailed above. In addition the Baltic states were omitted from the derivation of this relationship due to the special traffic structure in these countries. As these countries carry such large quantities of freight then they benefit from very low operating costs per gross tonne kilometre. However despite their special traffic structure we have no reason to believe that the special traffic structure in these countries affects the hypothesised relationship between adaptability and efficiency – that is the greater the adaptability the greater the cost savings. Therefore these countries are represented on figure 3.2 based on their adaptability score only. We have assumed that cost savings similar to other CEECs are achievable in these countries despite the different traffic structure. In addition Albania has also been included on figure 3.2 based on the adaptability index score.

The cost savings calculated do not result from drastic cut backs in the level of services. For each railway the overall level of output in terms of gross tonne kilometres remains broadly stable, although they may be a change in the structure of services, for example expansion of inter-urban passenger services and a reduction in branch line operations.

The results of this analysis are consistent with the operational and engineering analysis, focus group and comparative efficiency work carried out in the rest of the project. Poland has progressed well with restructuring and reduced costs, Romania and Bulgaria are beginning reform programmes and still benefit from low labour costs. Slovakia, Slovenia, the Czech Republic and Hungary are beginning to see cost efficiency fall as labour costs rise. Their rail reform programmes have also moved at a slow pace.

Figure 3.2 – Adaptability and Efficiency



3.3 Evaluation of Families of Measures

3.3.1 *Introduction*

The measures for improving the economic efficiency of railways presented in the appendix to the Final Report are grouped into nine families or groups corresponding to those groups in the power index. In this Section we quantify the cost savings that can be made through the implementation of the various powers and related measures.

3.3.2 *Adaptability Measures and Economic Efficiency*

It is quite an intellectual leap from the Adaptability/Economic Efficiency model to quantifying the potential cost savings that can be made through the adoption of powers by the railway companies. We shall therefore examine the reasoning that leads to the conclusion.

All railway organisational structures have some ability to accommodate changes from within the organisation, i.e. without needing external force or compulsion from the government or other regulatory body. This is the railway's Zone of Adaptability. Figure 3.3 shows a hypothesised relationship between the adaptability of a railway and its competitiveness. The Adaptability index provides the horizontal axis.

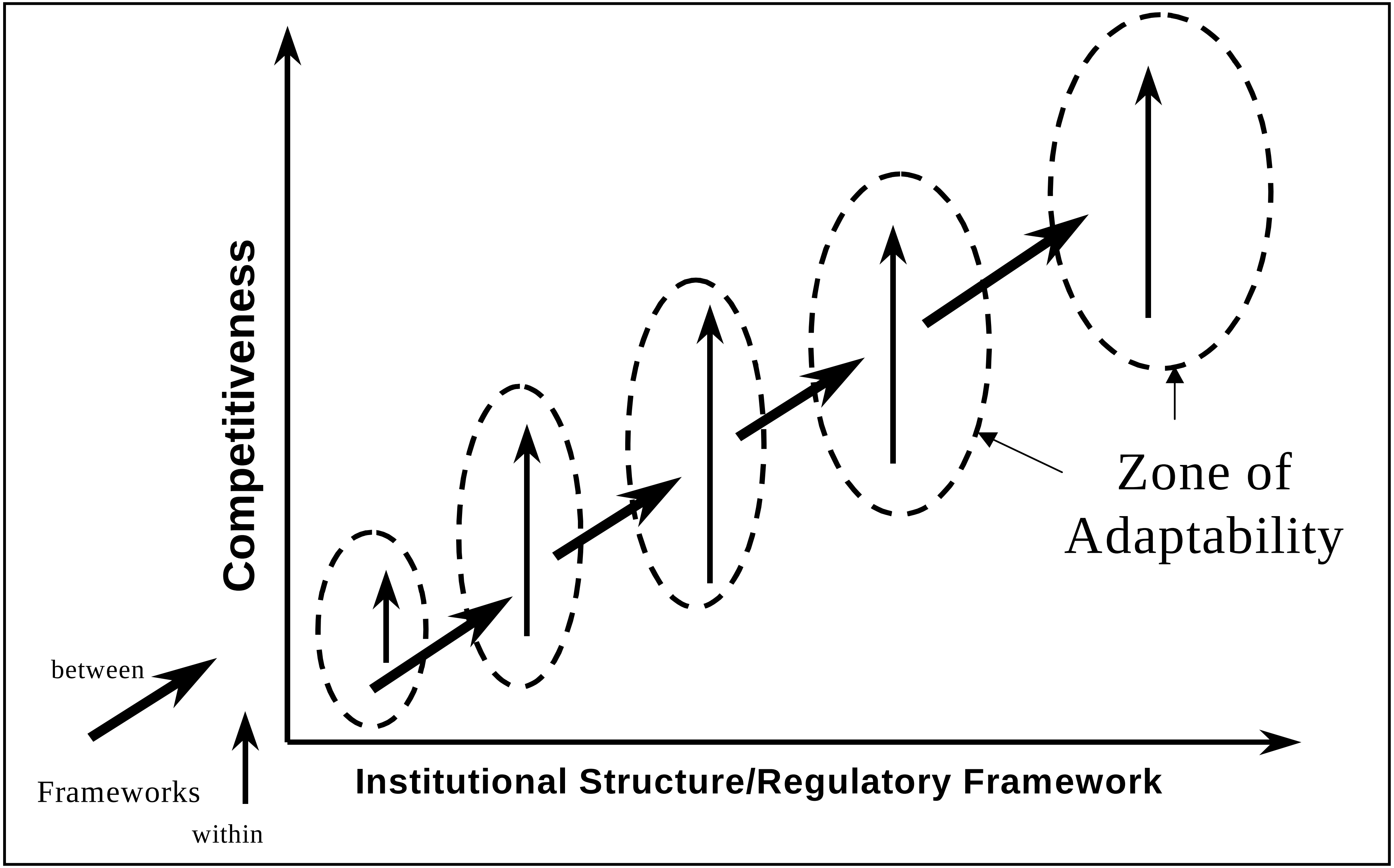
Within each zone, adoption of 'good practice' sets of *within framework* measures will improve rail's competitiveness, indicated by the vertical arrows. Adoption, or imposition, of *outside framework* measures could change the potential for competitiveness in two ways.

- via the framework change itself, indicated by the angled solid arrows, and
- by implementing both the set of within framework measures that can usefully be applied and the quantum of their impact represented by the longer vertical arrows in zones of adaptability towards the right of the figure.

Figure 3.3 therefore shows a hypothetical situation in which the potential for competitiveness rises throughout as the institutional and organisational hierarchy changes from Command to Privatised. It should be noted that the zones of adaptability are sufficiently large that a badly run liberalised railway can be less profitable than a well run one with a traditional organisational structure. When the regulatory framework constraining a railway is altered allowing for a change in the adaptability of the railway company, the efficiency improvement will not occur automatically. It still remains for the management to implement the measures necessary to realise the expected efficiency improvements. The most efficient railways in the adaptability /economic efficiency curve were, until recently, relatively less efficient and adaptable. Now they represent best practice in the industry and a benchmark against which to compare other railway companies. These railways have acquired their efficiency by implementing a number of successful measures which were paced by the development of their adaptability, and which have resulted in the improved levels of efficiency. The bulk of these measures undertaken by the railway companies are represented in the measures presented in the appendix to the Final Report.

These measures, as mentioned earlier, are directly related to the construction of the power index. We can therefore associate the families of measures with the corresponding powers, accountability and with the corresponding efficiency improvement calculated through the Adaptability/Economic Efficiency model.

Figure 3.3 – Competitiveness and Adaptability – A Hypothesised Relationship



3.4 *Quantifying the Cost Savings*

We will now proceed by calculating the dollar values in cost savings of each family of measures. This will allow us to rank each family of measures by the impact that they have upon operating costs. In order to calculate this we need to calculate the effect on operating cost per gross tonne kilometre of each power.

Table 3.1 shows the powers ranked in the order that they are likely to be implemented within a railway. The second column shows the Marginal Power - the contribution that each power makes to the overall power index, and the third column the accumulated power index.

The next step is to calculate the accumulated adaptability. In order to calculate this we have multiplied the accumulated power index by the mean accountability in the CEECs excluding Albania. The mean accountability has been selected as the distribution, excluding Albania, of accountability scores is not widespread among the CEECs.

We are then able to calculate the accumulated adaptability index by multiplying the accumulated power index by the accountability. This is then inserted in the equation derived earlier relating the adaptability index to economic efficiency returning the affect on operating cost per gross tonne kilometre. The final step is to then calculate the marginal effect in operating cost per gross tonne kilometre.

This gives us a useful tool in the identification of priority measures for the railways allowing us to select those groups of powers with the highest potential cost savings, and hence identify priority measures to address these shortcomings in powers. This is developed further in the next sub section which quantifies the potential cost savings for each of the railway companies.

In addition to this calculation we have calculated the effect of increasing the accountability from the mean of 0.66 to its maximum possible value of 1. This is presented in table 3.2 with the powers ordered as in the original power index.

Table 3.1 – Marginal Cost Savings in Order of Implementation ($US)

Powers for the Railway (Ranked)	Marginal Power Index	Accumulated Power Index	Accountability (average) Index	Accumulated Adapt. Index	Accumulated effect on unit cost / Gtkm	Marginal effect on unit cost /Gtkm
Freight transport pricing	0.09	0.09	0.66	0.06	0.0996	
Recruitment of Staff	0.03	0.12	0.66	0.08	0.0912	0.008
The Operational budget	0.08	0.20	0.66	0.13	0.0761	0.015
Appointment of Management	0.06	0.26	0.66	0.17	0.0684	0.008
Selling assets, remaining with profit	0.03	0.29	0.66	0.19	0.0652	0.003
Leasing	0.01	0.30	0.66	0.20	0.0642	0.001
The Regional/2nd organisational level	0.09	0.39	0.66	0.26	0.0565	0.008
Procurement with competitive bidding	0.10	0.49	0.66	0.32	0.0498	0.007
Borrowing/ lending money	0.04	0.53	0.66	0.35	0.0475	0.002
Operations	0.10	0.63	0.66	0.42	0.0424	0.005
The Main Organisation	0.06	0.69	0.66	0.46	0.0397	0.003
Passenger transport pricing	0.09	0.79	0.66	0.52	0.0357	0.004
Appointment of the Director General	0.04	0.83	0.66	0.55	0.0343	0.001
Long Term Business Plan	0.04	0.86	0.66	0.57	0.0333	0.001
Annual Investment budget	0.03	0.90	0.66	0.59	0.0319	0.001
Long Term Investment Plan	0.04	0.93	0.66	0.61	0.0309	0.001
Go bankrupt	0.04	0.98	0.66	0.65	0.0294	0.002
Board Appointed by a Private Owner	0.02	1.00	0.66	0.66	0.0288	0.001

Table 3.2 – Marginal Cost Savings ($US)

Families of Measures /Power Area	Powers	Value/ marginaleffect USD/Gtkm
Appointments		**0.0182**
	Board Appointed by a Private Owner	0.0006
	Appointment of the Director General	0.0015
	Appointment of Management	0.0077
	Recruitment of Staff	0.0085
Organisational Structure		**0.0104**
	The Main Organisation	0.0027
	The Regional/2nd organisational level	0.0077
Annual budgets		**0.0164**
	The Operational budget	0.0150
	Annual Investment budget	0.0013
Long term plans		**0.0020**
	Long Term Business Plan	0.0010
	Long Term Investment Plan	0.0010
Pricing & Marketing		**0.0190**
	Passenger transport pricing	0.0040
	Freight transport pricing	0.0150
Finance		**0.0081**
	Borrowing/ lending money	0.0023
	Leasing	0.0010
	Selling assets, remaining with profit	0.0032
	Go bankrupt	0.0015
Procurement with competitive bidding		**0.0067**
Operations		**0.0051**
Accountability 0.66 - 1.00		**0.0120**

3.4.1 *Calculation of Cost Saving for each Railway Company*

For each country in the sample we are now able to identify in which family of measures/group of powers the railway company lacks power. In conjunction with the calculations presented in tables 3.1 and 3.2 we are therefore able to calculate which families of measures/groups of powers would yield the greatest cost savings if the railway company was to gain complete power within this group.

However, if we were to select which groups of powers, and hence which family of measures to recommend in the Action Plans, solely upon the level of cost savings then the potential savings would be overestimated.

As mentioned earlier it is not plausible for a railway company to gain some powers while lacking power in other groups - there is an order in which a railway company gains powers. For example it is not feasible to suggest that a railway can have complete power over pricing and marketing without any power over budgets or the organisational structure.

We have therefore calculated the benefits based upon a trade off between the potential cost savings and the ease of implementation, that is those groups of powers/families of measures with the greatest potential cost savings that are also able to be implemented in the medium term (no more than 5 years).

For the purpose of this calculation we have assumed that the railway company is able to gain complete power within the three most highly ranked power groups within 5 years. This is shown in tables 3.3 and 3.4. For example in Romania we have concentrated on powers and measures within the following groups/families: Appointments, Annual Budgets and Finance. The groups of powers that have been selected for each railway company are the priority areas, however measures in other areas are recommended in the Action Plans.

The cost savings shown in tables 3.4 have been derived in the following way:

- Based on the current level of adaptability and the relationship between adaptability and operating cost per gross tonne kilometre shown in figure 3.1 the current expected operating cost per gross tonne kilometre has been calculated.

- The power index has been recalculated assuming that the railway now possesses complete control over the three families of measures/groups of powers indicated in table 3.3. The groups selected have been determined by the potential level of cost savings as well as the likelihood of implementation in the medium term.

- Based on this recalculated index the operating cost per gross tonne kilometre has been recalculated. This enables the calculation of likely percentage savings in operating cost.

This percentage saving has then been applied to the annual operating cost yielding an expected cost saving over the medium term for each railway company. This cost saving has been presented in table 4.6 in terms of local currency and Euros (based on market exchange rates).

It should be noted that, as mentioned earlier, the cost savings for the Baltic States are based on the assumption that savings in costs achievable in other CEECs could also be achieved in these railway companies.

The analysis shows that substantial cost savings are obtainable in all the countries in the sample. In most cases these cost savings are in the region of 30% of operating cost. The measures recommended are to be implemented in the medium term (less than 5 years). It is however recognised that it is unlikely that the full benefits will be realised immediately following the introduction of the measures. The consultants believe that the full scope of the cost savings is possible within 2 years of the implementation of all the recommended measures.

Table 3.3 – Selected Power Groups for each country

Families of Measures/Power Area	Appointments	Organisational Structure	Annual Budgets	Long Term Plans	Finance	Procurement with competitive bidding	Operations	Pricing & Marketing
Albania	■	■	■					
Bosnia & Herzegovina		■	■		■			
Bulgaria	■		■		■			
Czech Republic	■		■		■			
Estonia			■		■	■		
Fyrom	■	■	■					
Hungary	■		■			■		
Latvia			■			■		■
Lithuania		■	■		■			
Poland					■	■		■
Romania	■		■		■			
Slovak Republic			■		■	■		
Slovenia	■	■	■					

shaded areas indicate prioritised groups of powers/families of measures

Table 3.4 – Cost Savings

	Adaptability		Op Cost/GTkm			Operating Cost (millions of local currency)			
	Before extra powers	After extra powers	Before extra powers	After extra powers	% Saving	Before extra powers	After extra powers	Saving	Saving (million Euro)
Bulgaria	0.23	0.46	0.0601	0.0397	33.8%	273,043	180,650	92,393	48
Czech Republic	0.24	0.48	0.0583	0.0379	34.9%	34,193	22,245	11,948	321
Hungary	0.17	0.37	0.0680	0.0455	33.1%	146,751	98,241	48,510	222
Poland	0.47	0.72	0.0386	0.0263	31.9%	8,221	5,601	2,620	694
Romania	0.23	0.35	0.0602	0.0472	21.6%	7,139,165	5,598,560	1,540,605	179
Slovak Republic	0.13	0.27	0.0760	0.0547	28.0%	19,810	14,266	5,544	148
Slovenia	0.20	0.47	0.0632	0.0391	38.2%	39,294	24,300	14,994	83
Estonia*	0.44	0.62	0.0406	0.0308	24.2%	1,200	910	290	19
Latvia*	0.43	0.57	0.0412	0.0334	19.1%	93	75	18	28
Lithuania*	0.17	0.46	0.0679	0.0396	41.6%	510	298	212	49
Albania**									
Bosnia & Herzegovina**									
Fyrom**									

* These railways were not in the sample when the relationship in figure 4.4 was calculated

** No results for these railways due to lack of data

3.4.2 *Overall Cost Saving*

We can now calculate total potential cost savings for the CEECs as a whole. If we convert the local currency savings to Euros using purchasing power parity (PPP) exchange rates in order to compensate for the lower costs in the CEECs then the total cost savings amount to more than Euro 4 billion. The breakdown of these cost savings is presented in table 3.5 below.

Table 3.5 – Cost Savings (million Euro PPP)

	Cost Saving (million EURO PPP)
Bulgaria	188
Czech Republic	820
Hungary	423
Poland	1,496
Romania	638
Slovak Republic	417
Slovenia	125
Estonia	34
Latvia	55
Lithuania	121
Albania	
Bosnia & Herzegovina	
Fyrom	
Total	4,319

These cost savings are achievable over the next 7 years if immediate action is undertaken to implement the measures in the Action Plans. This is in line with the estimated cost saving presented in the Adaptability and Efficiency Report of EURO 5 billion achievable if all railways in the CEEC were as efficient as the most efficient railway.

3.4.3 *Further Savings*

In addition to the cost savings detailed above the Consultants believe that further cost savings are achievable in the longer term for a number of reasons. Firstly, the measures proposed encourage a process of continuous improvement within the railway companies and in the longer term greater cost savings will be available.

Secondly it should also be noted that the analysis does not take into account any increases in revenue resulting from the adoption of new powers by the railway companies. Based on the consultants' previous experience of passenger railways in the CEEC, in addition to the cost savings, increases in revenue of between 5 and 10 per cent are also likely.

Finally, in addition to changes in the powers available to the railway companies, improvements in costs can also be generated through changes in the accountability of the railway company. Changes in the accountability of a railway company are likely to follow changes in the level of powers available to the company. If we assume that in each of the CEECs the railway company has full responsibility for economic efficiency and therefore an accountability index of 1 then calculations suggest *further* cost savings at purchasing power parity exchange rates of more than Euro 3 billion.

3.4.4 Do Nothing Scenario

As countries prepare for accession to the European Union wage costs will rise. In order to further illustrate that doing nothing is not an option for these railways and that they must act urgently to improve their financial situation the impact of increases in wages have been calculated.

If we assume that average wages rise to the level prevalent within the EU then the financial implications are extremely serious. Our calculations suggest that rises in wages of this magnitude will, ceterus paribus, result in increases in operating costs of between 2 and 4 times, over the period to 2020.

This translates to an additional cost for the CEECs of between 13 and 26 billion EURO by around 2020. This massive increase in cost means that the choice facing the railways in the CEECs is stark. Doing nothing is not an option. The railway companies must adapt and implement changes to reduce costs or face becoming an increasing financial burden on the state and the modal choice of last resort.

The next sub section examines the possible change management paths that can be used in order to implement the measures in the Action Plans.