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# The Role of Efficiency Estimates in UK Regulatory Price Reviews: The Case of Rail.

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## **Abstract**

This paper reviews the methods that have been applied to assess the efficiency performance of Britain's rail infrastructure provider since privatisation. The paper shows that a wide range of approaches has been adopted by the ORR. However, we argue that, in contrast to the other regulated sectors, the benchmarking methods developed in rail have not been sufficiently robust to restrain costs to efficient levels. We suggest that the main problem stems from a lack of external comparators based on hard data, such as international benchmarks or comparisons with previous experience under British Rail. Although the ORR obtained an external perspective through bottom-up consultant reviews, we suggest that such studies are not an adequate substitute for quantitative analysis. Looking forward we suggest that more work needs to be done to obtain a better understanding of the reasons for recent cost increases, and also to develop robust international benchmarks against which to judge Network Rail's relative efficiency position. International comparisons are not straightforward, of course, and it is therefore important to start now, rather than wait until the next review of Network Rail's finances, by which time it will be too late (again).

## 1. Introduction

This paper forms part of the output from a Conference held at London Business School on the 6<sup>th</sup> July 2004, entitled: 'UK Regulatory Price Review: The Role of Efficiency Estimates'. The Conference reviewed the experience in three regulated sectors: electricity, water and rail. Of course efficiency analysis has played a central role in UK regulatory price reviews for each of these industries. In the case of electricity and water, costs have been relatively well behaved, and substantial efficiency savings have been achieved. However, the experience in rail has been very different, in large part because of the substantial cost shock resulting from the Hatfield accident in 2000.

The purpose of this paper is to review the efficiency approaches developed by the Office of Rail Regulation (ORR; formerly the Office of the Rail Regulator) and others in respect of rail infrastructure and rail industry costs more generally (covering the period since privatisation). The main argument developed in the paper is that, in contrast to the other regulated sectors, the benchmarking methods adopted in rail have not been sufficiently robust to restrain costs to efficient levels. Furthermore, given the scale of the recent cost rises this matter is of major policy significance. Government subsidy levels have increased sharply as a result, and there is a danger that the current high cost levels will undermine the case for rail as compared with other modes of transport, and ultimately threaten the future of the industry.

The paper is organised into six sections. Section 2 briefly describes the trends in rail infrastructure and overall industry costs during the post-privatisation period, both before and after the Hatfield accident<sup>1</sup>. Section 3 outlines and evaluates the efficiency analyses carried out during the 2000 Periodic Review of Railtrack's finances. Section 4 describes the alternative approaches developed during the more recent 2003 Interim Review. Section 5 evaluates the ORR's Interim review efficiency determination and briefly presents some of the findings of our own analysis in this area (Smith, 2004)<sup>2</sup>. Finally, section 6 offers some conclusions.

## 2. Post-Privatisation Cost Trends on Britain's Railways

The Hatfield accident represents a major turning point for rail infrastructure costs and overall rail industry costs (including the cost of train operation) in Britain. Over the post-privatisation, pre-Hatfield period, there is a considerable weight of evidence to suggest that substantial efficiency improvements were made (see Affuso, Angeriz and Pollitt, 2002; Cowie, 2002; Pollitt and Smith, 2002; and Kennedy and Smith, 2004). Affuso, Angeriz and Pollitt (2002) consider the efficiency performance of the twenty-five train operating companies (TOCs) over the period 1994/95 to 1999/00. They find

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<sup>1</sup> A train derailment on 17<sup>th</sup> October 2000, caused by defective track, which resulted in four people being killed.

<sup>2</sup> Paper is forthcoming in the Journal of Transport Economics and Policy. In the meantime a version of it is available on the Institute for Transport Studies (ITS) website, as part of the ITS Working Paper Series.

that privatisation was associated with a significant improvement in the efficiency performance of the TOCs (in the range 17% to 20%).

Meanwhile, Cowie (2002) finds that the passenger train operating companies (TOCs) achieved total factor productivity (TFP) improvements of 13% between 1995/96 and 1998/99. On the infrastructure side, Kennedy and Smith (2004) report unit cost reductions over the period 1995/96 to 1999/00 of between 23% and 25%. At the overall rail industry level, Pollitt and Smith (2002) find post-privatisation efficiency savings in operating costs of approximately £800m (in 1999/00 prices; pre-Hatfield), equivalent to approximately 13% over the period 1992/93 to 1999/00<sup>3</sup>. Separately, during the 2000 Periodic Review, Railtrack reported efficiency savings of 2.2% per annum over the period 1994/95 and 1999/00<sup>4</sup>.

It is clear then that there is a consensus of opinion to support the view that the first few years after privatisation saw considerable improvements in efficiency, both in infrastructure provision and train operation. Furthermore, at the time of the Periodic Review, it was the expectation that further efficiency improvements would be forthcoming, following the experience of the other UK regulated sectors (see section 3). However, given the subsequent large cost increases after the Hatfield accident, it has been argued that the initial cost reductions following privatisation were achieved by neglecting the infrastructure, rather than through genuine improvements in working practices, with the “chickens coming home to roost” during the post-Hatfield period (see, for example, Bartle (2004)). We will not discuss this point further, although we note that the evidence on quality measures during the pre-Hatfield period does not support the above argument (see Pollitt and Smith, 2002 and Smith, 2004).

Of course, as noted in the previous paragraph, the Hatfield accident resulted in a sharp rise in rail infrastructure costs as shown in Table 1 below. Total infrastructure cash costs almost doubled in real terms over the four years between 1999/00, the last full financial year before the Hatfield accident, and 2003/04. Whilst part of the explanation for the cost rises may be found in increased track renewal volumes, which would be expected to result in a rise in renewal expenditure (see section 5 below), it is clear from Table 1 that costs have increased very sharply across all cost categories.

However, whilst it is well known that rail infrastructure costs have been rising sharply since Hatfield, recent analysis (Smith, 2004) shows that train operating costs have also been on the rise in recent years (with TOC operating costs rising by 26% between 1999/00 and 2001/02; and rolling stock costs also rising very sharply over that period). Of course, the TOCs are regulated under a different regime to that adopted for Network Rail, based on periodic competition for the market (through franchising), and therefore efficiency analysis in respect of the TOCs does not play the same central role in the regulatory framework as in the case of rail infrastructure. Nevertheless, the aforementioned finding suggests that attention is required to costs across the industry, and not just in respect of infrastructure. We return to this point in section 5, where some of the results from Smith (2004) are briefly discussed.

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<sup>3</sup> In this study 1992/93 is considered to be the last full year before the effects of privatisation started to be felt. See Pollitt and Smith (2002) for further details.

<sup>4</sup> See ORR (1999).

**Table 1**  
Rail Infrastructure Cash Costs

<b>Infrastructure cash costs<sup>a</sup></b>	1999/00	2000/01	2001/02	2002/03	2003/04	% growth
<b>£m, 2002/03 prices</b>	Pre-Hatfield	Post-Hatfield period				1999/00-2003/04
Operating costs	795	801	1,133	1,263	1,218	53%
Maintenance	680	734	967	1,184	1,284	89%
Renewals	1,394	1,941	2,036	2,421	3,093	122%
Enhancements	398	594	860	746	742	87%
	<b>3,266</b>	<b>4,070</b>	<b>4,996</b>	<b>5,614</b>	<b>6,337</b>	<b>94%</b>
Index of cost per train km	100	122	147	163	182	82%

(a) Operating costs plus capex. Sources: ORR; Network Rail; SRA.

### 3. 2000 Periodic Review Efficiency Studies

The 2000 Periodic Review of Railtrack's finances was concerned with determining the company's funding requirement over the second control period (CP2; financial years 2001/02 to 2005/06). As noted above, the review was conducted against the background of improving efficiency performance during the first control period (CP1; financial years 1995/96 to 2000/01), and the expectation that further improvements would be possible, in line with the experience of the other privatised utilities. It should also be noted that the ORR's final efficiency determination was published on October 19<sup>th</sup> 2000, just two days after the Hatfield accident, and did not take account of the resulting increase in costs (which of course were not known until later).

In arriving at its determination, the ORR relied on a three generic types of efficiency study (carried out by various consultants), as summarised in Table 2 below<sup>5</sup>. Of course, each of these approaches will be familiar to those involved in UK regulatory price reviews. Perhaps the most important point to make here is that none of the studies identified a frontier against which to assess Railtrack's relative efficiency position, and were either based on trend data, or on the "bottom-up" review approach.

**Table 2**  
2000 Periodic Review Efficiency Studies

<b>Type of Study</b>	<b>Consultants</b>	<b>Description of Approach</b>
"Top-down" International Comparison	NERA (2000)	Analysis of the total factor productivity growth achieved by US Class I railroads over the period 1986-1998.
"Top-down" Comparison with UK Privatised Utilities	Europe Economics (1999)	Analysis of post-privatisation trends in real unit operating expenditure (RUOE) for the other privatised network companies (water, sewerage, electricity transmission and distribution, and gas transportation).
Bottom-up Consultant Review	Booz-Allen & Hamilton (1999 and 2000)	Consultant review of Railtrack's expenditure plans (by asset class and function), covering both activity levels and unit costs.

<sup>5</sup> See ORR (2000). In addition, the ORR also commissioned Horton 4 Consulting to review the other studies. Horten 4 Consulting (2000) supported the conclusions of the Europe Economics (1999) report.

This situation was, to some extent, inevitable. Since Railtrack was a monopoly provider in Britain, there were no domestic comparators to support yardstick competition as was possible in water and electricity distribution. Furthermore, in common with the other regulated sectors, relative efficiency comparisons with non-UK rail infrastructure providers also proved difficult due to a lack of data (with railways in most other countries being vertically-integrated). There are also other more general problems of comparability associated with, for example, differences in types and density of traffic and accounting policies across countries. However, it should also be noted that *internal benchmarking*, which would at least have enabled the construction of an internal efficiency frontier within Railtrack, was not attempted. This was, though, identified as an area for development at subsequent reviews.

In the absence of a frontier against which to establish Railtrack's relative efficiency position, the only hard data the ORR had available was based on productivity trend information. This information was derived from two sources: US Class I railroads<sup>6</sup> (NERA, 2000); and UK privatised network utilities (Europe Economics, 1999). However, these comparisons were far from perfect when it came to making judgements about the scope for future efficiency savings in respect of rail infrastructure.

The problem with the NERA study - being based on long-term data from the US - was that it said nothing about the scope for Railtrack to achieve the expected "catch-up" to private sector best practice that had been achieved in other privatised industries. The problem with the Europe Economics study was that it produced a wide range of results depending on, in particular, the extent of scale and capital substitution effects in the comparator industries. Whilst these two studies were supplemented by the review carried out by BAH, based on their knowledge of international best practice, the BAH study suffered from the same problem as all such bottom-up approaches, namely that it was based on subjective judgements and not on hard data from comparable companies.

In the event, the Europe Economics study was the most influential in informing the ORR's final efficiency determination. In other words, it was assumed that Railtrack would be able to achieve savings similar to those achieved by the other privatised utilities, and the company was set a 5-year efficiency target of 17%, close to the lower end of the range suggested by the Europe Economics study. However, it should be noted that this target was (a) in line with that suggested by NERA's international benchmarking; and (b) was also supported by the results of the bottom-up review of potential efficiency initiatives carried out by BAH.

Of course, subsequent developments suggest that the ORR's efficiency determination and the supporting efficiency studies were too optimistic (provided one accepts the need for much higher costs in the post-Hatfield environment; see section 5). The two trend-based external comparisons, by their nature, could not have been expected to spot the impending need for increased investment. However, to the extent that the pressures for higher maintenance and renewal spending were building up, based on

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<sup>6</sup> Whilst the US railroads are freight dominated, and therefore not readily comparable with the UK network in terms of relative efficiency levels, NERA argued that US data on productivity trends was comparable and useful for the ORR in making its efficiency determination.

the “bow-wave” and historic under-investment arguments (see section 5)<sup>7</sup>, it might have been expected that this point could have been picked up by the BAH bottom-up review of Railtrack’s plans - given that this was based on the consultants’ knowledge of best practice elsewhere in the world.

Perhaps the lack of data on the condition of Railtrack’s assets played a role here. Nevertheless, if data quality was an issue, this did not appear to be sufficiently serious to prevent the ORR from setting challenging targets for Railtrack, based on the information available.

#### **4. Rail Efficiency Studies: More Recent Developments**

As noted earlier, the Hatfield accident represents a major turning point in the fortunes of Britain’s privatised railways. The response of the industry to the accident started off a chain of events that resulted in Railtrack being placed into administration roughly a year later (October 2001), with the company subsequently replaced by a “not-for-dividend” operator, Network Rail, in October 2002. In September 2002 the ORR announced an Interim Review of Network Rail’s access charges, aimed at determining the level of funding required by an efficient operator to maintain and renew the network - taking account of the new information provided by the Hatfield accident. The review covered the five year period 2004/05 to 2008/09.

Table 3 summarises the studies commissioned by the ORR during the 2003 Interim Review. As in 2000, the ORR commissioned comparisons with UK privatised industries (OXERA, 2003a); as well as bottom-up reviews of Network Rail’s business plan, in terms of activity levels and unit costs and (LEK, TTCI and Halcrow, 2003 and Accenture, 2003). Meanwhile, international benchmarking was again carried out, although of a different nature to that undertaken in 2000 (Halcrow, TTCI and LEK, 2003; see below). Furthermore, two additional approaches were developed: process benchmarking (OXERA, 2003b) and internal benchmarking (LEK, 2003). The latter built on some work carried out by Kennedy and Smith in 2002 (published in 2004), as described further below.

Of the studies in Table 3, only three played a major role in the ORR’s final efficiency determination: firstly, the internal benchmarking study; and, secondly, the two bottom-up reviews.

Given the post-Hatfield cost shock, the trends experienced in other privatised utilities were of little relevance, and were used only to inform the phasing of Network Rail’s targets. Top-down analysis of international rail productivity trends was abandoned, mainly due to lack of time, and replaced with a bottom-up comparison of specific working practices in overseas rail infrastructure providers. However, as it turned out, this study produced little in the way of immediate savings opportunities, and did not play a significant role in the ORR’s final decision. Meanwhile, the process benchmarking study was not central to the main analysis, being based on a small set of non-core activities, accounting for less than £200m (or only 3% of the cost base).

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<sup>7</sup> The “bow-wave” argument refers to the fact that significant volumes of track were replaced in the 1970s and are therefore coming up for renewal now. The under-investment point refers the general assumption that investment was insufficient for many years under British Rail.

**Table 3**  
2003 Interim Review Studies

Type of Study	Consultants	Description of Approach
Comparison with UK Privatised Industries	OXERA (2003a)	Comparison of real unit operating expenditure reductions in other UK regulated network industries. Used by the ORR to inform the phasing of Network Rail's efficiency targets.
Bottom-up Review of Activity Projections	LEK., TTCI and Halcrow (2003)	Focus of the review was on the planned volume of activity and whether this activity was necessary and sensible in terms of its scope and timing. Based on the consultants' knowledge of best practice engineering approaches.
Bottom-up Review of Contracting Strategy	Accenture (2003)	Bottom-up review of Network Rail's contracting approach, based on the consultants' knowledge of international best practice.
International Benchmarking	Halcrow, TTCI and LEK (2003)	Comparison of working practices across European and US rail infrastructure providers. Focus on bottom-up comparison of working practices rather than top-down cost comparisons.
Process Benchmarking	OXERA (2003b)	Benchmarking Network Rail's non-core activities (e.g. Finance and HR) against external comparator (e.g. the National Grid Company). Based on simple cost or headcount measures for each function as a proportion of total operating costs or total headcount.
Internal Benchmarking	LEK (2003)	Comparison of operating, maintenance and renewal unit costs across 6 regions and 19 contract areas (the latter for maintenance only). Some regression analysis (using dummy variables for each region) was conducted based on job-by-job data to create a sufficient number of observations; this analysis enabled efficiency scores to be computed.

The internal benchmarking approach suggested that significant savings could be achieved if Network Rail was able to implement its own best practice consistently across the network. Based on the application of econometric frontier techniques (corrected ordinary least squares and stochastic frontier analysis), Kennedy and Smith (2003; 2004) found potential savings at the company level of around 13%. This paper obtained sufficient observations for estimation by using panel data for seven zones over a seven year period (1995/96 to 2001/02).

The LEK (2003) report found savings of up to 24% for maintenance activities, with slightly lower figures for renewals (up to 13%) and operating expenditure (up to 19%); although these targets are based on a higher cost base (2002/03 and 2003/04 costs) than that considered in the Kennedy and Smith work. Where econometric analysis was carried out, the LEK study obtained sufficient data points by utilising data on a job-by-job basis for Network Rail's six regions.

It is worth noting that, whilst most the benchmarking work in rail has been based on simple unit cost measures or qualitative consultant reviews, the Kennedy and Smith and LEK studies utilise the kinds of econometric methods adopted in some of the

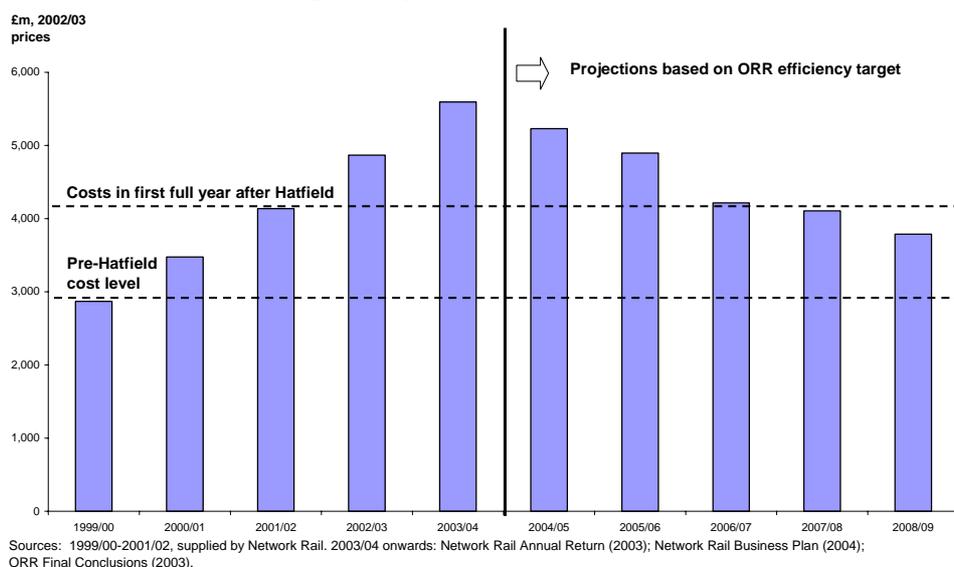
other regulated sectors (these methods are discussed in greater detail in the other Conference papers).

Of course, the scale of the cost rises experienced over the post-Hatfield period meant that benchmarking based on internal comparators was not going to be sufficient in developing an appropriate efficiency target for Network Rail going forward. However none of the studies listed in Table 3 provided external comparators based on hard data. Instead, the ORR relied on bottom-up consultant reviews to provide an external perspective: namely, an analysis of Network Rail’s activity projections (LEK, TTCI and Halcrow, 2003), and the Accenture (2003) review of the company’s contracting strategy. Inevitably such reviews involve the application of considerable judgement on the part of the consultants.

In the event, the ORR’s efficiency judgement can be described as follows. First, the ORR required Network Rail to cut back on some of the proposed activity which the LEK, TTCI and Halcrow (2003) had suggested was unnecessary. Second, the ORR tasked the company with reducing its unit costs on this revised level of activity by 31% in real terms. This latter figure was based on the results of the internal benchmarking, which implied savings of up to 24%, and the Accenture study which suggested potential unit cost savings of around 17-18%. In arriving at its judgement, the ORR also considered a number of other factors (e.g. the impact of new technology) which the ORR argued were not fully reflected in the studies carried out.

Whilst the 31% efficiency target set by the ORR sounds tough, Figure 1 shows that future rail infrastructure costs are nevertheless projected to remain well above pre-Hatfield levels for many years – assuming that the targets are achieved - and are not expected to fall below 2001/02 levels until 2007/08 at the earliest.

**Figure 1**  
Rail Infrastructure Operating, Maintenance and Renewal Cash Costs



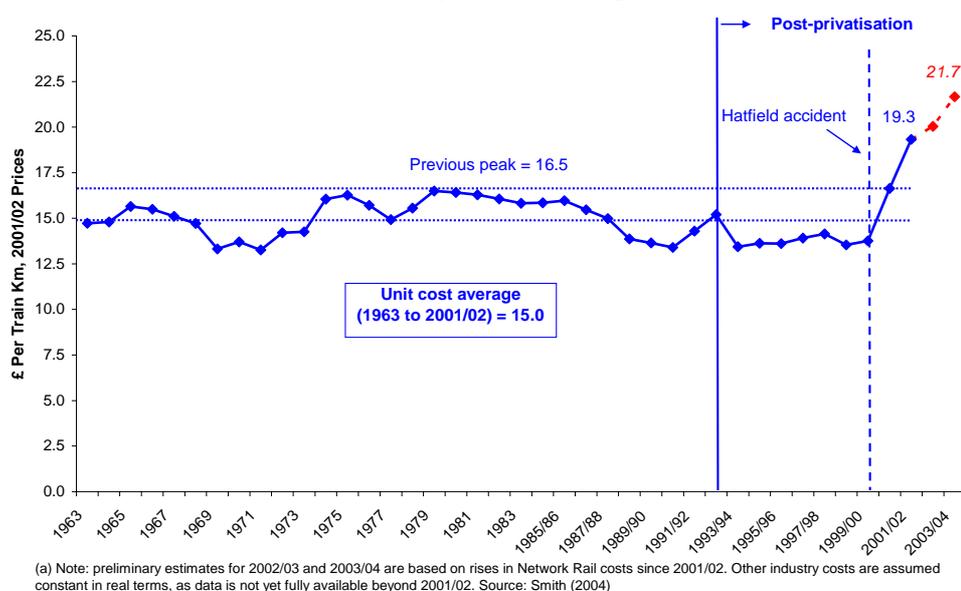
## 5. Evaluation of the 2003 Interim Review Findings

The first point to note about the ORR's 2003 efficiency determination is that it was based on a wide range of evidence (see Table 3; and ORR, 2003). Furthermore, the ORR clearly enhanced the benchmarking framework in comparison with the 2000 Periodic Review, in particular through the development of the internal benchmarking approach implemented by LEK.

That said, the review contained one major omission: namely the lack of external comparators based on hard data. We still do not know where Network Rail stands internationally. Furthermore, whilst the ORR acknowledged the twin effects of the "bow-wave" effect - combined with previous under-investment during the BR period - as explanations for the post-Hatfield cost explosion (see section 3 above), to our knowledge these effects were not quantified in any detail. It should also be noted that both of these potential arguments for higher costs were known at the 2000 review.

As a result, the Interim Review was unable to provide a clear, empirically-based justification for post-Hatfield cost levels based on international comparisons, or by reference to historical precedents in Britain. Inevitably, such comparisons are not straightforward, in particular, attempts to draw conclusions based on international data. However, we argue that in the circumstances – with infrastructure costs having almost doubled within four years – more quantitative work in this area should have been attempted. In this respect, we note the findings of our own analysis, which suggests that current rail industry costs cannot be justified by reference to historical benchmarks, even when the volume of track renewal activity is taken into account (see Figure 2; see also Smith, 2004 for further details).

**Figure 2**  
Total Rail Industry Cash Costs per Train Kilometre



Of course, the ORR did obtain some external evidence through the two consultant reviews carried out by LEK, TTCI and Halcrow (2003) and Accenture (2003). But, as

noted earlier, those studies relied heavily on the subjective judgements of the consultants. In this respect it should be pointed out that the previous bottom-up reviews carried out at the 2000 Periodic Review – only a few years earlier - came to a very different view about the level of funding required to sustain the rail infrastructure (i.e. much lower maintenance and renewal activity and unit costs).

In the absence of hard data from comparable situations elsewhere, therefore, it could be argued that bottom-up studies tend to “find what they are expected to find”, rather than producing much in the way of new information. This is, in our view, an inherent feature of bottom-up reviews, and not a criticism of the consultant studies in this particular case.

## **6. Conclusions**

This short paper has reviewed the efficiency studies conducted in respect of Britain’s rail infrastructure provider since privatisation. The paper shows that a wide range of approaches has been adopted by the ORR. However, it also demonstrates that the regulatory framework in rail has been hampered by the lack of external benchmarks against which to make objective judgements about the relative efficiency of rail infrastructure provision in Britain. This problem first surfaced during the 2000 Periodic Review, but has taken on a much greater significance following the post-Hatfield cost increases.

The 2003 Interim Review saw a number of enhancements to the ORR’s benchmarking approach, in particular the development of internal benchmarking based on Network Rail’s regional structure. However, we argue that the Interim Review did not to provide a clear, empirically-based justification for post-Hatfield cost levels based on external data, for example, international comparisons, or by reference to historical precedents in Britain. With respect to the former, we still do not know where Network Rail stands internationally. And our own analysis suggests that the latter comparison is not favourable. Although the ORR obtained an external perspective through bottom-up consultant reviews, we suggest that such studies are, by their nature, highly subjective, and do not provide an adequate substitute for quantitative analysis.

As a result, we suggest that many are unconvinced of the need for higher infrastructure spending in the post-Hatfield environment, or at least on the scale proposed. This point echoes the argument of Foster and Castles (2004) that there is still “considerable uncertainty over the level of efficient costs and performance of Network Rail”. And clearly, the recent sharp rise in infrastructure costs was one of the key factors that led to the Government’s latest review of the rail industry structure (see Department for Transport, 2004). Looking forward, we argue that more work is needed to obtain a better understanding of the reasons for recent rail cost increases, in particular, the cost implications of the current safety regime, and also to develop robust international benchmarks against which to judge Network Rail’s relative efficiency position. The latter is particularly important, given the fact that overseas comparisons offer (possibly) the only way of justifying existing cost levels.

Of course, international comparisons are not straightforward for well known reasons. Any analysis would have to be based on like-for-like data, and in particular would

have to address the impact of potentially lumpy renewal volumes on costs in any given year. Ultimately, to do a good job, co-operation would likely be required with overseas railway companies. The experience in other related sectors, for example the London Underground, is that a useful international benchmarking framework takes many years to develop. It is therefore important to start now, rather than wait until the next review of Network Rail's finances, by which time it will be too late (again). We are currently developing our research in this direction.

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