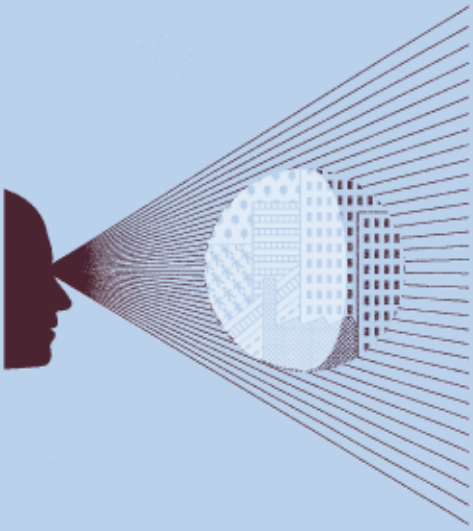
Oxera

What is the necessary margin for Network Rail to accommodate risk?

Prepared for Office of Rail Regulation

October 9th 2006



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1 Introduction

The ORR has identified two ways in which it might set the allowed rate of return for Network Rail at the next access charges review. It could:

– set a conventional weighted average cost of capital (WACC) based on an assumption of the cost of debt, the cost of equity, and Network Rail's efficient/actual gearing (net debt:RAB) position. If this approach were adopted, Network Rail would also pay the government a 'FIM fee';

– recognise the specific characteristics of Network Rail's current financial structure—in particular, the fact that it has no conventional equity and all debt raised to date has been indemnified by a government guarantee—in order to allow for the cost of debt and then (possibly) also a surplus margin.

With regard to both approaches, there has been considerable discussion about whether Network Rail might require an annual surplus in addition to interest costs, and, if so, how much this surplus might be. If the cash-flow approach is adopted, it is this amount that will be explicitly added to Network Rail's interest costs; if the FIM fee approach is adopted, it is likely that the WACC less the maximum FIM fee payable[1] will need to leave an annual amount equal to this annual buffer.

The reasons given for Network Rail's net revenue allowance to include an allowed rate of return above that strictly required to meet interest payments are the following:

– to provide Network Rail with the ability to absorb the risks faced by other private sector businesses;
– to enable Network Rail to introduce non-FIM-protected capital;
– to be consistent with the company's for-profit commercial status.

This is not, however, the only form of financial buffer that Network Rail will benefit from. In particular, in addition to this cash-flow buffer, it will have a balance-sheet buffer, in the sense that, at the start of CP4 there is likely to be a considerable difference between its current debt:RAB ratio and either the 85% debt:RAB ratio referred to in Licence Condition 29 (if the FIM remains in place) or the maximum debt:RAB ratio that would continue to allow sustained access to the debt markets (if debt capital is not protected by the FIM).[2] However, even with this balance-sheet buffer, there are likely to be some benefits from providing some form of annual cash-flow buffer, as unanticipated access to the debt markets will involve (potentially significant) transaction costs, and may lead to a long-term deterioration in the perception of Network Rail in the capital markets. That said, 'too much' reliance on the cash-flow buffer providing financial flexibility is likely to be costly and inefficient, as the opportunity cost of using the cash elsewhere is likely to be significant. The interactions between the cash-flow and balance-sheet buffers are discussed in further detail in this report.

This report sets out some preliminary analysis undertaken by Oxera in exploring this issue. It discusses four methodologies that seek to provide a high-level assessment of the allowance that Network Rail might require. For each methodology, the rationale for considering the approach is first discussed together with its advantages and disadvantages; the results are then presented, followed by the application of the approach to Network Rail. As noted, this

[1] In other words, if Network Rail were to continue to raise all its debt with the benefit of the FIM.

[2] Further financial flexibility is provided by the (assumed) continuation of the interim review provisions and, possibly, by the fact that the Network Rail's interest costs will be remunerated assuming that the FIM is not in place.

forms a preliminary assessment of this issue; with more time, it may be possible to refine the methodologies and results presented.

The methodologies are discussed as follows:

– section 2 considers the estimation of comparators' margins;
– section 3 examines the appropriate margin based on capital intensity;
– section 4 looks at the underlying cost volatility;
– section 5 considers commitment facilities;
– finally, section 6 concludes.

2 Estimating the margins of appropriate comparators

2.1 Rationale, advantages and disadvantages

The first methodology is the relatively simple one of considering the margins made by companies undertaking a similar type of activity to Network Rail (ie, rail engineering).

Assuming that the company is operating in a competitive market, the size of this margin, after interest payments, is a function of the market return on equity and the degree of systematic risk faced by that company. However, the *effect* of this margin is that the company is given a degree of protection against an unanticipated need to access the debt markets, as the dividends that might otherwise be paid out of this margin (or the retained earnings that might otherwise be used to finance expansion) could be deferred in the event of a cost shock. Understanding the potential size of this buffer for accommodating shocks in other companies undertaking activities broadly similar to those of Network Rail—and hence with similar business risk—could therefore inform what the appropriate size of the buffer might be for Network Rail.

There are, however, some potential disadvantages associated with this approach.

– The companies that undertake activities similar to Network Rail normally comprise a number of divisional elements, of which only one is responsible for rail-related activities. To understand the margins of companies undertaking a similar type of activity to Network Rail, it is desirable to focus on the rail-related division only. However, this implies that interest costs cannot be deducted from operating profits (since firms' financing decisions will be made at the group level). This potentially leads to an aspect of double-counting, since the operating margin of the comparator may include an allowance for the remuneration of corporate-wide interest costs, while the purpose of this exercise is to estimate the surplus required by Network Rail in excess of its interest costs. However, this problem may not be particularly acute because, on a stand-alone basis, the divisions in question would not be expected to have significant assets and would therefore be unlikely to have substantial debt finance.

– The comparators may not undertake the same activities as Network Rail, and therefore might not face the same business risk. In this regard, it is not clear whether the comparators have a higher or lower risk profile than Network Rail. On the one hand, they operate in a competitive environment, while Network Rail is a monopolist, and, due to the nature of the regulatory framework, is largely insulated from demand-side risk. On the other hand, the companies in question may benefit from contractual protections that act to mitigate risk (eg, cost-pass-through provisions), which are largely absent from the 'regulatory contract' under which Network Rail operates.

  Moreover, these comparator companies are relatively 'asset-light'. This is an advantage for the methodology, in the sense that, as explained above, it means that an inability to strip out interest costs from the margins earned by the comparators is not as great a concern as it might otherwise be. However, it raises a question regarding risk. In particular, if, everything else being equal, an increase in asset intensity raised the risk faced by a company, this would suggest that the risk faced by Network Rail would be greater than for these comparators, and hence the estimated margin would be an understatement.

– For other companies, the deferral of distributing dividends/using retained earnings for financing expansion to accommodate (cost) shocks is only necessary on certain, limited

occasions—eg, in a straightforward case, dividends would only need to be deferred one time in 20; in the other 19 times, they could be distributed to shareholders. By contrast, in the Network Rail case, the primary function of the surplus would be to accommodate cost shocks. This might suggest that the surplus would only need to be the margin derived from comparators, multiplied by the frequency with which the margin might be expected to be used to absorb costs. However, in addition to the potential difficulty of working out what this frequency might be, it could leave Network Rail exposed to cost shocks early on in the period after such a regime was implemented. For example, if, in response to the potential that equity returns are used to avoid unanticipated access to the debt markets one time in 20, providing an annual surplus equal to 5% of annual equity returns would provide the 'correct' level of surplus over a 20-year period, but would leave Network Rail exposed to cost shocks early in that 20-year period.

This discussion indicates two points:

– the results derived from this methodology might be considered an upper-bound estimate. However, this also needs to be seen in the context of whether these companies' risk profile is equivalent to that of Network Rail;

– the treatment of annual surplus not used to accommodate cost shocks is an important policy issue.

2.2 Results

This methodology was based on a selection of companies undertaking rail engineering activities, as well as United Utilities Operating Services, a company set up specifically to take responsibility for the operation and maintenance of the entirety of Welsh Water's assets. The results are presented in Table 2.1 .

Table 2.1 Margin on turnover and margin on costs for selected comparators (%)

	Margin on turnover				Margin on costs			
	2003	2004	2005	2006	2003	2004	2005	2006
United Utilities Operating Services	0.14	9.74	9.12	5.54	0.14	10.79	10.03	5.87
Alstom Transport	–0.47	1.32	4.27	6.32	–0.47	1.33	4.47	6.74
Atkins Rail			4.74	1.47			4.98	1.50
Babcock Rail			5.03	4.05			5.30	4.22
Balfour Beatty (rail engineering)		5.48	4.18			5.80	4.36	
Grant Rail	1.19	4.03			1.20	4.20		
Jarvis Rail			–6.97	10.85			–6.52	12.18

Source: Company accounts and Oxera calculations.

The summary statistic, as presented in Table 2.2 below, suggests a margin on costs of around 4.25–4.5%, and a margin on turnover of around 4%. The results are presented with and without Alstom Transport, since this company's characteristics are the least similar to those of Network Rail's business activities.

Table 2.2 Summary statistics on operating margin and margin on costs for comparators (%)

	Operating margin	Margin on costs
All companies	3.89	4.23
All companies excluding Alstom Transport	4.19	4.57

Source: Company accounts and Oxera calculations.

These results are also broadly corroborated by the comments made by representatives of these companies in a parliamentary inquiry into the costs of the rail network:

> Mr David Clarke, Strategy Director at Jarvis Rail, estimated [that the profit margin] was in the 'range' of 4% for maintenance and 6% for renewals.[3]
>
> Mr Andrew Rose, Chief Operating Officer of Balfour Beatty Rail thought profits on maintenance for the private sector under Network Rail's 'new maintenance contract' (since set aside when the company took direct control of maintenance) would be '4.7% of sales value'.[4]

2.3 Application to Network Rail

The easiest way to apply the figures derived above is to apply the margin on cost figures to the ORR's estimate of Network Rail's future costs in CP4. This is shown in Table 2.3, using a range of 4.5–5.0% for the margin on costs (the lower end being informed by the comparator analysis above, excluding Alstom Transport; the upper end by the findings from the Select Committee hearing), and the ORR's low and high estimates for Network Rail's average annual OM&R costs for CP4.

Table 2.3 Implication of comparator assessment for Network Rail's required margin (£m)

	Annual average expenditure	
	Low	High
4.5% margin on costs	134.6	176
5.0%	149.5	195.5

Source: Oxera calculations.

This methodology indicates that an annual surplus of broadly £135m–£195m would be appropriate.

[3] House of Commons Select Committee on Transport (2004), 'Transport: Seventh Report', section 3, para 91.

[4] Ibid., footnote 124.

3 Estimating the appropriate margin based on capital intensity

3.1 Rationale, advantages and disadvantages

A second approach that could be adopted recognises that the absolute amount of operating profit required by a company is a direct function of its capital intensity. The greater a company's proportion of assets that need to be financed from a given amount of turnover, the higher its returns need to be. If Network Rail's asset intensity is measured, and the typical proportion of turnover accounted for by the operating profit of a company with that same asset intensity is also (econometrically) assessed, this information could be used to determine an appropriate level of operating profit. With an estimate of Network Rail's expected interest costs, its appropriate margin could then be calculated.

Many of the advantages and disadvantages of this approach are the same as for the first approach discussed above. In particular, the discussion about whether Network Rail's margin above interest costs needs to be the same as that for other companies given that the primary purpose for this margin would be to provide a cash-flow buffer—whereas for other companies this role is performed by the margin in limited situations only —remains pertinent here.

Beyond this, the approach does have a further advantage over the approach discussed in section 2, in that it can make use of a wider sample of companies. In particular, to undertake the regression analysis between capital intensity and margin on turnover, the sample considered includes the FTSE 350 companies over the past six years, providing a sample of 1,979 observations and making the analysis considerably more statistically robust than the previous analysis.

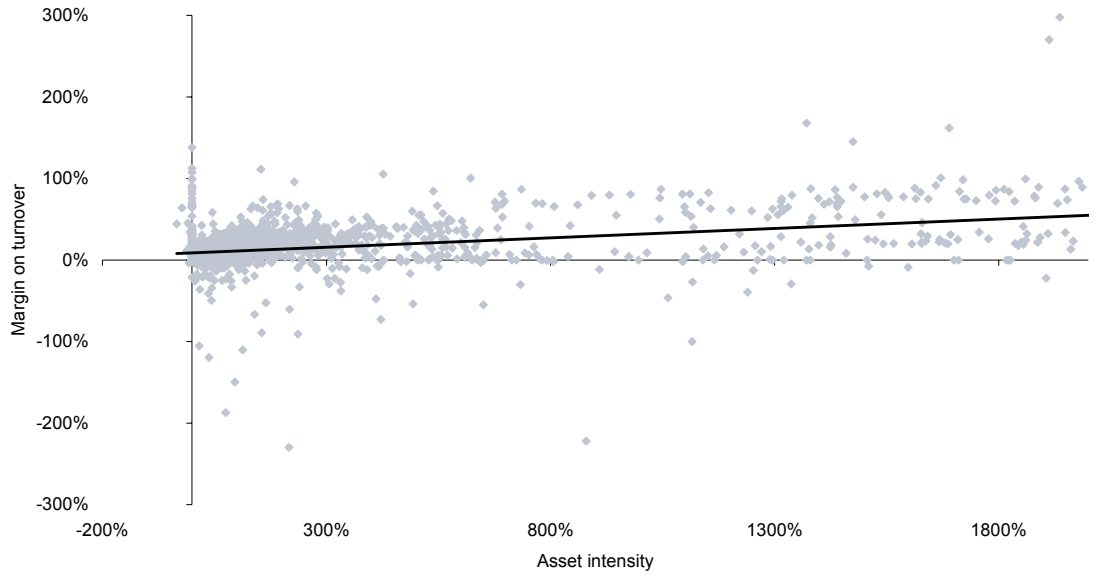
However, this also represents one of the disadvantages of the analysis, in that it assumes that the sole driver of the required size of the margin on turnover is asset intensity. This is equivalent to noting that the methodology does not consider the extent to which Network Rail's systematic risk may be greater or less than that of the market as a whole, but implicitly assumes that it is equal to the market.

Finally, the analysis also compares the asset intensity of FTSE 350 companies, measuring assets as total assets less current liabilities, while the measure of asset value used for Network Rail is its RAB. This may lead to distortions since many FTSE 350 companies will have their fixed assets measured using historical cost, while others will be valued on a replacement cost basis. In contrast, Network Rail's RAB incorporates neither of these valuation assumptions (due to the treatment of overspend during the Railway Administration period), instead falling somewhere in between these two approaches.

3.2 Results

Figure 3.1 plots the relationship between asset intensity (measured as total assets less current liabilities divided by turnover) and margin on turnover (measured as operating profit divided by turnover).

Figure 3.1 Relationship between asset intensity and margin on turnover



Source: Datastream and Oxera calculations.

As expected, the graph shows a generally positive relationship between the two variables: as asset intensity increases, so does the margin on turnover required and achieved by firms.

This relationship was explored econometrically using a simple ordinary least squares (OLS) regression, with margin on turnover regressed on asset intensity. The results of this regression are presented in Table 3.1.

Table 3.1 Econometric estimates of the relationship between capital intensity and operating margins

Parameter	Coefficient	Standard error	T-stat
α (constant)	0.1	0.006	15.73
β	0.0236	0.001	21.24

Source: Oxera calculations.

The R2 statistic for the regression was 0.19, reflecting the discussion above that asset intensity is unlikely to be the sole driver of expected returns.

The simple regression analysis therefore indicates that, typically, a company with no assets would expect to receive a margin on turnover of around 10%, and that for every 1% increase in asset intensity thereafter, the average increase in margin on turnover was around 0.0236%.

3.3 Application to Network Rail

This relationship can then be applied to Network Rail. At the start of the next control period, the ORR estimates that Network Rail's starting RAB will be £29.8 billion and its estimated revenue (turnover), before calculation of the return allowance, will be between £2.68 billion and £3.55 billion. The question that then needs to be answered is what Network Rail's allowed return should be such that, when added to these base revenues, the relationship between asset intensity and margin on turnover is 'typical', given the econometric relationship established above. Table 3.2 presents these estimates.

Table 3.2 Application of econometric results to Network Rail

	Low	High
Margin (£ billion)	**1.06**	**1.15**
Revised turnover (£ billion)	3.74	4.70
Capital intensity (%)	797	633
Margin on turnover (%)	28.3	24.6
Check	0.1+(0.023*797) = 28.3%	0.1+(0.023*633) = 24.6%

Source: ORR (2005), 'Periodic Review 2008: Initial Assessment of Network Rail's CP4 Revenue Requirement and Consultation on the Financial Framework', December, and Oxera calculations.

This methodology therefore suggests that the appropriate total allowed return for Network Rail, given its asset intensity, is between £1.06 billion and £1.15 billion. With estimated interest costs of £900m, this would imply an allowance over and above interest costs of between £158m and £255m.

This methodology can also be used to cross-check the results from the methodology in the previous section. The methodology set out in section 2 assumed that the difference in asset intensity between Network Rail and the comparators need not represent a problem for undertaking the comparative analysis, as the increase in margin requirement resulting from Network Rail's greater asset intensity would be fully covered by the allowance that the ORR will make for Network Rail's interest costs. Using the results from this section allows this assumption to be tested by asking what increase in total margin might be required, given the difference in asset intensity between the comparators and Network Rail. Assuming that the capital intensity of the comparators is effectively zero,[5] the difference in capital intensity between Network Rail and the comparators is approximately 730%. Using the econometric relationship established, this would imply that Network Rail's margin on turnover would need to be 17.2% points (730*0.0236) greater than the asset-light comparators. When added to the margin on turnover that the comparator companies were making (of approximately 4%) this implies that, if adjusted for Network Rail's capital intensity, these companies would require a margin on turnover of around 21%, slightly less than the margin suggested in the analysis above.

[5] For example, the average asset intensity of United Utilities Operating Services company was 0.45% over the four-year period 2002–05.

4 Underlying cost volatility

4.1 Rationale, advantages and disadvantages

The third approach considered by Oxera is one that directly considers the volatility of costs, rather than examining the profits made by companies, which can be used to absorb this volatility in costs (and revenues). In particular, it seeks to understand the underlying volatility of costs—as measured by the difference between the regulatory allowance and the actual expenditure amount—across a range of regulated company comparators. With this established, a regulatory policy can be adopted by the ORR that sets the annual surplus of Network Rail such that it covers a certain level of cost overrun by Network Rail, based on what the comparator data suggests is the likelihood of that particular size of overrun occurring. In other words, this approach seeks to determine the size of Network Rail's surplus so that ORR can be confident that it is likely to cover x% of any the annual deviation in cost from regulatory assumptions that Network Rail is likely to experience.

The advantage of this approach is that, by focusing directly on underlying cost volatility, it removes the problems discussed above relating to the extent to which profits earned by a company reflect simply the cash buffer that it requires (as opposed to required remuneration for equity investors). However, as will become apparent below, this approach can be implemented in a number of ways, and it is in part a matter of subjective judgement/ regulatory policy as to which method is adopted. The approach also assumes that the cost volatility of the companies used in the analysis (regulated companies, including Network Rail's historical record) is an appropriate measure of Network Rail's underlying cost volatility.

4.2 Results

4.2.1 Vanilla case

The sample of company performance against regulatory expectation is derived from the following regulated industries/companies.

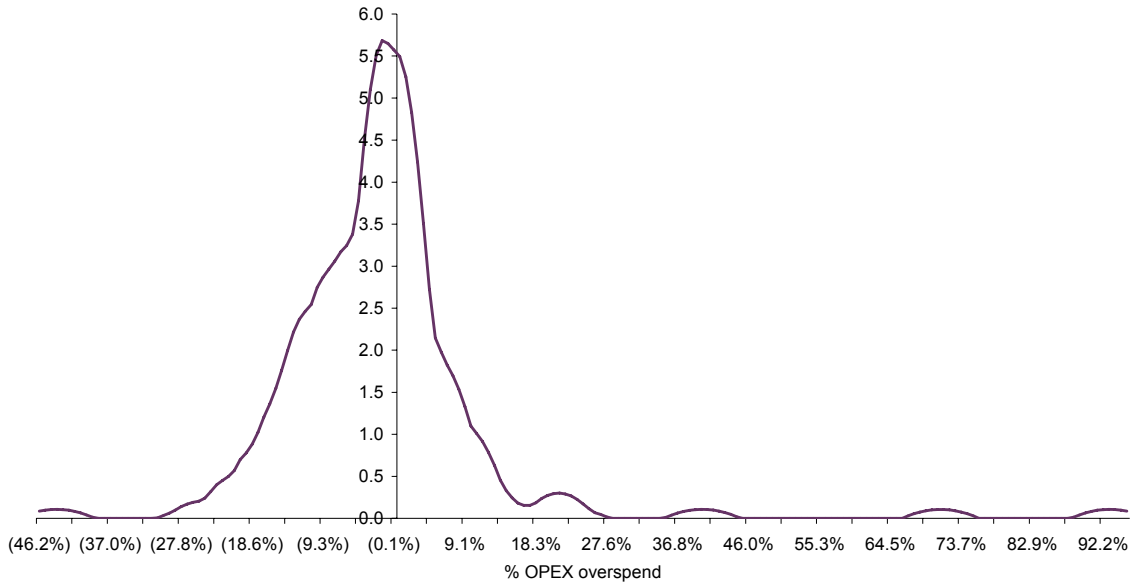
Table 4.1 Sample used for assessing cost volatility

Company/sector	Category of spend	1999/2000	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06
Network Rail	Operating			✓	✓	✓	✓	✓
	Maintenance			✓	✓	✓	✓	✓
	Renewals			✓	✓	✓	✓	✓
	Enhancements			✓	✓	✓	✓	✓
WASC/WOC	OPEX		✓	✓	✓	✓	✓	
Gas distribution networks	OPEX				✓	✓	✓	
	CAPEX				✓	✓	✓	
	REPEX				✓	✓	✓	
National Grid Electricity	OPEX			✓	✓	✓	✓	
	CAPEX		✓	✓	✓	✓	✓	
National Grid Gas Transmission	OPEX				✓	✓	✓	
	CAPEX				✓	✓	✓	
ScottishPower	OPEX		✓	✓	✓	✓	✓	
	CAPEX	✓	✓	✓	✓	✓	✓	
Hydro Electric	OPEX	✓	✓	✓	✓	✓	✓	
	CAPEX	✓	✓	✓	✓	✓	✓	

Note: For gas distribution companies, performance is considered as National Grid Gas as a whole until the sale of the four distribution companies.
Source: Oxera.

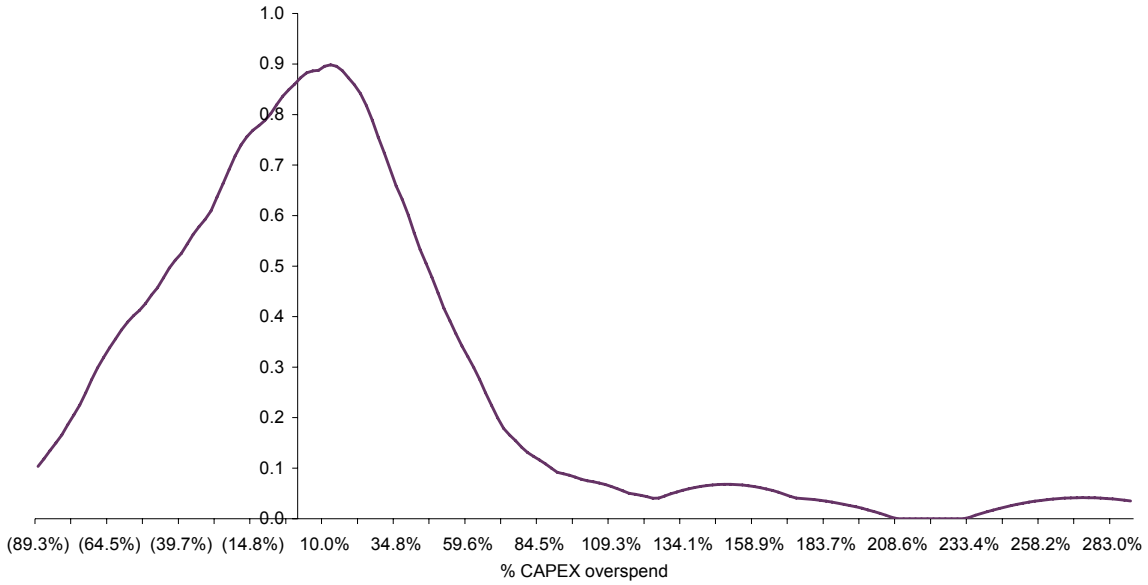
With this sample of companies, the distribution of regulatory performance against targets could be established. As an example, Figures 4.1 and 4.2 plot this distribution for OPEX and CAPEX separately, with a negative number representing underspend.

Figure 4.1 Distribution of company performance relative to regulatory assumption for OPEX



Note: This distribution was calculated using an Epanechnikov kernel density estimator, with optimal bandwidth.
Sources: Ofwat (various years), 'Financial Performance and Expenditure Assessment Report'; Network Rail (various years), 'Regulatory Financial Statements'; Ofgem (2006), 'Gas Distribution Price Control: Second Consultation—Supplementary Appendices,' July; Ofgem (2006), 'Transmission Price Control Review 2007–2012: Third Consultation—Supplementary Appendices', March, and Oxera calculations.

Figure 4.2 Distribution of company performance relative to regulatory assumption for CAPEX



Note: This distribution was calculated using an Epanechnikov kernel density estimator, with optimal bandwidth.
Sources: Ofwat (various years), 'Financial Performance and Expenditure Assessment Report'; Network Rail (various years), 'Regulatory Financial Statements'; Ofgem (2006), 'Gas Distribution Price Control: Second Consultation—Supplementary Appendices,' July; Ofgem (2006), 'Transmission Price Control Review 2007–2012: Third Consultation—Supplementary Appendices', March, and Oxera calculations.

These diagrams show that, typically, companies have outperformed relative to regulatory assumptions on OPEX—ie, the peak of the distribution is slightly to the left of the vertical axis—but have underperformed in relation to CAPEX.

The summary statistics examining a series of expenditure categories are presented in Table 4.2.

Table 4.2 Summary statistics of company performance against regulatory targets: base case (%)

	OPEX	REPEX	Other CAPEX[1]	All CAPEX	All expenditure
Median	(1.0)	11	1.6	6.1	(0.6)
Mean	(0.2)	14.4	12.4	13.0	2.9
Standard deviation	17.4	23.6	72.6	62.8	34.1
Maximum	106.3	74.4	273.3	273.3	273.3
Minimum	(43.5)	(11.5)	(71.4)	(71.4)	(71.4)

Note: [1] Other CAPEX constitutes non-REPEX CAPEX for those sectors where a distinction is made, plus overall CAPEX for those sectors where no distinction is made.
Sources: Ofwat (various years), 'Financial Performance and Expenditure Assessment Report'; Network Rail (various years), 'Regulatory Financial Statements'; Ofgem (2006), 'Gas Distribution Price Control: Second Consultation—Supplementary Appendices,' July; Ofgem (2006), 'Transmission Price Control Review 2007–2012: Third Consultation—Supplementary Appendices', March, and Oxera calculations.

With these summary statistics, it is possible to establish confidence intervals around Network Rail's possible expenditure relative to regulatory forecasts.[6] These can then be used to form

[6] As discussed above, this assumes that the observations in the samples are independent and that the distribution is normally distributed.

the basis for establishing the appropriate size of Network Rail's surplus. In undertaking this assessment, two approaches could be used.

– The first would be to apply the confidence intervals around the 'mean expected' amount of under- or overspend. For example, if it were decided that the surplus should be sufficient to cover 95% of all deviations from the expected level of expenditure, this evidence would suggest that, in relation to OPEX, the surplus should be equal to the *mean expectation* of cost performance (outperformance of 0.2%) plus 1.96 * standard deviations (17.4%), which is equal to 33.79%. Given that the ORR's estimate for Network Rail's annual average O&M expenditure is between £1,590m and £1,860m, this implies a margin to cover overruns in relation to this expenditure of between £537m and £629m.

– The alternative approach would be to use the same confidence intervals as above, but instead of applying these to the mean expected under- or outperformance, apply them directly to the regulatory targets. For example, this would result in the surplus being equal to 1.96 * standard deviations (17.4%), equal to 34.10%. Applying this percentage to the same average annual O&M expenditure of between £1,590m and £1,860m would imply a margin to cover cost over-runs of £542m and £634m.

A similar approach could be taken in relation to renewals and enhancement expenditure. However, in this case, it may be more reasonable to assume that, rather than the surplus having to meet the entirety of the overspend, it need only cover the financing costs of the overspend until the next periodic review. This would reflect the fact that, for example, efficient overspend on CAPEX can be built into the RAB at some point in the future, while (aside from the exceptional post-Hatfield Railway Administration period) regulated companies would be expected to meet the costs of any OPEX overrun. Therefore, the approach taken to estimate the size of the surplus needed in relation to renewals and enhancement expenditure is to work out the maximum overspend (95% of the expected expenditure levels), assume that this overspend takes place in each of the five years of the review period, and calculate the average annual interest costs associated with this overspend assuming a 5% interest rate.[7]

The results from this analysis are presented in Table 4.3.

Table 4.3 Calculation of required surplus under base-case examination of cost volatility (£m)

	Range for the ORR's annual expected expenditure	Spend category used	Margin calculated by reference to 'expected' expenditure or 'regulatory target'	Maximum % overspend to be covered (mean +1.96 standard deviation)	Maximum overspend to be covered	Required surplus
OPEX & maintenance	1,590–1,860	OPEX	Expected	33.8%	537–629	537–629
	1,590–1,860	OPEX	Regulatory target	34%	541–633	541–633
Renewals & enhancement	1,550–2,220	All CAPEX	Expected	136%	2,109–3,021	316–453
	1,550–2,220	All CAPEX	Regulatory target	123%	1,908–2,733	286–410
Total			Expected			854–1,082
			Regulatory target			827–1,043

Source: Oxera calculations.

[7] Further attention would need to be given to what this interest rate should be, and, in particular, whether it should be assumed to be the interest rate that would pertain with or without the FIM.

The table shows that, under these vanilla-case assumptions, this methodology would require Network Rail to have a surplus of between £825m and £1,050m.

4.2.2 Alternative scenarios

The initial implementation of this methodology implies a considerably greater buffer than the analysis indicated by the previous two approaches. However, there are at least two reasons why it might significantly overstate the volatility of costs and hence the required size of Network Rail's buffer.

– The sample from which the performance relative to regulatory assumptions was assessed contained a number of 'extreme' cases—eg, Network Rail's overspend during the Railway Administration period, and historically unprecedented (for the sector) overspend in the gas distribution sector. While an approach that removed these observations from the sample in their entirety risks being perceived as arbitrary, alternative regulatory measures (ie, interim review procedures) are in place to deal with these more extreme events. Hence, it could be argued that the size of the required surplus need not be informed by these cases.

– As Ofwat recently discussed,[8] there continues to be a fairly typical profile of company expenditure across a price control period: CAPEX is typically significantly lower than regulatory expectation in the early years of the price control; and a similar, although less pronounced, pattern is observed for OPEX. This is partly due to the incentives that regulated companies face. Unless a rolling mechanism is in place, the strongest financial benefit from beating the regulatory target is obtained during the first few years of the price control. However, there may also be practical reasons for this pattern. In particular for CAPEX, in the early years of the price control, planning issues, for example, may lead to deferral of expenditure. Regardless of the underlying cause, the impact of this systematic pattern is that the (implicit) assumption of the above analysis—that under- and outperformance in any one year is independent of any other year—is not likely to be valid. In turn, this will mean that the variance/standard deviation reported above will not represent the 'true' standard deviation. Rather, it will capture part of this systematic pattern.

Both of these issues are addressed below.

Exceptional circumstances

In terms of the first of these issues, a further mechanism that Network Rail benefits from (and, for the purpose of this analysis, is assumed to remain in place in CP4) is a general reopener provision. This mechanism works by allowing an interim review if Network Rail's **cumulative** expenditure is 15% higher or lower than that assumed at the time of the periodic review. However, as this mechanism works on cumulative expenditure, while the cash-flow surplus is provided to annual revenues, it is necessary to convert the interim review provision into an annual amount. Recognising that, in terms of annual spend, the threshold is easier to exceed in the first year and thereafter becomes progressively more difficult, one way that this could be done is by calculating the annual average expenditure that would cause the interim review to be triggered, assuming that, up to this point, Network Rail's expenditure forecasts were in line with the ORR's expectations.[9] This calculation is presented in the tables below for ORR's low and high forecasts of Network Rail's expenditure.

[8] Ofwat (2006), 'City Briefing', November.

[9] In undertaking this analysis, it is assumed that the ORR's current policy—that an interim review cannot be triggered for the first two years of the review period—is relaxed.

Table 4.4 Conversion of cumulative interim review provision into annual thresholds (low expenditure)

	2009/10	2010/11	2011/12	2012/13	2013/14
Annual expenditure (low)	3,782	3,465	3,208	2,965	2,703
Required overspend to trigger interim review	567	1087	1,568	2,013	2,418
As a percentage of annual expenditure	15	31	49	68	89
Average annual expenditure (%)	51	–	–	–	–

Note: Required overspend to trigger interim review calculated on the basis that, up to that point, Network Rail has exactly matched the ORR's expectations.
Source: ORR (2005), 'Periodic Review 2008: Initial Assessment of Network Rail's CP4 Revenue Requirement and Consultation on the Financial Framework', December, and Oxera calculations.

Table 4.5 Conversion of cumulative interim review provision into annual thresholds (high expenditure)

	2009/10	2010/11	2011/12	2012/13	2013/14
Annual expenditure (high)	4,407	4,268	4,181	4,058	3,930
Required overspend to trigger interim review	661	1,301	1,928	2,537	3,127
As a percentage of annual expenditure	15	30	46	63	80
Average annual expenditure (%)	47	–	–	–	–

Note: Required overspend to trigger interim review calculated on the basis that, up to that point, Network Rail has exactly matched the ORR's expectations.
Source: ORR (2005), 'Periodic Review 2008: Initial Assessment of Network Rail's CP4 Revenue Requirement and Consultation on the Financial Framework', December, and Oxera calculations.

These calculations indicate that, on average, an annual out- or underperformance of 47–51% relative to the annual regulatory target would be sufficient to trigger an interim review, given the current expected profile of Network Rail's expenditure in CP4.

Applying this to the sample of performance against regulatory targets already collected suggests that the distribution could be truncated at ±49% of the regulator's targets, with all observations outside of this range instead assumed to be either 49% or –49% respectively.[10] The impact of this 'decision rule' on the summary statistics is shown below.

Table 4.6 Revised summary statistics with truncated distribution (%)

	OPEX	REPEX	Other CAPEX	All CAPEX	Total expenditure
Median	(1.0)	11.1	1.6	6.09	(0.6)
Mean	(1.12)	12.3	(0.15)	3.25	(0.1)
Standard deviation	13.3	18.3	37.1	33.3	19.8
Maximum	49	49	49	49	49
Minimum	44	(11.5)	(49)	(49)	(49)

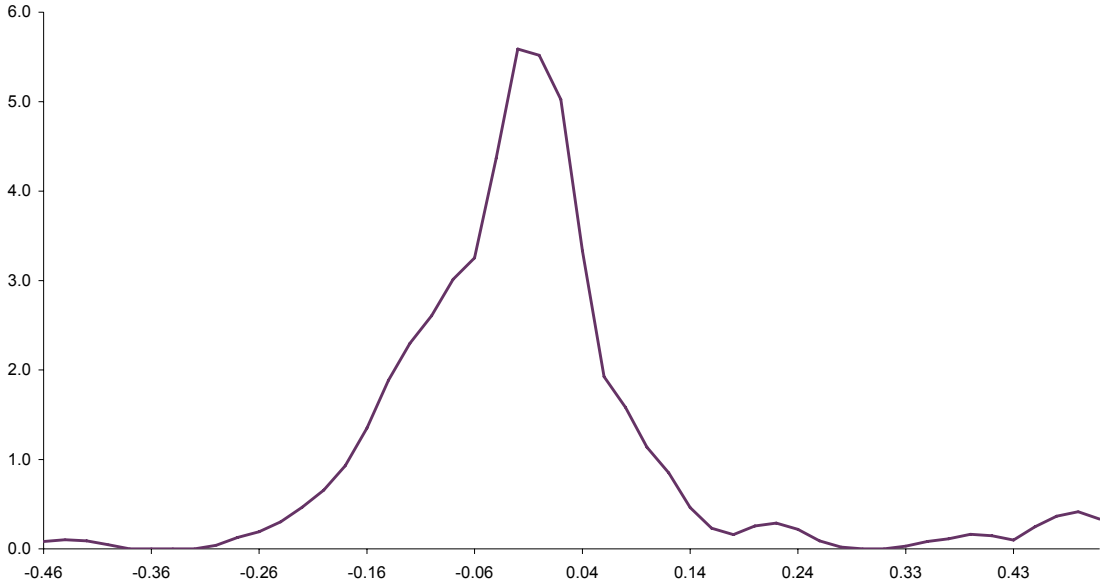
Sources: Ofwat (various years), 'Financial Performance and Expenditure Assessment Report'; Network Rail (various years), 'Regulatory Financial Statements'; Ofgem (2006), 'Gas Distribution Price Control Second Consultation—Supplementary Appendices', July; and Ofgem (2006), 'Transmission Price Control Review 2007–2012: Third Consultation—Supplementary Appendices', March, and Oxera calculations.

[10] One reason for applying this form of truncation, as opposed to discarding the observations altogether, is that simply because an interim review is triggered, Network Rail would lose/recover all of its under-/overspend to that point.

It can be seen that, relative to the full sample, the standard deviations have fallen, as would be expected, and there has been a reduction in the mean—ie, there have been more examples of extreme underperformance, which have now been truncated, than outperformance. The impact of the truncation is also much more marked for CAPEX performance than OPEX performance, reflecting the greater unpredictability of the former.

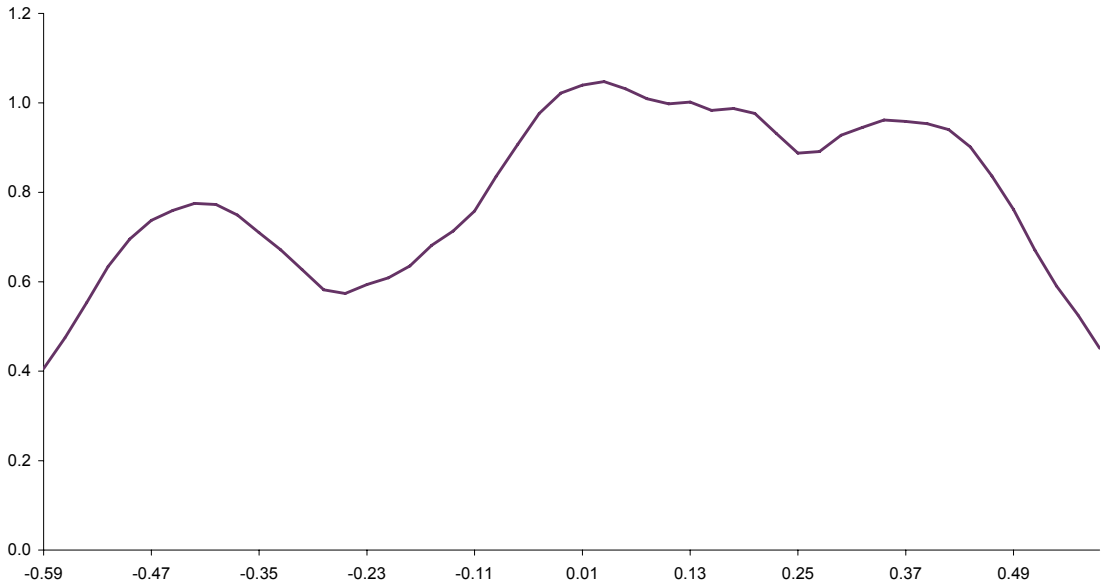
The impact of the truncation rule on the distribution of cost performance can be seen in the figures below.

Figure 4.3 Truncated OPEX distribution



Source: Oxera calculations.

Figure 4.4 Truncated CAPEX distribution



Source: Oxera calculations.

Applying these revised summary statistics to the projected level of Network Rail expenditure in exactly the same way as before results in the following forecasts for the maximum overspend to be covered and the required surplus.

Table 4.7 Revised calculations for required surplus using truncated distribution (£m)

	Range for ORR's annual expected expenditure	Spend category used	Margin calculated by reference to 'expected' expenditure or 'regulatory target'	Maximum % overspend to be covered (mean +1.96 standard deviation)	Maximum overspend to be covered	Required surplus
OPEX & maintenance	1,590–1860	OPEX	Expected	24.9	396–463	396–463
	1,590–1860	OPEX	Regulatory target	26.0	414–484	414–484
Renewals & enhancement	1,550–2,220	All CAPEX	Expected	68.5	1062–1520	159–228
	1,550–2,220	All CAPEX	Regulatory target	65.2	1011–1448	152–217
Total			**Expected**			**555–691**
			Regulatory target			**565–701**

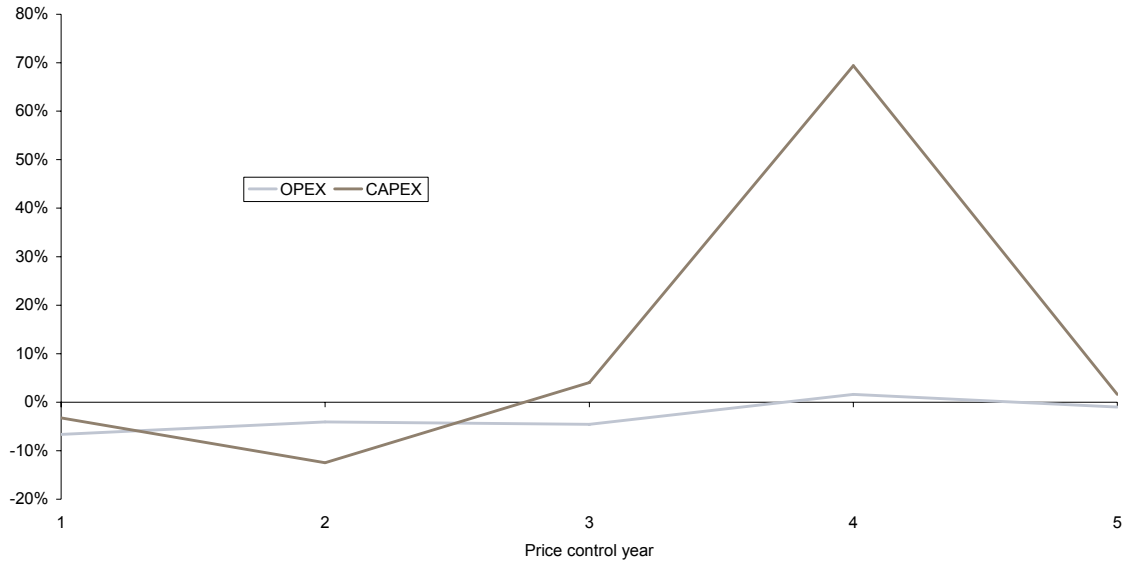
Source: Oxera calculations.

It can be seen that this restriction reduces the appropriate level of surplus to approximately £555m–£750m.

Systematic variation

The results above are those where the standard deviation/variance is based on the entire sample, even though there is evidence to suggest that there is systematic variation across the price control period. Corroborating the findings from Ofwat, the figure below demonstrates the 'average' under- or outperformance against regulatory targets across different years of a price control, with spend below the regulatory target much more likely in the early years of the price control, and overspend more prevalent in the later years.

Figure 4.5 Average under- and overspend across the control period



Note: Only two 'Year 5' CAPEX observations were contained in the sample. These results are based on full the sample—ie, before 'censoring' of any data, as discussed above.
Source: Oxera calculations.

To account for this systematic variation in under-/outperformance, so that only the genuine underlying volatility in costs is captured, one approach would be to consider only under- or overspend across the five-year period. However, this would reduce the size of the sample significantly, limiting the reliability that could be placed on any statistical inference. It would also ignore the likelihood that, not withstanding the systematic pattern shown above, the annual volatility in costs will be of some significance in determining the appropriate annual margin. Instead, three methodologies to account for this pattern were considered, each of which has advantages and disadvantages, as discussed below.

– The first approach ('Option A') divides the overall sample of observations into five sub-samples of observations, one for each year of a 'typical' price control period. With these five sub-samples established, the same exercise can be undertaken as above: the mean and standard deviation of cost performance in, for example, year 1 of a price control can be calculated, and with this established, the figures can be applied to the ORR's forecasts of Network Rail's year 1 expenditure in CP4.

  The advantage of this approach is that it provides a way of controlling accurately for the systematic variation in costs. The downside is that, due to the sample of observations available, there are only a few observations that can be used for some years—particularly year 5 for CAPEX performance, where only two observations were available.

– The second approach ('Option B') is quite similar to the first, in that the 'expected' under- or outperformance in each year of a price control is calculated. This is then deducted from each individual observation of cost performance depending on the year to which the observation related, to form an 'expectations-adjusted' percentage cost under- or outperformance. With each observation in the sample adjusted in this way, the full sample of observations is then used to calculate the standard deviation of cost performance. (The nature of this approach means that the 'expected' cost under- or outperformance is zero, as the observations are normalised to examine performance around an expected level only.)

  The advantage of this approach is that the full sample is available to calculate the typical level of volatility, in contrast to the approach above. It is also arguably an advantage not to have the 'complicating' issue of examining the difference between measuring deviation around the 'expected' level of under- or outperformance as opposed to around the regulatory target. However, it still requires each year of the price control to be examined in isolation to make the initial adjustment, meaning again that the expectation adjustment for CAPEX under-/outperformance in year 5 of the price control is informed by only two observations.

– The final approach ('Option C') adopted to control for the systematic variation in cost performance does so by constructing a sample of rolling average under- or outperformance. This means that the sample consists of cost performance in year 1, average cost performance in years 1 and 2, average cost performance in years 1, 2 and 3, etc. In this way, the benefits of seeking to examine performance across an entire control period are maintained, and at the same time the total number of observations in the sample is not reduced too far to prevent reliable statistical inference.

  This approach places the most emphasis on cost performance in year 1 of the price control, as this feeds into (with differing weights) each of the observations within the sample. While this is partly a disadvantage, there is also arguably some merit in placing emphasis on cost performance in year 1. This is because, for Network Rail, this will be when most reliance will need to be placed on the cash buffer since the balance sheet

will be weaker than in other years when the (unused) cash buffer will have strengthened the balance sheet.

The results of these three methodologies are presented in the tables below. In each case, the methodologies were applied after the data had been truncated at ±49% to take account of exceptional circumstances.

Table 4.8 Controlling for systematic variation: Option A

	Range for ORR's annual expected expenditure	Spend category used	Margin calculated by reference to 'expected' expenditure or 'regulatory target'	Maximum % overspend to be covered (mean +1.96 standard deviation)	Maximum overspend to be covered	Required surplus
OPEX & maintenance	1,380–1,920	OPEX	Expected	Varied year on year. Range of 12.7–18.8%	211–249	211–249
	1,590–1,860	OPEX	Regulatory target	Varied year on year. Range of 8.3–19.8%	259–301	259–301
Renewals & enhancement	1230–2,400	All CAPEX	Expected	Varied year on year. Range of 1.4–83.1%	35–1971	134–187
	1230–2,400	All CAPEX	Regulatory target	Varied year on year. Range of 3.0–88.8%	18–1,844	128–186
Total			**Expected**			**345–436**
OPEX & maintenance			**Regulatory target**			**387–487**

Note: The range for ORR annual expected expenditure is wider as this approach considers each year individually rather than annual average expenditure.
Source: Oxera calculations.

Table 4.9 Controlling for systematic variation: Option B

	Range for ORR's annual expected expenditure	Spend category used	Margin calculated by reference to 'expected' expenditure or 'regulatory target'	Maximum % overspend to be covered (mean +1.96 standard deviation)	Maximum overspend to be covered	Required surplus
OPEX & maintenance	1,590–1,860	OPEX	n/a	16.1%	257–300	257–300
Renewals & enhancement	1,550–2,220	All CAPEX	n/a	53.4%	828–1,186	124–178
Total						**381–478**

Source: Oxera calculations.

Table 4.10 Controlling for systematic variation: Option C

	Range for ORR's annual expected expenditure	Spend category used	Margin calculated by reference to 'expected' expenditure or 'regulatory target'	Maximum % overspend to be covered (mean +1.96 standard deviation)	Maximum overspend to be covered	Required surplus
OPEX & maintenance	1,590–1,860	OPEX	Expected	11.0%	175–206	175–206
	1,590–1,860	OPEX	Regulatory target	15.4%	246–287	246–287
Renewals & enhancement	1,550–2,220	All CAPEX	Expected	54.4%	845–1,210	127–181
	1,550–2,220	All CAPEX	Regulatory target	50.2%	778–1,114	117–167
Total			**Expected**			**302–387**
OPEX & maintenance			**Regulatory target**			**362–454**

Source: Oxera calculations.

It is striking that all three of these methodologies, although approaching the issue from a somewhat different perspective, support a margin in the region of £300m–£500m.

5 Commitment facilities

5.1 Rationale, advantages and disadvantages

The final approach considered is an analysis of what the typical 'market' response is to the possibility of liquidity constraints faced by highly geared structures induced by cost or demand shocks, and using this market response to inform what the appropriate margin for Network Rail should be.

To deal with short-term fluctuations in costs and revenues, highly geared structures typically put in place working capital facilities (or commitment facilities), which the company can draw on to preserve liquidity. However, having access to and drawing on any such facilities causes the company to incur costs. If the expected (or maximum) level of costs incurred as a result of having access to these facilities can be calculated, this might inform the appropriate size of the surplus that Network Rail would require, on the basis that, with a surplus of this size, it would be remunerated for the expected (maximum) level of costs that it would incur in having access to these liquidity facilities.

The advantage of this approach is that, by focusing on the market response to the possibility of cost shocks in highly geared structures, the approach arguably relies on less subjectivity than alternative approaches. However, the potential problem with the approach is that the information available on Network Rail's current working capital facilities relate to a situation in which Network Rail benefits from the provision of the FIM, arguably reducing the working capital requirements that the company requires. By contrast, one of the reasons behind providing a surplus is to facilitate the move towards the issuance of non-FIM-protected debt. Although Network Rail's working capital requirements with the FIM in place are likely to be the best available comparator for Network Rail without the FIM, this consideration suggests that the results derived from this methodology could be considered a lower-bound estimate. A further potential problem with the approach is that it may involve a degree of circularity—ie, the size of the working capital facilities that Network Rail requires may be informed by the periodic review settlement, when an aspect of this settlement may be determined by the size of the working capital facilities to which Network Rail has access.

5.2 Results and application to Network Rail

Discussions with Network Rail have revealed that the current working capital facility that Network Rail has available is £1,000m, down from the £2,750m reported in the 2006 Annual Report. Furthermore, the company has suggested that the 'Kreditanstalt für Wiederaufbau working capital facility'—recorded in Note 20 to the 2006 Annual Report at £228m—should not be considered a working capital facility. There is also the £4 billion Tranche A facility initially provided by the SRA when Network Rail was being formed.

On this basis, the total working capital facilities to which Network Rail has access in order to provide liquidity in the event of cost shocks is £5 billion. However, the accounts also make it clear that the £4 billion standby facility will 'only be called on as a last resort.' In the same way that, in the previous methodology, it was argued that extreme events should not be used to inform the size of the annual buffer, as additional regulatory protective measures are also in place (ie, interim review provision), so it can be argued that this standby facility should also be excluded from the analysis. This would lead to the maximum for the working capital facilities to which Network Rail has access in a typical year being £1,000m.

Calculating the cost associated with having access to, and drawing on, these facilities is made difficult by the information available in the public domain. Typically, the costs associated with these facilities would consist of:

– the interest cost on any funds drawn down from the facility;
– a 'commitment fee' on any undrawn funds, which is typically lower than the interest rate on funds drawn down, but which reflects the cost of the company having access to the facility on a short-term basis;
– an arrangement fee—a fixed amount incurred to find a creditor willing to provide such a facility.

However, Oxera has been unable to find any information in relation to these three costs. In addition, in the same way that the ORR needs to decide whether the interest costs associated with Network Rail's debt should be remunerated with or without the FIM, so a decision needs to be taken about whether the interest costs on these facilities should be calculated with or without the benefit of the FIM. (At present, as for Network Rail's other borrowings, they would benefit from the FIM if these funds were called on.) In the absence of any better information, an interest rate assumption of 5%, as used in the analysis in section 4 above, combined with working capital facilities of £1,000m, would imply a maximum annual cost of access to the facilities (excluding arrangement fees), and hence an appropriate annual buffer, of £50m. Using the 5.31% interest rate referred to in Network Rail's annual report as its typical interest rate for overdrafts and short-term loan facilities would imply a margin of £53.1m.

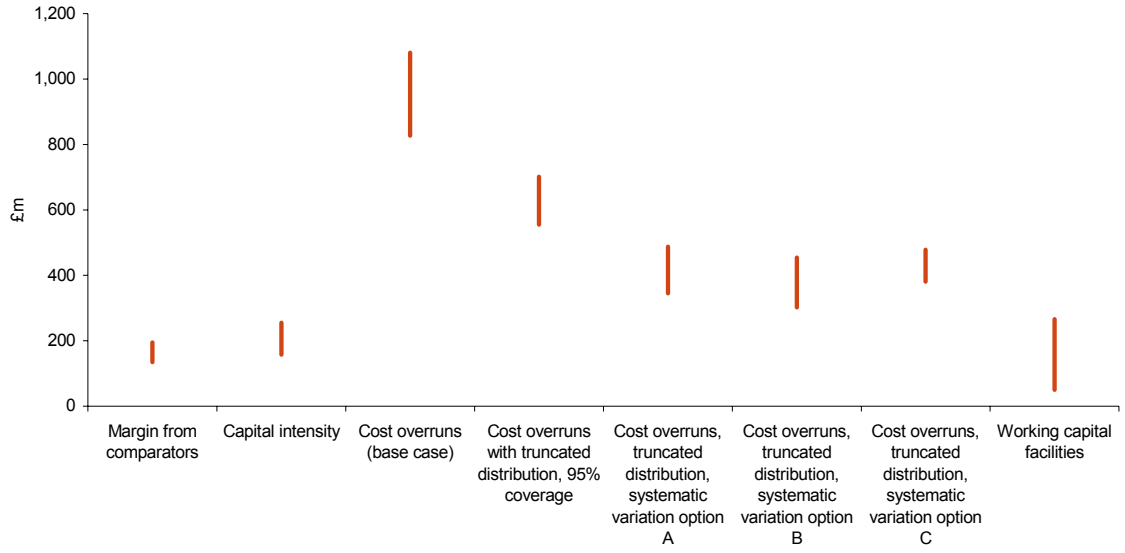
If the Tranche A facility were included, the analysis would support a range of £250m–£265.5m.

6 Conclusions

This report has conducted some preliminary analysis of the appropriate amount of surplus margin, over and above interest costs, to incorporate into Network Rail's allowed return, or to allow it to retain following the payment of a FIM fee. The primary purpose of this surplus margin is to provide some form of annual cash-flow buffer for Network Rail to absorb cost shocks.

Four methodologies have been considered, each with strengths and weaknesses. Therefore, the results from the methodologies should be considered 'in the round'. In this context, Figure 6.1 below indicates the size of the margin from each methodology considered.

Figure 6.1 Annual cash-flow buffer required under different methodologies



Source: Oxera calculations.

This figure shows that three of the four methodologies suggest that a margin in the region of £150m–£250m would be appropriate. The only methodology that falls outside this range is that derived from the cost overrun methodology, where, depending on the assumptions used, an annual buffer of around £1,054m can be justified. However, for the various reasons discussed in the text, the 'vanilla-case' for applying this methodology is likely to significantly overstate either Network Rail's cost volatility, or the extent of this cost volatility that needs to be accommodated through the surplus margin. However, if this methodology is applied with these factors adjusted for—ie, with the truncated distribution for cost performance (where extreme cost performance is excluded because it is dealt with through the interim review provisions), and various approaches are taken to seek to account for systematic variation in cost performance across the control period—this methodology broadly suggests a range of between £350m and £450m. This is much closer in line to the other methodologies and, as such, supports a much narrower range for the appropriate margin.

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