RISK ADJUSTED COST OF CAPITAL FOR NETWORK RAIL

OFFICE OF RAIL REGULATION

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Report

FINAL

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CONTENTS

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EXECUTIVE SUMMARY

This paper has been prepared by CEPA for ORR and presents our assessment of the appropriate risk-adjusted cost of capital for Network Rail (without financial indemnity mechanism (FIM) support).

1. Introduction and overall methodology *(Section 1)*

The context for this study is ORR's proposals for the high-level financial framework for Control Period 4 ('CP4'). In particular, ORR have decided: to set an allowed return on the basis of a 'risk-adjusted cost of capital'; to support Network Rail's proposal to raise finance for its future investment without support of the FIM, which would only be used to support existing debt (including refinancing of that debt) and; to provide that the allowed return above Network Rail's financing cost be split between a risk buffer and a ring-fenced investment fund.

In this context, CEPA's approach to setting the cost of capital is to identify the weighted average cost of capital ('WACC') that would be faced by an efficient, conventionally financed (i.e. debt and equity) business which has comparable assets and risk characteristics as Network Rail[1]. We believe that this is the right approach, and it is consistent with the methodology that other UK regulators have adopted.

However, adopting this approach should not be taken to suggest any change in the financial or corporate structure of Network Rail. It is also important to note that our approach assumes that there is no financial indemnity support for the 'notional network rail'.

2. Notional gearing *(Section 2)*

There is now strong regulatory precedent to set the level of gearing in the WACC at a 'notional' level as a proxy for the 'optimal' gearing. This level of gearing reflects the trade-off between the benefits of an increased tax shield and the costs of higher default risk. Regulators have typically set the notional gearing at a level that is consistent with maintaining a 'solid' investment grade rating. We interpret this as being in the range BBB+ to A[2].

Evidence of the relationship between gearing and credit ratings is mixed, but it suggests that it is entirely possible to maintain a solid investment grade rating at gearing levels as high as 70%. We have also looked at a high-level model of Network Rail to consider how different gearing levels impact on adjusted interest cover – which is one of the ratios that the rating agencies focus on in setting the issuer rating.

Given regulatory precedent on the notional gearing levels set for broadly comparable regulated sectors, we believe that an appropriate range for the notional gearing to be used by ORR in setting the WACC is 60 – 65%. For the purpose of this analysis, we use the

[1] We refer to this as the 'notional network rail'

[2] Standard & Poor's ratings.

central assumption of 62.5%. But the actual gearing assumption to be used by ORR would need to be confirmed as part of final judgements about the overall price settlement[3].

3. Cost of debt *(Section 3)*

Our approach to estimating a range for the pre-tax[4] cost of debt has been to:

- Discuss how an efficiently operated notional network rail might be expected to finance itself in terms of debt maturities, the mix of nominal and index-linked fixed debt and the use of hedging.
- Review the available evidence on the risk free rate, debt premia and the 'all in costs' of debt – looking at spot rates, medium and longer-term averages.
- Identify ranges for the cost of debt of a notional network rail and cross check these against a high-level understanding of the likely evolution of Network Rail's actual cost of debt.

Our judgement is that an appropriate broad range for the cost of debt for a 'notional network rail' with gearing of 62.5% would be **2.7% - 3.5**%.

Our view about the appropriate narrow range depends on the extent to which it is appropriate for ORR to take account of the possibility of mean reversion in CP4. Factors that contribute to this judgement include: (i) whether ORR expects to introduce 'trigger' or 'indexation' mechanisms on the cost of debt; and (ii) whether at the time that the WACC is set for CP4, Network Rail has hedged a significant proportion of the interest costs on its future financing requirements. If either is the case, then an appropriate cost of debt is likely to be in the range of **2.7% – 3.00**%.

In the absence of either triggers or hedging we believe that it would be appropriate for the regulator to allow for an element of mean reversion. This suggests a narrow range which is slightly higher, i.e. **3.0% – 3.25**%.

4. Cost of equity *(Section 4)*

Our approach to estimating an appropriate post-tax[5] cost of equity for a notional network rail is to focus on the overall required return on equity. This approach reflects well-documented concerns about the robustness of estimates of the cost of capital derived using bottom-up CAPM estimates alone.

The longer-term average required post-tax return on equity as reported by Smithers (2006) is in the range 6.5% - 7.5%. Our judgement is that an appropriate range for the

[3] Since the level of gearing that can be sustained at an investment grade will depend on the allowed revenue for the WACC as well as the other assumptions relating to capex, opex and amortisation.

[4] In what follows, where we refer to the 'cost of debt' it is a reference to the real pre-tax cost of debt, unless otherwise stated.

[5] In what follows where we refer to the 'cost of equity' it is a reference to the post-tax cost of equity, unless otherwise stated.

cost of equity for a notional network rail in CP4 is 6.5% - 7.0%. If anything we believe that a point estimate is unlikely to be at the top end of this range. This reflects in particular:

- Evidence of the actual required returns by equity investors in a range of market acquisitions of regulated utility businesses.
- Recent precedent on the determined cost of equity for comparable regulated utilities.
- General market conditions – which point to historically low required returns on all risk bearing assets (although we recognise the recent tightening of financial markets).

However, we note that in seeking to define a point estimate for the allowed cost of equity (for a notional network rail) ORR would need to make judgements about: (i) the allowance to provide for mean reversion; and (ii) the relative riskiness of Network Rail compared with other regulated utilities.

5. WACC *(Section 5)*

Tables 1 and 2 below bring together the above analysis to provide two possible narrow ranges of estimates for the post-tax vanilla WACC[6] (both assume a notional gearing of 62.5%).

The first range, in Table 1, is consistent with the lower range of estimates for the cost of debt – i.e. it is calculated on the basis that ORR either introduces 'indexation' / 'trigger' mechanisms or has a significant hedging programme in place.

The second range, in Table 2, assumes that there is no such 'indexation' / trigger' mechanism for the cost of debt and no significant hedging, and therefore allows for some element of mean reversion

Table 1 – WACC (with cost of debt 'triggers')

Sample	Lower	Upper
Post-tax Cost of Equity	6.5%	7.0%
Pre-tax Cost of Debt	2.7%	3.0%
Gearing	62.5%	62.5%
Post-tax vanilla WACC	**4.1%**	**4.5%**

[6] The post-tax vanilla WACC is calculated using the pre-tax cost of debt and the post-tax cost of equity. See Annex D for a fuller definition.

Table 2 – WACC (without cost of debt 'triggers')

Sample	**Lower**	**Upper**
Post-tax Cost of Equity	6.5%	7.0%
Pre-tax Cost of Debt	3.0%	3.25%
Gearing	62.5%	62.5%
Post-tax vanilla WACC	**4.3%**	**4.7%**

1. INTRODUCTION

The 2008 Periodic Review (PR08) being undertaken by ORR will determine the allowed revenues that Network Rail may receive, and the regulated outputs it must supply. In deciding on Network Rail's allowed revenues an important component will be the return on its regulated asset base (RAB) that the company is allowed to earn.

This report has been prepared by CEPA on behalf of ORR and presents our assessment of the appropriate cost of capital for a risk-adjusted Network Rail (i.e. without the financial indemnity mechanism (FIM) support). The broad methodology has been discussed with ORR, but the views expressed are those of the authors.

1.1. Terms of reference

The terms of reference for this work as provided by ORR are set out in full in Annex A. In summary ORR have requested advice in the following areas:

- Analysis of the cost of debt associated with Network Rail's embedded debt including what impact the indexation of (a component of) the cost of debt might have.
- Analysis of the incentives created by the recommended methodology and what implications these have for Network Rail's financing strategy and the regulatory framework.
- The estimated range for the cost of debt.
- The appropriate range for the cost of equity for a capital intensive regulated network utility.
- The appropriate notional gearing level for a company such as Network Rail along with recommendations on the approach to be taken for Network Rail.
- An estimated range of Network Rail's cost of capital taking the above into consideration.

A separate study has been commissioned on the use of triggers in the cost of capital, referred to by ORR as 'indexation'.

1.2. Background

A key feature of Network Rail regarding the approach that ORR is proposing to take in setting the cost of capital is that it is a company limited by guarantee (CLG) benefiting from the Government's credit guarantee via the FIM.

The particular context for this study is the development of the ORR's thinking on the financial framework and the corporate finance incentives facing Network Rail. These

issues are set out in Section 7 of ORR (February 2007) [7] and the earlier consultation paper on the financial framework[8]. The key points of relevance are:

- ORR's decision to support Network Rail's proposal to raise new debt in CP4 on an unsupported basis (the FIM will still apply to the refinancing of existing debt); and also to place greater emphasis on recent cost of debt data.
- The proposal that Network Rail pay DfT, as provider of the FIM, a fee reflecting the value of the credit guarantee, expected to be around 50 basis points.
- The allocation of surpluses to a risk buffer and a ring-fenced investment fund.

In this context, the appropriate approach to setting the cost of capital is to seek to identify the weighted average cost of capital that would be faced by an efficient, conventionally financed[9] business with comparable assets and risk characteristics as Network Rail[10]. This is how we have interpreted the 'risk-adjusted cost of capital' referred to by ORR in its consultation paper and the subject of this paper.

For the avoidance of doubt, reference to a 'notional network rail' with both debt and equity (and a weighted average cost of capital) should not in any way be taken to suggest or imply any change in the financial or corporate structure of Network Rail.

We also draw specific attention to the fact that our approach does not seek to estimate or make any explicit judgements about the appropriate level of the FIM fee. Rather the cost of debt is set assuming that there is no financial indemnity / support from the Government. This has two particular implications:

- First, it means that the CEPA ranges for the cost of capital (and particularly the debt premium) should only be the same as the ranges set by ORR if the difference between the debt premium on 'AAA' rated debt (i.e. the rating of Network Rail's existing guaranteed debt) and 'solid investment grade' rated debt (i.e. BBB+ to A) is the same as the FIM fee.
- Second, we do not take account of any assumed 'implicit' support of new debt issues in CP4, which will not be supported by the FIM.

1.3. Structure of report and CEPA methodology

In order to define the allowed revenues that relate to the cost of the capital, ORR needs to determine for the next review period: the cost of debt[11]; the cost of equity; the appropriate gearing (measured as net debt: RAB); an approach to allowing for taxation costs; and the appropriate RAB against which the WACC should be applied to get the allowed revenues.

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[7] February 2007 paper, *Periodic Review 2008: Advice to Ministers and framework for setting access charges.*

[8] Office of Rail Regulation, *Periodic Review 2008: Enhancing Incentives for Continuous Improvements in Performance: A Consultation Paper,* July 2006. This paper draws particularly on CEPA 2006, *Incentives in the GB Rail Industry* – on options to increase corporate finance incentives acting on Network Rail.

[9] A limited company funded with a mix of debt and equity.

[10] We refer to this as the 'notional network rail'

[11] All of these parameters are in real terms.

In line with the terms of reference, this report focuses particularly on the cost of debt, cost of equity and the approach to gearing. From these we estimate the appropriate post-tax vanilla WACC[12] for Network Rail in CP4. For each element of this framework we are seeking to set the parameters on a forward looking basis – i.e. to an appropriate level for the forthcoming price review period. We do not discuss either the approach that ORR might use to allow for taxation costs or any issues relating to the size and treatment of the RAB.

The report is structured as follows.

- Section 2 discusses the appropriate gearing of a 'notional', conventionally financed, network rail. In line, with the methodology used by other UK regulators in setting the WACC, we proposed that ORR uses a 'notional' gearing approach.
- Section 3 assesses the evidence on the risk-free rate and the debt premium and provides CEPA's judgement on the appropriate range for the cost of debt for Network Rail in CP4. As part of this analysis we have included a discussion of the factors that might be taken account of in assessing how an efficiently financed notional network rail might structure its debt portfolio; and how this compares with Network Rail's current and planned approach.
- Section 4 discusses the appropriate post-tax cost of equity for an efficiently financed business with similar risk characteristics to Network Rail. Given the known weakness of the Capital Asset Pricing Model ('CAPM'), CEPA's approach is to give particular weight to available market evidence on the overall required return on equity.
- Section 5 brings this analysis together to provide CEPA's judgement of the range for the post-tax vanilla WACC.

There are five Annexes to this paper, as follows:

- Annex A provides the full terms of reference.
- Annex B provides a high-level view of the issues that need to be considered in assessing the relative riskiness of Network Rail compared with other regulated utilities (water, energy and airports in particular). This is relevant for the assessment of the appropriate gearing, debt premium and cost of equity. We have not as part of this study sought to carry out this analysis in detail. However, for the purposes of this paper, we make the assumption that Network Rail is at the low end of the range in terms of relative riskiness of UK regulated utilities.
- Annex C provides a summary of the approaches used recently by other UK regulators in setting the WACC[13]. Wherever relevant we include key points emerging from this review in the main sections of the report.

[12] Annex D provides summary definitions of the measures of the WACC for reference

[13] This review is limited to the 'broadly' comparable UK regulated sectors, i.e. excluding telecoms and post.

- Annex D provides some common definitions of the weighted average cost of capital (the 'WACC').

1.4. Market context

A major theme in CEPA's approach to estimating the appropriate WACC for regulated network businesses is our emphasis on market evidence. This is particularly relevant in our approach to estimating an allowed return on equity, but is also true in considering the other elements of the WACC.

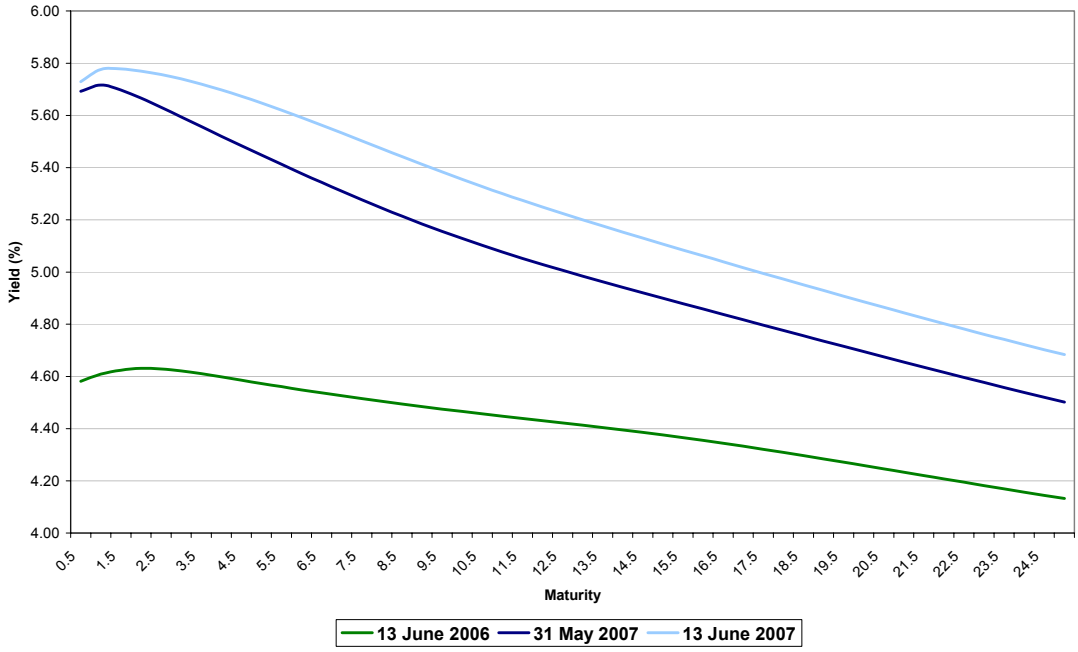
The market context in which ORR is setting the WACC for Network Rail is one in which required returns on assets of all classes have been at a sustained historically low level. Market commentators point to both global and domestic UK factors to explain this:

- Global factors include high personal savings rates in ageing populations such as Japan; high net notional savings rates particularly in China and the oil-producing Middle East Countries; and a decline in debt and equity risk premia.
- Domestic UK factors include developments in the pensions industry, stimulated by changes in legislation and accounting standards, which have resulted in an increase in demand for long life, index-linked assets in particular.

However, we note that, at the time of writing, there has been turbulence in the debt markets – which has resulted in significant movements in risk-free rates. Figure 1.1 shows the development of the GBP yield curve over the last few weeks and compared with a year ago. The key point to note is that there is an upward trend in yields across all maturities, and that rates have recently increased relatively sharply (by around 20 basis points).

It is not possible or sensible for ORR to seek to predict whether these changes will be sustained, reversed, or whether they will be the turning point in terms of reversion to the longer average rates of return. The important point to note is that in setting the components of the WACC on a forward looking basis ORR should take account of the possibility of mean reversion alongside other relevant factors.

Figure 1.1: Movements in the GBP yield curve



2. NOTIONAL GEARING

2.1. Introduction

A key factor for regulators in assessing a company's WACC is the assumption made about the appropriate level of gearing that would be sustained by an efficiently financed business.

In this section we discuss the appropriate level of notional gearing as a proxy for 'optimal gearing' for the assumed, conventionally financed network rail. Section 2.2 provides a summary of recent regulatory precedent. Section 2.3 considers the relationship between gearing and issuer rating for other regulated utilities.

2.2. Regulatory precedent

2.2.1. Approach

In theory, the optimal level of gearing is that level of gearing at which the marginal interest tax shield benefit (arising from tax allowances) equates to the marginal default risk cost. In practice, regulators have not sought to estimate this optimal level directly. Rather they have tended to use a 'notional' level of gearing as a proxy for the optimal rate.

The notional gearing is typically defined as the gearing ratio that would be consistent with an efficiently managed company achieving a solid investment grade rating (i.e. A, A-, or BBB+)[14].

Other key points to note are as follows:

- Gearing is calculated using the ratio of net debt to RAB. The principle reason for this is that regulators are concerned with companies' required return on their regulated assets.
- It is the issuer rating at the corporate level that should be considered when estimating the cost of debt for regulated companies.

Note that use of a 'solid' investment grade by regulators rating in setting allowed revenues allows some headroom compared with the licence requirement to maintain an issuer investment grade rating (in water and energy particularly).

[14] Standard & Poor's ratings.

2.2.2. Determinations

Table 4.1 shows recent notional gearing assumptions adopted by regulators to calculate the WACC.

Table 4.1: Notional gearing regulatory precedent

Regulator	Notional Gearing Assumption
Ofgem GDPCR (2007)	62.5%*
CAA (2006)	60%*
Ofgem TPCR (2006)	60%
Ofgem DPCR (2004)	57.5%
Ofwat (2004)	55%

** Initial proposals.*

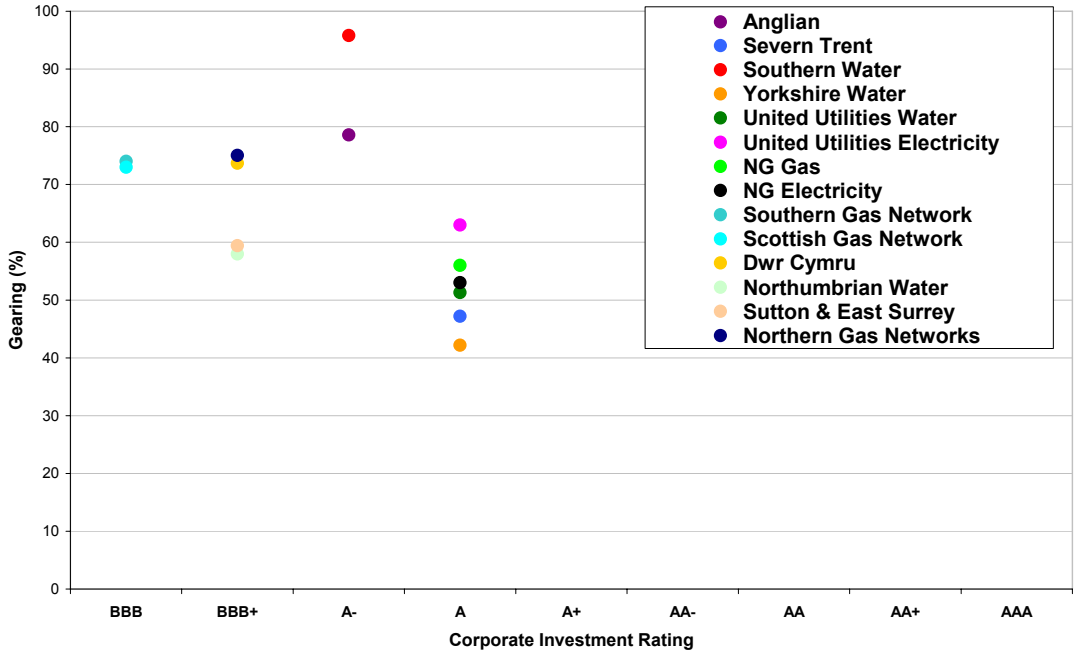
2.3. Market evidence

In order to inform a judgement about an appropriate assumed gearing for the notional network rail, Figure 4.1 shows the relationship between gearing and issuer credit rating for a range of regulated utilities. Points to note are as follows:

- In general, companies with an 'A' grade investment rating have gearing below 70%. There are examples of companies, such as Anglian and Southern Water, that have sustained gearing levels above 70% and held an investment grade rating at the 'A-' level.
- There is some overlap in the gearing ranges for the A rated companies and those with 'BBB+' corporate rating. The four companies with a 'BBB+' corporate rating are broadly in the range 60% - 75%. Within this range: both Sutton & East Surrey and Northumbrian Water have gearing around (slightly) below 60%. Northern Gas Networks and Dwr Cymru are examples of 'BBB+' rated companies with gearing levels higher than 70%.
- The two companies with BBB ratings (Scottish Gas Networks and Scottish Gas Networks) both have gearing in excess of 70%.

The fact that the evidence is mixed is not surprising given that gearing is clearly only one of the factors that will be considered by the rating agencies in assessing issuer's rating. But it does suggest that UK regulated companies are able to maintain a corporate investment grade rating with gearing ratios exceeding 65-70%.

Figure 4.1: Gearing levels for regulated utilities versus S&P credit rating



2.4. Conclusion

Identifying an appropriate notional gearing is inevitably a judgement. On the basis of the above evidence and regulatory precedent we believe that a reasonable assessment for the notional network rail is likely to be in the range 60 - 65%.

Within this range, we believe that a reasonable point estimate for the purpose of calculating the WACC would be 62.5%. In making this assumption we have taken account of, amongst other factors, the judgement that Network Rail is likely to be at the low end of the range of riskiness for regulated utilities

We recognise that it would be possible for ORR to make a different assumption in determining the allowed revenues for Network Rail, particularly if it believes that, in practice, Network Rail would be able to maintain a significantly high gearing whilst retaining an investment grade rating.

3. THE COST OF DEBT

3.1. Introduction

In this section we assess the real cost of debt that would be faced by an efficiently operated and financed network utility with comparable assets and business risks to those of Network Rail. This will comprise an estimate of the real risk free rate and the debt premium (taken to be the spread on corporate bonds).

In what follows we first summarise regulatory precedent in setting the cost of debt, before providing a detailed description of our methodology. The remainder of this section then provides our findings from applying that methodology.

3.2. Regulatory precedent and CEPA methodology

3.2.1. Regulatory precedent

Annex B to this report provides a review of the approaches taken by regulators in setting the WACC with particular reference to the cost of debt. Key points to note from this analysis are as follows.

Gearing

Recent precedent suggests that all UK regulators now set the cost of debt with reference to a level of gearing that is sufficient to achieve a particular investment grade rating (as discussed in section 2 above).

Embedded debt

Both Ofgem and Ofwat considered the issue of embedded debt in their respective 2004 determinations (although neither have done so since) and whether to allow a premium to allow for debt raised in previous debt market conditions. Ofgem opted not to do so on the grounds that: (i) interest rates had been sufficiently stable, which meant that there was unlikely to be much difference between the cost of debt set on a forward looking basis and the average cost of debt faced by the regulated companies at the beginning of price review period; and (ii) to allow a premium would reduce the incentive for companies to actively and efficiently manage their debt portfolios.

Ofwat also declined to include an embedded debt premium, concluding that since their assessment of the allowed cost of debt placed greater emphasis on longer-term historic averages for the risk-free rate and the debt premium and subsequently was at the high end of the range, the need for a premium was effectively negated.

Split cost of capital

Ofgem considered the idea of a split or multiple cost of capital for assets with different risk profiles in the context of TPCR (albeit only in the initial proposals). This would have provided an appropriate return on existing assets, whilst increasing the reward available to licensees for most difficult / risky investment.

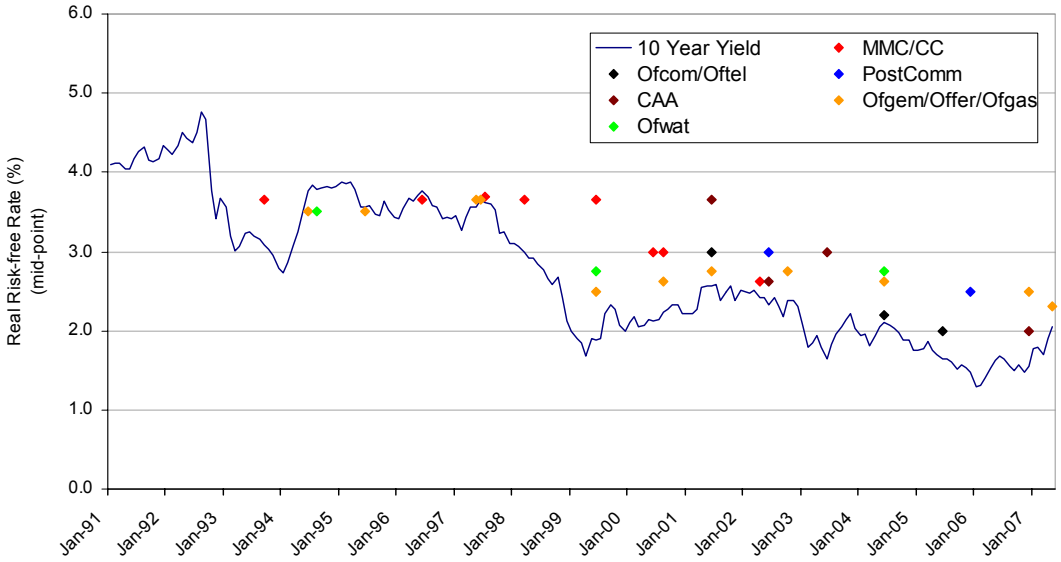
The addition of new assets (at a higher rate of return) to the existing asset RAB (at a lower rate of return) would offer the possibility of a lower rate of return over time. However, they concluded that a similar effect could also be achieved by establishing an appropriate rate of return over the entire asset base, reflecting the risks involved in an investment in both existing and new assets. We broadly share this view.

Forward looking estimates based on historic averages

In determining a forward looking estimate of the cost of debt, regulators have typically placed emphasis on short and long-term historic averages of the components of the cost of debt in making their determinations. The implication of this, as show in Figure 3.1 below, is that regulators' determinations have tended to lag movements in both the risk-free rate (as well as debt premiums), although it will be interesting to see how this picture evolves in light of the recent increases in the 10 year risk free rate. We believe that the reasons for this are clear:

- First, using historic averages recognises the fact that an efficiently financed utility will finance itself with a significant proportion of fixed-interest debt in previous control periods. Setting the cost of debt based only on current or forward rates may result in the regulated utility having insufficient allowed revenue to fund its actual cost of debt.
- Second, using historic averages allows for some mean reversion (although the precise level of allowance for mean reversion will depend on the actual historic period chosen). Given that the cost of capital needs to be set for the forthcoming control period, regulators have aimed off from (recent) low rates in order to allow for the possibility that market conditions might change during the period.

Figure 3.1: Monthly average yields on 10 year real zero coupon UK gilts vs regulatory real risk free rates



Source: CEPA, BoE

Recent decisions on the cost of debt

Table 3.1 below shows the recent decisions taken by regulators on the cost of debt. It shows that there has been a tendency to reduce the allowed cost of debt in recent years.

Table 3.1: Recent regulatory decisions on the cost of debt

Regulator	Decision	R_f	Debt premium	CoD Range	CoD Used
CAA	Heathrow** (2006)	2.00%	1.00%	3.00%	3.00%
CAA	Gatwick** (2006)	2.00%	1.00%	3.00%	3.00%
Ofgem	TPCR (2006)	2.50%	1.25%	3.75%	3.75%
Ofwat	Water & sewerage (2004)	2.50-3.00%	0.80-1.40	3.30-4.40%	4.30%
Ofgem	DPCR4 (2004)	2.25-3.00%	1.00-1.80%	3.25-4.80%	4.10%
CAA	Heathrow (2002)	2.50-2.75%	0.90-1.20%	3.40-3.95%	3.675%*

**Midpoint, ** Proposal referred to the CC*

3.2.2. CEPA Methodology

As noted in the Introduction, in establishing the appropriate cost of debt for a notional Network Rail, we assume that the notional company will not benefit from any Government support which might otherwise reduce its cost of debt.

In practice, any such support, whether explicit or implicit, should be off-set by the FIM fee, which should be set at a level so as to avoid any windfall gains for Network Rail / ensure financeability. Against this context and the above regulatory precedent, our detailed methodology is set out below.

In section 3.3, we review how an efficiently operated company might seek to arrange its funding requirements. Key elements of this funding strategy include:

- the assumed mix of floating and fixed rate debt;
- the assumed mix of index-linked and nominal debt;
- the assumed maturity profile; and
- the assumed use of hedging.

In section 3.4, we consider the evidence available on the separate components of the cost of debt i.e. by looking at the risk-free rate and then the debt premium on solid investment grade (interpreted as BBB+ to A) rated bonds.

- For the risk free rate, we look at spot, five and ten year average rates, as well as the very long-term average, for both nominal and index-linked bonds across a

range of maturities (5, 10, 20, 30 and 50 year)[15]. We consider it appropriate to include data on risk free rates as implied by index-linked bonds as regulated companies are making increased use of these instruments[16].

Where possible we have used zero coupon gilts as the benchmark, as they eliminate re-investment risk, but these gilts are not currently available in the index-linked market or for longer dated maturities (beyond 20 years) for nominal gilts. In considering the long-term averages, we also review the evidence on term premia across different time periods – this is especially significant given the recent inverted yield curve.

- For the debt premium, we look at spot and five year average premia on A rated bonds of 10, 20 and 30 year maturity. We consider it appropriate to set the debt premia at a level consistent with a solid investment grade rating[17] (i.e. in the range BBB+ to A).

Section 3.5 sets out the evidence of actual 'all-in' costs of debt recently achieved by comparable utilities[18]. We consider this useful as it provides actual market data on the current cost of debt, which can be set against the evidence on the individual components of the cost of debt.

In Section 3.6, we provide our assessment of the appropriate range for the allowed cost of debt for a notional network rail, making a judgement as to the appropriate weighting on: current and average data for the risk free rate and debt premium; market evidence of current total costs of debt; and the potential for mean reversion.

Section 3.7 sets the above evidence and judgements against indicative estimates of the costs of debt faced by Network Rail in CP3, which we then adjust by the difference in cost of debt premium between an assumed solid investment grade rating and Network Rail's current 'AAA' rating. This is to take account of the 'risk-adjusted' approach adopted by ORR for CP4. We do this to cross check that our ranges are broadly consistent with Network Rail's actual cost of debt. (Note that ORR will also need to consider its approach to setting in-year allowed revenues and whether or not any smoothing should be adopted, which would have a further impact on financeability.)

[15] Ten year averages are not available for index-linked bonds.

[16] Our evidence on index-linked debt is sourced from the Debt Management Office (DMO)'s data on individual gilts. For nominal gilts, we use the Bank of England (BoE) data for maturities of up to 20 years, deflated by market expectations of inflation (which we believe to be the 'correct' deflator, as that that will, by definition, be the deflator priced into the markets, rather than say the BoE central target inflation of 2%). As the BoE does not supply data for maturities beyond 20 years, we use DMO data for longer maturities, and deflate this by the market expectations of inflation on the 20 year data. We realise there is likely to be some differential between market expectations of inflation 20 years and 30 years from now, but believe that this is the best available methodology.

[17] For debt premium, we rely on data from a range of sources including Reuters, Bloombergs and the Grant Thornton Utilities data base.

[18] This analysis draws on the report prepared by Lexicon for ORR, updated by CEPA with the most recent available data from Reuters.

In estimating Network Rail's cost of debt, we have considered (at a very high level) both the maturity profile and cost of its current debt, the likely profile and cost at the start of CP4 and its expected net financing requirements during CP4.

ORR have asked us to consider the treatment of embedded debt in our assessment of Network Rail's cost of capital. We broadly accept the recent approach adopted by Ofgem and Ofwat and therefore believe it inappropriate to include an estimated premium for embedded debt in our WACC calculation methodology.

3.3. Factors determining how an efficient company might finance itself

An efficiently financed business will look to adopt an 'optimal' debt structure that minimises its actual debt financing costs whilst also seeking to mitigate various risks such as interest rate risk, regulatory risk, inflation risk and refinancing risk. In doing so it will need to balance the factors set out below.

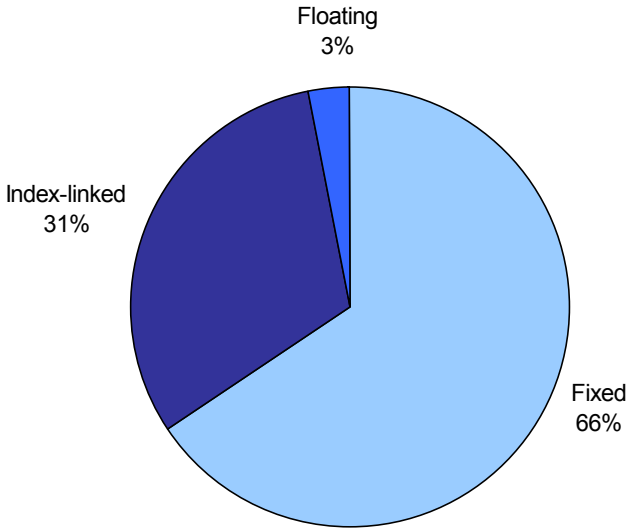
3.3.1. Mix of floating and fixed rate debt

In setting the cost of debt, we need to make an assumption about the level of fixed debt. If we assume a high level of fixed interest debt for the notional network rail in CP4, which might well be appropriate to reduce interest rate risk, then consideration needs to be given to the average cost of debt for that entity, rather than the potential spot rates available in CP4.

Regulated utilities typically make use of fixed rate debt. Recent analysis by Lexicon, as illustrated in Figure 3.2 below, demonstrates that UK regulated utilities have on average fixed (both nominal and index-linked debt) 97% of their debt. We understand that Network Rail, by comparison, fixes a minimum of 80% of debt within a Control Period.

We therefore assume that a notional network rail would use a high proportion of fixed debt and thus not be significantly exposed to interest rate movements on its existing debt (although clearly it will be exposed to interest rate movements on its re-financing and new debt programme – see related discussion in Section 3.3.4 on hedging).

Figure 3.2: UK regulated utilities mix of fixed and floating debt



Source: Lexicon

3.3.2. Mix of index-linked debt

Introduction

Given the difference in current pricing between index-linked gilts and nominal gilts (only part of which is explained by inflation expectations and inflation risk premia), we need to form a view as to the potential mix of index-linked gilts and nominal gilts for a notional network rail. This section reviews the market evidence on this issue, considers Network Rail's actual position and then forms a judgement as to the appropriate mix for CP4.

Market evidence

There is good evidence that regulated utilities in the UK are increasingly making use of index-linked debt instruments. In the past 12 months some 48 index-linked bonds have been issued by regulated utilities in the UK totalling £3,640m.

Figure 3.2 above showed the breakdown of outstanding bond debt by type for regulated water, gas and electricity companies in the UK – approximately 30% of bond debt was index-linked as of 2006, since then we believe the percentage has steadily increased due to the substantial index-linked issues undertaken by National Grid and the water companies.

The reasons for this seem clear: (i) yields on index-linked treasury securities are currently at historically low levels; and (ii) revenues in RPI-X regulation are by definition index-

linked so this method of financing has clear merits given that regulated companies' exposure to inflation risk is small[19].

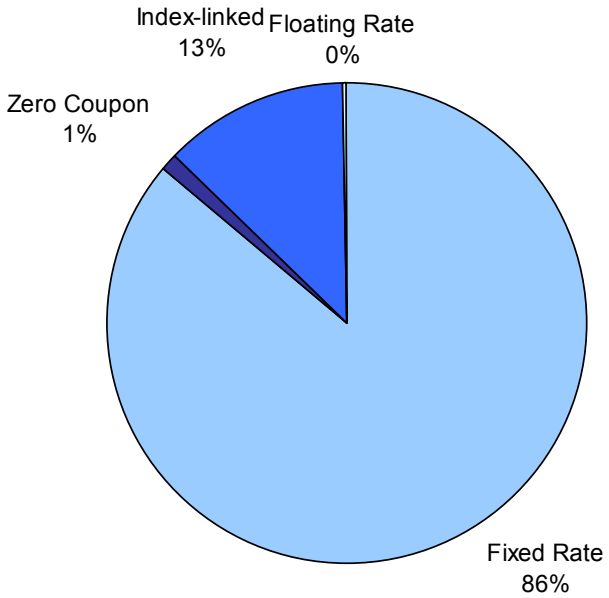
Furthermore, since most regulated companies face little or no natural competition, index-linked bonds can present debt providers with an attractive low-risk investment. (One of the main risks is the regulatory regime and potential changes to that regime, i.e. changes to level of volume or price/margin risk or a move away from RPI-X to some other form of regulation.)

Smithers (2006), however, have recently argued that it is inappropriate to use the yields on index-linked gilts in assessing the appropriate risk free rate. They argue this on the grounds that utilities have typically not used index-linked debt to finance their investment, and because the rates implied by indexed-linked bonds are affected by, in particular, current market conditions. Given the above analysis we do not agree with Smithers' judgement on this issue.

Network Rail

Figure 3.3 below shows the comparable breakdown for Network Rail as at May 2007 (i.e. following the issue of £1bn index-linked debt). It shows that currently around 10% of Network Rail's debt is index-linked.

Figure 3.3: Network Rail mix of fixed and floating debt (May 2007)



Source: ORR / Network Rail

Network Rail has indicated that it expects its net debt to rise to £22bn by the end of CP3 (i.e. March 2009) and that 'much' of its current £10bn debt raising programme will be index-linked. The exact proportion that is index-linked will depend upon on Network

[19] There does remains a very slight exposure to inflation risk relating to timing issues, in particular, the lag between setting the index benchmark and final repayment of the debt..

Rail's treasury management decisions and the market's appetite for these debt instruments, although it seems possible that the majority of the programme will be index-linked. This assumption is supported by the fact that Network Rail's recent £1bn index-linked issue was oversubscribed. If we assume that all of the current financing programme is index-linked, the company's total proportion of index-linked debt will stand at around 45% at the start of CP4. Should the company raise half of the debt on an index-linked basis this figure declines to around 25%.

Our assessment

Our judgment is that, in determining the cost of debt it is appropriate and realistic to assume that a significant proportion of Network Rail's future debt will be issued as index-linked bonds. The actual proportion will be determined by Network Rail policy and market conditions. But for the purpose of this analysis, in defining a proportion of index-lined debt that a 'notional' rail operator might be considered to use in financing itself, we consider a proportion of 30% as defensible. We would expect ORR to review this assumption prior to setting the WACC in the light of Network Rail's actual financing.

3.3.3. Debt maturity structure

Introduction

Given the current and historic differences in yields at different maturities, and that an efficiently financed rail infrastructure operator might be expected to finance itself with a mix of debt of different maturities, we need to form a view as to the potential maturity profile of the debt basket for a notional network rail. This assessment is provided in the context of Network Rail's weighted average asset life and weighted average maturity profile.

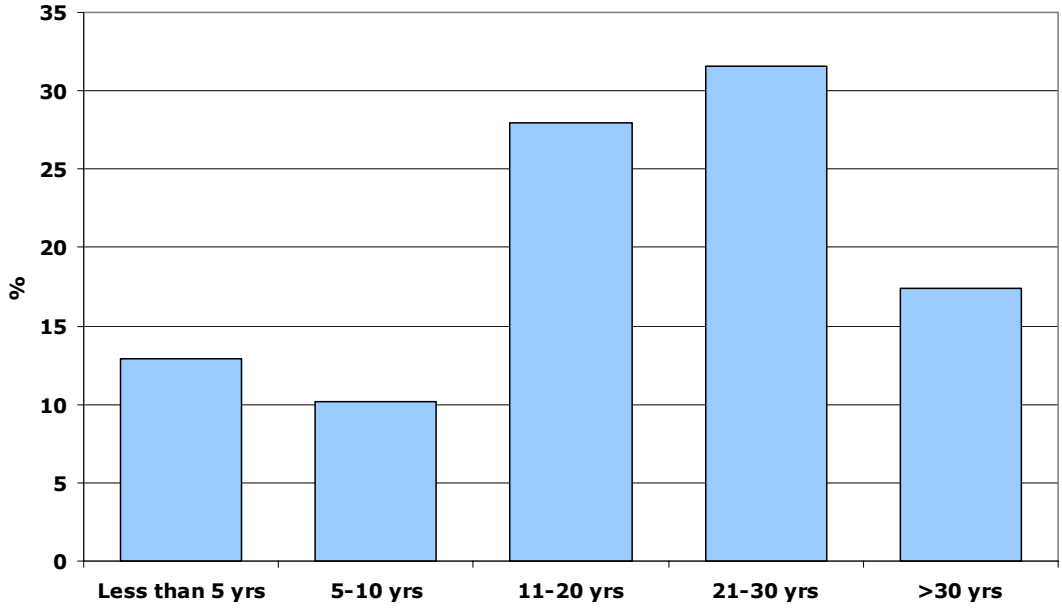
Factors effecting the judgements taken on the nature of this portfolio might include:

- **The useful life of the assets.** The broad expectation is that an efficiently financed infrastructure company will seek to match the maturity of its debt portfolio to the useful life of its assets. This approach provides certainty around the financing costs of an asset over its life and allows the company to determine the investment's NPV with greater accuracy.
- **The shape of the yield curve** i.e. the interest rates available at different tenors. The returns required on debt of varying tenor will differ depending on current interest rates and current expectations of future interest rates.
- **Refinancing risk.** The expectation is that debt maturity will be spread across a number of tenors in order to reduce the re-financing risk in any year. In the current market conditions with a steeply inverted yield curve, there is clearly merit in seeking to make use of unusually low long-term rates. However, we would not expect an efficiently financed company to raise all of its debt at a single maturity – because of the future refinancing risk.

Market evidence

As suggested above, regulated businesses with long lived assets will typically attempt to 'match' their average debt to maturity with the average remaining life of their asset base. Figure 3.4 below shows the debt maturity profile for regulated UK water, electricity and gas companies. The weighted average age to maturity on debt for the 14 companies is approx 20 years. Whilst this maturity may be less than the assumed weighted average economic asset life, it provides an indication of efficient financing structures for networked utilities.

Figure 3.4: UK regulated utilities debt maturity profile (March 2006)



Source: Lexicon, CEPA

Network Rail's current debt portfolio

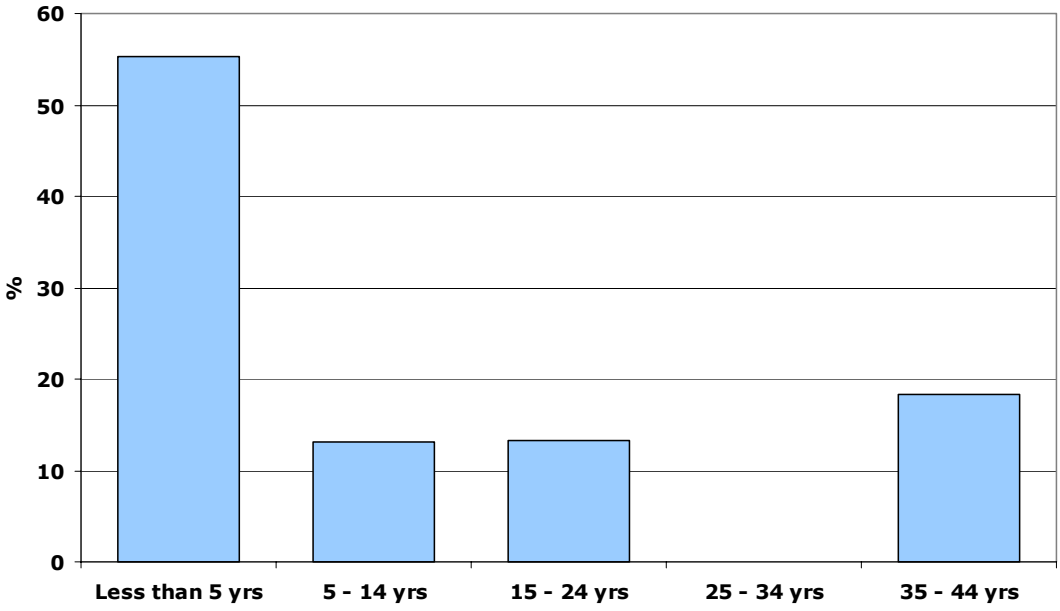
As background, Figure 3.5 below shows Network Rail's current debt maturity profile. A significant proportion of debt is due to mature within the next five years. This reflects the relatively high degree of short-term debt raised by Network Rail at its inception. As this matures, there is an opportunity for Network Rail to: i) take advantage of current low costs on long-dated debt; and ii) develop a debt maturity structure that is more typical of regulated utilities with assets that have long expected useful economic lives.

Network Rail has announced plans to embark upon a new programme of RPI index-linked bond issues. Key features of the programme are as follows:

- debt raised in CP3 will benefit from the FIM, making it 'AAA' rated;
- maturities on the bonds will range from 15 – 45 years; and
- upon completion, Network Rail's debt is expected to be £22bn at end CP3.

In the absence of firm plans from the company we have assumed the debt will be issued in equal proportions at 15, 30 and 45 year maturities. This would result in the average age to maturity of the debt being extended to around 20 years. This compares to around 10 years for Network Rail currently[20].

Figure 3.5: Network Rail debt maturity profile (May 2007)



Source: Network Rail / ORR

Network Rail's asset lives

Network Rail's Annual Report and Accounts 2006[21] state that: 'As the depreciated replacement cost of the railway network significantly exceeds its value in use, it is revalued to its value in use at each reporting date…The depreciation charge for any year is calculated using the average carrying value for the year and the estimated weighted average remaining useful economic life of the railway network. The estimated remaining weighted average useful economic life of the network is currently *25 years*[22].'

We understand that in practice this weighted average useful economic life may be understated: for example, Ove Arup, in its May 2003 Independent Review of Depreciated Replacement Costs for Engineering Assets stated the remaining life for the network was 50.5 years (we assume this is a weighted average across all asset categories).

Assessment

In our analysis we have assumed a weighted average remaining asset life of a minimum of 25 years and have taken this into account in our assessment of a notional debt maturity profile that might be appropriate for an efficiently financed network rail operator.

[20] This includes the recent £1bn 30 year bond issued by Network Rail in early May 2007.
[21] Page 50.
[22] Emphasis added

Our judgement is that the appropriate average (and perhaps conservative) maturity profile is a weighted average maturity profile of 20 years with a broadly even distribution. This is broadly in line with other regulated utilities with similar, long-lived assets and reflects Network Rail's probable position for CP4.

We recognise that, in the current market, an efficiently financed company might seek to put in place a portfolio with a greater proportion of long-dated debt to benefit from current low rates.

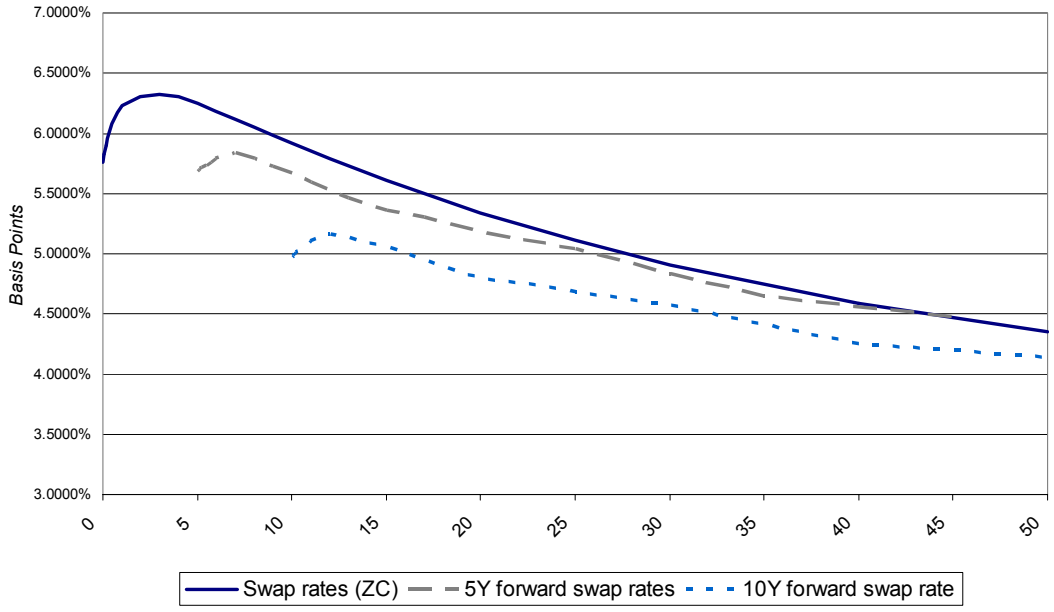
3.3.4. Use of options and swaps

Background

We believe that it is reasonable to expect an efficiently financed utility to make use of hedging instruments where these offer value for money. In particular in the current market there may be merit in Network Rail locking in lower rates now for its known refinancing programme over CP4.

Figure 3.6 shows the UK GBP nominal swap yield curve together with the forward swap yield curves[23] as at 14-06-2007. The lower forward swap curves reflect the forward rates implicit in the downward sloping spot yield curve.[24]

Figure 3.6: Spot and forward swap curves (GBP)



Source: Reuters

The judgement that Network Rail needs to make is whether the added certainty associated with locking in current low rates by forward swaps is worth the additional costs associated with swaps (compared with bonds). In order for it to be economic for

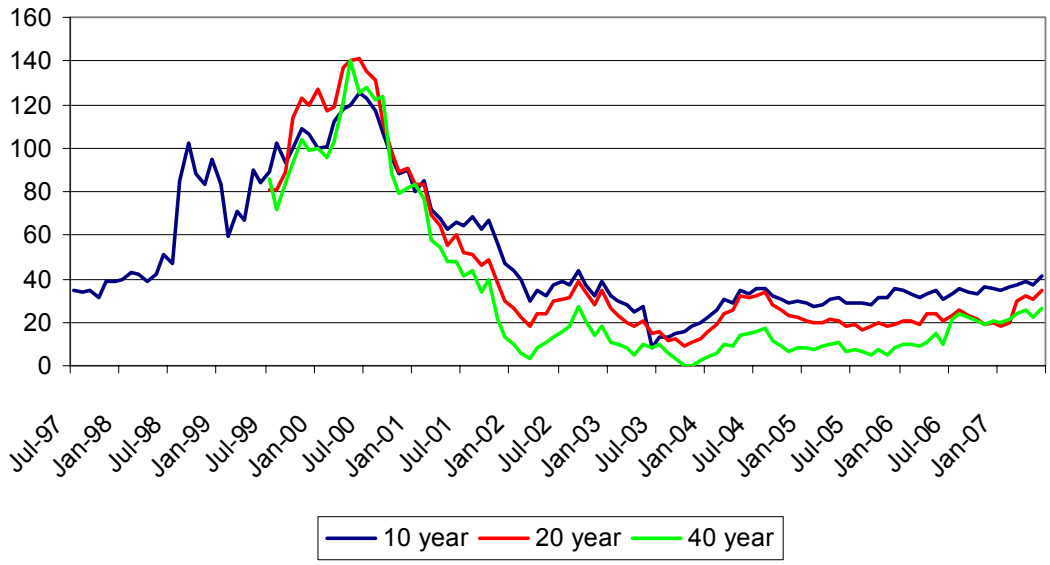
[23] The forward swap yield curves show the costs of swaps purchased 'today' for the forward market.

[24] A similar relationship is likely to observed with spot and forward inflation swaps. However, we have not reviewed this data.

Network Rail to hedge, the discounted value of the swap spread needs to be lower than the expected cost of an increase in the underlying gilt rate for the particular maturity[25]. For example the discounted cost of a 40bp swap spread over 10 years on £1bn borrowing is close to £39m.

Figure 3.7 shows a time series of swap spreads at 10 and 20 and 40 year maturities. It shows that spreads have been in the range 5 to 40 basis points fairly consistently over the last 5 years, although on an upward trend recently.

Figure 3.7: Spot and forward swap spreads (GBP)



Source: Reuters

Taking account of hedging in setting the WACC for Network Rail

We do not believe that it is sensible or appropriate for CEPA to seek to second guess the judgements that an efficiently financed network rail would make about hedging[26].

However, in coming to a judgment about the appropriate WACC for CP4, we do believe that it is appropriate for ORR to take account of the extent to which Network Rail has used hedging arrangements to lock in current low rates for its future refinancing[27]. If Network Rail does have significant hedging in place, it would (other things being equal) lessen the extent to which ORR needs to allow for mean version in the WACC over CP4[28].

There is a separate question about the hedging that Network Rail may choose to do in CP4 itself. We do not believe that it is possible for ORR to seek to second guess this.

[25] The later entirely depends on how Network Rail values the uncertainty associated with interest movements.

[26] This would require a separate and fuller analysis of hedging options, which is not part of the this study. In addition, the decision on whether it is worth paying the costs of hedging is entirely dependent on the value that Network Rail places on certainty.

[27] At the point that the WACC is set.

[28] That is, if Network Rail has hedged some of its future interest costs in the forward swap market, it will be less sensitive to movement in the underlying cost of debt in CP4.

3.3.5. Conclusion

In our analysis of the appropriate cost of debt, we therefore assume that an efficiently financed regulated utility would:

- use at least 80% fixed debt;
- use at least 30% index-linked debt; and
- have a debt maturity profile with a weighted average of about 20 years, with equal proportions of 10, 20 and 30 year debt.

3.4. Risk free rate and debt premium

3.4.1. Risk free rate

In this section we look at the market evidence on risk free rates from index-linked and nominal securities data and suggest relevant ranges for consideration in determining the cost of debt based on the mix of maturities and index-linked gilts discussed in Section 3.3.1.

Index-linked debt

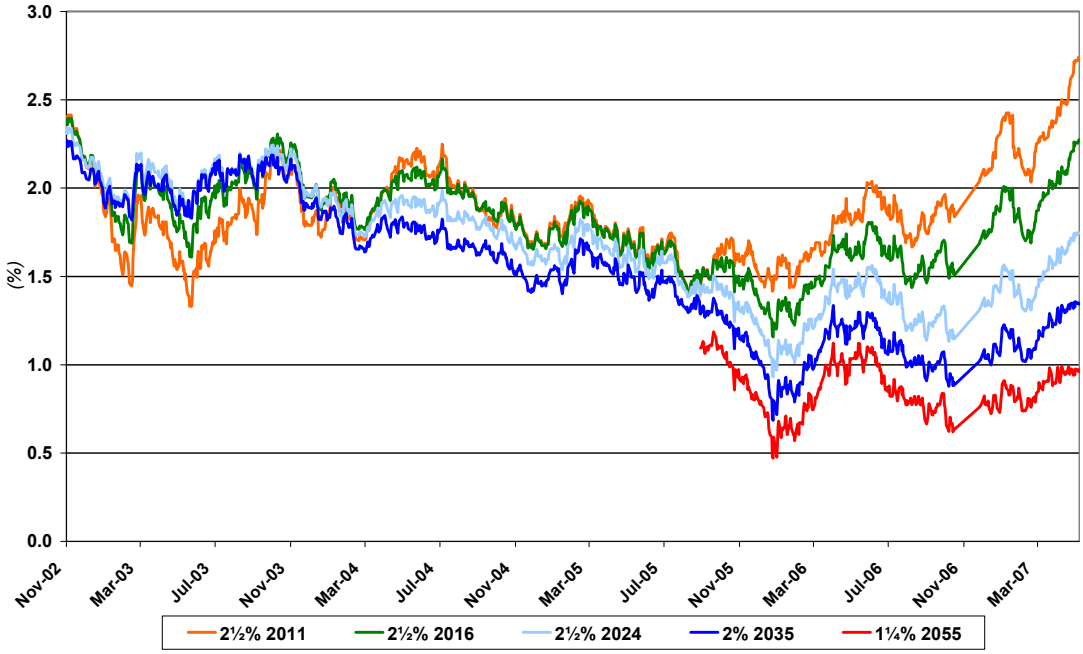
In analysing the yields on index-linked Treasury gilts (ILGs) we have used Debt Management Office (DMO) data[29].

The current market evidence, as illustrated in Figure 3.8 below[30], shows that since reaching historical lows in early 2006, yields on ILGs have gradually increased. This is particularly true of the shorter-term debt. In addition, since early 2004 the yield curve for ILGs has been inverted (i.e. downward sloping) and since then the spread between yields at long maturities and shorter maturities has increased. The implication of this is that the greater the weight placed on longer-term debt, the lower the derived risk free rate will be.

[29] Annex 1 contains further details on the selection of ILGs currently in issue.

[30] We have focused our analysis on those ILGs that have time series data for more than 12 months and are sufficiently liquid to allow meaningful inferences.

Figure 3.8: Yields on UK index-linked gilts



Source: Debt Management Office

Table 3.2 below provides information on spot rates and averages yields over the last five years for index-linked gilts of 10, 20 and 30 year maturities[31].

The final column of Table 3.2 shows the weighted average yield, assuming an entity has equal proportions of debt at 10, 20 and 30 year maturities. This analysis implies a range for the risk free rate, based on index-linked gilts, of 1.6% - 1.7%. It should be noted that the spot rates reflect the recent sharp increases in yields, especially on those with shorter maturity profiles.

Note that the ranges for implied risk free rates widen considerably (particularly for the spot rates) if we also consider the 5 year and 50 year maturity. The range for the spot rates is 0.95% - 2.70% and 0.85% - 1.85%[32] for the five year average. All of the sub 100bp rates are for 50 year gilts[33].

Table 3.2: Real yields on 10, 20 and 30 year to maturity index-linked gilts

Time series	10 year maturity	20 year maturity	30 year maturity	Weighted average
Spot	2.06	1.54	1.26	1.6
5 yr average	1.81	1.69	1.54	1.7

[31] The spot data is for 2017, 2027 and 2037 maturities. As historic averages are not available for these gilts, the average data is taken for the 2016, 2024 and 2035 maturity gilts as illustrated in Figure 3.8. 10 year average data is not available for any of these gilts.

[32] Note that the 2055 ILG forms the lower end of this range and was issued in September 2005.

[33] Note also that the weighted average would also lower slightly if it included 50 year maturities as part of the portfolio of debt maturities.

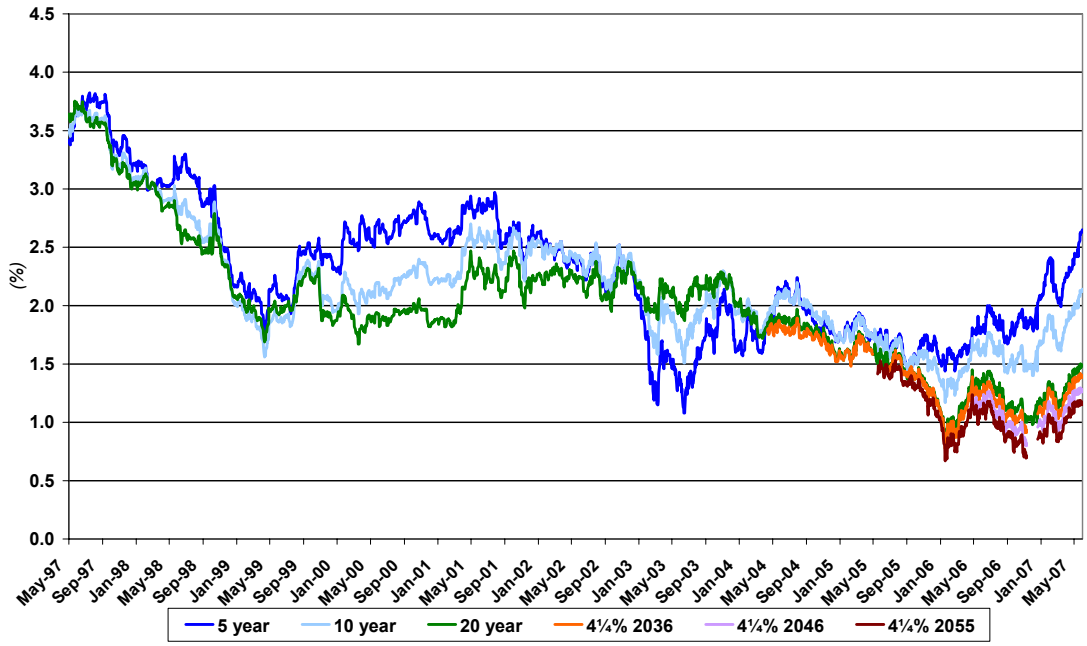
Conventional nominal debt

The majority of Network Rail's debt is currently, and could continue to be made up of conventional bonds with nominal yields. We rely on yields from both the Bank of England (BOE) and the DMO as follows:

- BoE provides data on real yields on zero coupon securities as implied by the difference between nominal and index-linked bonds.[34] But this dataset does not extend beyond 20 year maturities.
- In order to form a view of the risk-free rate on debt of longer-term maturities we have therefore considered the observed nominal yields on individual conventional gilts of long tenor as supplied by the DMO. To obtain real yields for these longer maturities, we have employed the BoE's forward looking market expectations of inflation for 20 year debt and assumed that this can be extended for longer time horizons without adjustment[35].

The resulting real yields are presented in Figure 3.9 below, which shows real yields on 5, 10 and 20 year zero coupon nominal Treasury gilts as well as yields on individual 30, 40 and 50 year gilts, with the real yield being calculated as described above. Not surprisingly, the trends depicted are similar to those observed for ILGs.

Figure 3.9: Real yields on UK gilts



Source: Bank of England, : Debt Management Office

[34] The Bank of England employs the 'Fisher relationship' making use of information contained in real yields on the index-linked gilt market and the nominal yields on the conventional gilt market to obtain an implied market expectation of inflation.

[35] We realise there is likely to be some differential between market expectations of inflation 20 years and 30 years from now (for example the BoE's dataset shows the market expectation of inflation 10 years hence are currently around 3.0% whilst for 20 years it is around 3.20%), but, as stated above, believe that this is the best available methodology.

Taking into account the maturity profile identified in Section 3.3.1, the relevant range for the real risk free rate based on yields on nominal gilts is 1.7% - 2.0%. This range is very similar to that implied by index-linked gilts.

Once again, the ranges for implied risk free rates widen considerably (particularly for the spot rates) if we also consider the 5 year and 50 year maturity: the current spot range on real yields is 1.17% - 2.65%; five year averages are in the range 1.70% - 1.85%; and 10 year averages in the range 2.00% - 2.30%.

Table 3.3: Real yields on 10, 20 and 30 year to maturity conventional gilts

Time series	10 year maturity	20 year maturity	30 year maturity	Weighted average
Spot	2.14	1.49	1.42	1.7
5 yr average	1.84	1.68	1.58	1.7
10 yr average	2.16	2.01		2.0

Inflation risk premium

The real yields in Table 3.3 do not take account of the likelihood that the Bank of England's estimate of market expectations of inflation also includes an inflation risk premium. That is, the difference in nominal yields and real yields includes not only (i) investors expectations of inflation; (ii) but also the risk premium that bond investors require to hold nominal rather than index-linked assets. If we assume that this risk premium is up to 25bp (as opposed to zero in Table 3.3), then it suggests that the actual range for the weighted average premium in Table 3.3 would be 1.95% to 2.25%.

Longer term averages and term premium

As part of our analysis we have also considered the longer-term averages for the risk free rate. Both the level and the shape of yield curve (i.e. the term premium) are relevant. For both we rely on the work carried out in Smithers (2004) and (2006). They provide an estimate of the long-term real risk free rate of 2.5%, although they note that 'historic average values provide considerably less evidence that this has a stable mean'[36].

As regards the term premia, Smithers (2006) find that although the average term premium in the longer term (i.e. over the twentieth century) is around 0.75%[37]; (i) this is not statistically significantly different from zero; and (ii) that the average term premium over the previous twenty years was -0.28[38].

Despite the uncertainty associated with the Smithers work, the implications are relatively clear for this analysis. To the extent there is reversion to the longer-term averages for risk free rates in CP4 it is likely that it will result in higher rates than those suggested by the unadjusted market data alone.

[36] Smithers (2006) p38
[37] Ibid
[38] Smithers (2006) p41

Summary of the risk free rate data

In summarising the data on risk free rates, we first take the weighted average data for 10, 20 and 30 year maturities (in line with our notional Network Rail) derived from both index-linked and nominal gilts, and then weight these rates according to the proportion of index-linked and nominal bonds assumed to be used by an efficiently financed utility.

The results of this are presented in Table 3.4 below, and give a range of 1.7% to 2.25%, (including the adjustment for inflation risk premia of up to 25bp on real yields.)

Table 3.4: Risk free rates from 10, 20 and 30 year maturities

Time series	Index-linked (30%)	Nominal (deflated) (70%)	Weighted
Spot	1.6	1.7-1.95	1.7-1.95
5 yr average	1.7	1.7-1.95	1.7-1.95
10 yr average	n/a	2.0-2.25	2.0-2.25

3.5. Debt premium

The debt premium is the premium required by investors to compensate them for the additional risk of the debt instrument held over risk free sovereign debt. In line with standard methods, we have measured the debt premium as the spread between corporate bonds and benchmark treasury gilts of similar maturity.

Because debt premium pricing has become commoditised against credit ratings, we can consider debt premia for credit ratings rather than needing to consider the premium for individual regulated utilities.

To date, debt issued by Network Rail has benefited from the FIM, allowing the company to raise debt at a credit rating consistent with, or very close to, sovereign debt (i.e. 'AAA'). As noted in the gearing section, we consider it appropriate to consider a solid investment grade rating for a notional network rail. We interpret this as being in the range BBB+ to A grade ratings

In what follows we consider both current and historical spreads[39] on sterling corporate bonds for different credit ratings and for different maturities. The analysis uses three sources of data (which differ slightly in terms of the time series available; the nature of the composites; and the benchmarks used):

- Reuters provides spread data for corporate bonds at different maturities for a blended A rating or a blended BBB rating. The composite is made up of bonds from a range of sectors (including utilities).
- Bloomberg provides spreads for individual ratings (BBB+, A- and A). The composites are also cross-sectoral.

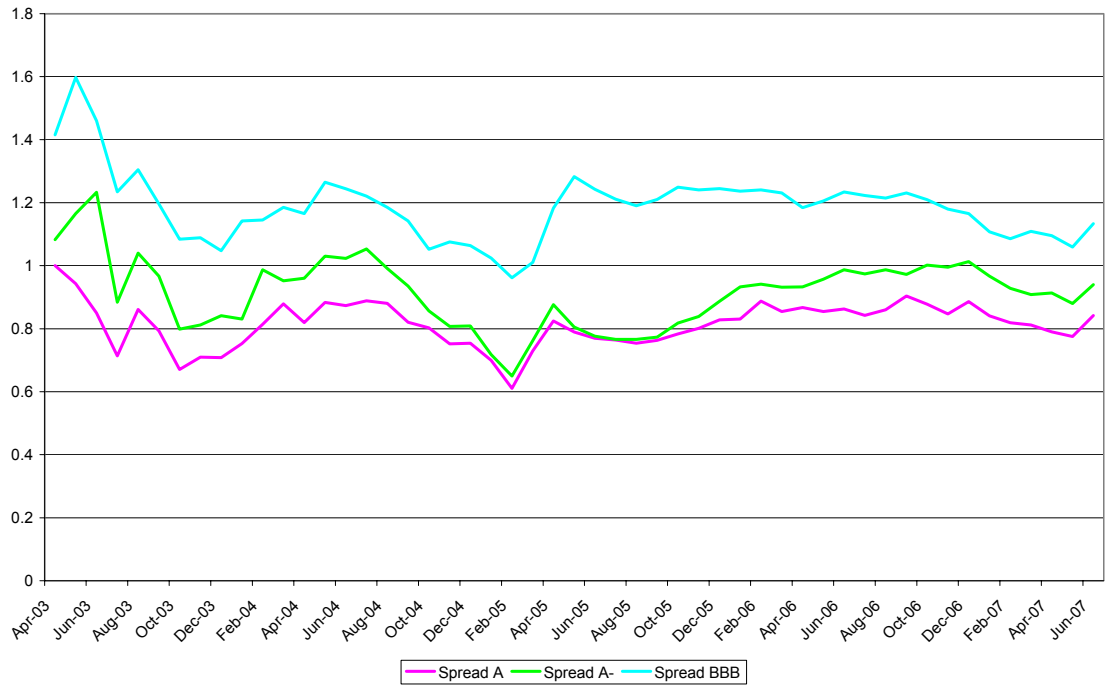
[39] Spreads are taken to refer to the difference in the yield to maturity of the bond (or composite) against the relevant benchmark gilt.

- The Grant Thornton utilities bond database (the 'GT database'). We have been provided access to data from this database by individual rating (BBB+, A- and A), and for A rated bonds by maturity. The time series available (depending on the credit rating and maturity) is from 1995 to September 2006.

Debt premium of different credit ratings

Figure 3.10 presents a time series spreads on A, A-, and BBB corporate debt for 10 year maturities from Bloomberg. Table 3.5 below compares the long-run averages from the Bloomberg (Bmg) dataset with the information available from the GT database; and also with the information from Reuters on a blended A and BBB.

Figure 3.10: 10 Year Spreads on A, A- and BBB corporate bonds



Key points to note from Table 3.5 are:

- Average debt premium for a 'solid investment grade rating' corporate bond (taken as a simple average of the BBB+, A- and A) has been 0.96 over the last five years. Over the last year it has been 0.98.

- The average premium between the BBB+ and A- has been 0.27; and the premium between the A- and A has been 0.09 over the last five years.

On the basis of this analysis we believe that an appropriate average estimate for the spread on investment grade rated bonds, with 10 year maturity, is 100bp[40].

[40] Smithers (2006) note that the lack of long term average data for UK corporate spreads but state that 'the average spread for the UK A-rated bond [since 1993] has been 105 basis points…[but] that historical movements…have been highly persistent'

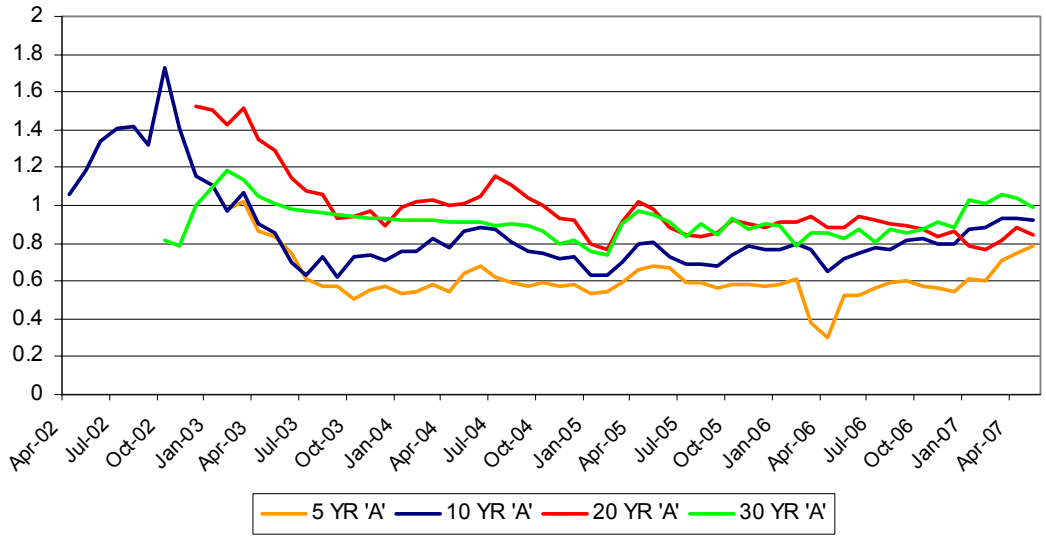
Table 3.5: 10 Year spreads[41]

Basis points	BBB+		A-		A		BBB	A
	Bmg	GT[42]	Bmg	GT	Bmg	GT	Reuters (blend)	
Spot	1.13	n/a	0.94	n/a	0.84	n/a	1.29	0.92
1 year average	1.15	0.90	0.96	0.77	0.84	0.72	1.20	0.84
5 year average	1.17	1.14	0.90	0.97	0.81	0.87	1.49	0.86

Debt premium at different maturities

Figure 3.10 presents the spreads on 5, 10, 20 and 30 year debt for A rated corporate bond debt using the blended Reuters data. The figure shows that the premia have fallen significantly since 2003 and been relatively stable since 2005. Figure 3.12 provides the same information from the GT database for A rated bonds.

Figure 3.11 – Spreads on A rated corporate bonds



Source: Reuters

[41] GT averages are based on a range of maturities, whereas Bloomberg and Reuters are for 10 year maturities.

[42] Note that GT averages are from September 2006, so are not strictly comparable with Bloomberg and Reuters.

Figure 3.12 – Spreads on A rated utility bonds[43]

Source: Grant Thornton

Tables 3.6 and 3.7 compare the spot, 1 year and 5 year averages of spreads of 'A' rated bonds of different maturities. Key points to note are as follows:

- The differences in spreads for different maturities (from Reuters) is a maximum of 10 basis points. But the differences are not stable across maturities for spot, 1 year average and 5 year average data.
- The differences in spreads for different maturities is more marked for the Grant Thornton database – around 20 basis points for the five-year average. But again the differences are not stable across the different averages.

Given this, on balance, we do not believe that the evidence suggests that we should use different spreads for the maturities (10, 20 and 30 year) assumed to make up the portfolio of fixed interest debt held by the notional network rail[44].

Table 3.6: Spreads for different maturities of a blended 'A' rated corporate bonds (Reuters)

Sample	10 Year	20 Year	30 Year
Spot	0.92	0.85	0.99
1 year average	0.84	0.86	0.93
5 year average	0.86	0.99	0.89

[43] Note that there is a gap in this series for the 15-20 year maturities in 2003.

[44] Note that the difference in spreads between 5 year and longer-dated maturities is significant.

Table 3.7: Spreads for different maturities of an A rated utility bonds (Grant Thornton)

Sample	10 – 15 Years	15- 20 years	20 – 25 years
Spot	n/a	n/a	n/a
1 year average	0.74	0.80	0.83
5 year average	0.78	0.88	1.01

Conclusion on debt premium

On the basis of the above discussion we believe that a reasonable assumption for the debt premium for solid investment grade rated debt is around 100 basis points – for all maturities.

3.6. 'All-in' actual cost of debt

In this section we cross check the market evidence on risk free rates and debt premia against the evidence from actual bond issues by regulated utilities.

We examine the market data on actual index-linked issues, as that shows a very low real cost of debt. Tables 3.8 and 3.9 below show a selection of recently issued index linked bonds. The rates are in the range 1.5 to 2.0%[45]. In achieving these rates, these companies have made use of historically low rates on very long-dated bonds. This data is consistent with our analysis of the risk free rate and debt premium presented above.

Table 3.8: National Grid index-linked bond issues

Issue date	£M	Coupon (%)	Maturity date
03-Apr-06	200	1.65	2036
07-Apr-06	50	1.68	2036
11-May-06	50	1.82	2056
26-May-06	150	1.82	2056
14-Jul-06	50	1.80	2056
27-Jul-06	25	1.69	2056
28-Jul-06	50	1.66	2056
28-Jul-06	25	1.58	2056
28-Jul-06	50	1.66	2056
20-Feb-07	100	1.92	2037
16-Mar-07	50	1.76	2037
28-Mar-07	100	1.81	2037

Source: Reuters

[45] Based on information available on coupon rates and assuming that bonds are issued at par.

Table 3.9: Water company index-linked bond issues

Issue date	£M	Coupon (%)	Maturity date
Yorkshire Water	125	1.46	2056
Yorkshire Water	125	1.46	2051
Northumbrian Water	100	1.75	2053
Northumbrian Water	100	1.71	2049
Northumbrian Water	60	1.63	2041
Northumbrian Water	150	2.03	2036
Severn Trent Water	100	1.40	2057
United Utilities Water	50	1.44	2056
United Utilities Water	35	1.38	2056
United Utilities Water	50	1.56	2056
United Utilities Water	25	1.59	2056
United Utilities Water	50	1.59	2056
United Utilities Water	100	1.85	2056
Yorkshire Water	125	1.46	2056

Source: Cazenove, February 2007; Lexicon

3.7. Conclusion on the cost of debt

3.7.1. Ranges

Introduction

The range for the cost of debt, based on spot, five and ten year average data and on our judgement about the how an efficient notional network rail would finance itself is **2.7% to 3.25**%.

However, in coming to a judgement about the appropriate range for a notional network rail (below) on a forward looking basis, it will also be important for ORR to take account of : (i) the potential for mean reversion over CP4; and (ii) as a sub-set of this, the potential term premium over CP4:

- **Potential for mean reversion**: very recently, there is evidence of some mean reversion toward longer-term averages – risk free rates have increased sharply for 5, 10 and 20 year maturities, in certain cases by over 50 bp in the calendar year to date for both index-linked and nominal gilts. Short-term rates (on the 5 year maturity) now exceed 2.5%.
- **Term premium**: our methodology above has placed equal weight on 10, 20 and 30 year bonds. Given that the yield curve has been inverted for much of the last 10 years, this further reduces the range for the cost of debt. If we were to consider the cost of debt solely on the benchmark 10 year risk free rate, which is equivalent to assuming that the term premium might be flat going forward, then

the range for the cost of debt would increase by approximately 10 to 45 bp, depending on the historic average period taken.

Based on the above evidence, there might be a case for ORR to extend the top end of the range for the cost of debt to 3.5%. However, this is a judgment that we would expect ORR to make in the light of actual market conditions at the time that the rate of return for the price review is set.

3.7.2. Narrow ranges

The key judgement that ORR needs to make in deciding on an appropriate narrow range for the cost of debt is the extent to which it should take account of mean reversion in the WACC over CP4.

CEPA's view is that, in making this judgement in relation to the cost of debt, it is appropriate to have regard to particular factors[46]:

- Whether ORR expects to introduce trigger or 'indexation' mechanisms on the cost of debt / or risk free rate (e.g. for new debt). Subject to the ORR's further work on this issue, we presume that the indexation mechanisms are only likely to relate to new debt raised in the period ; and / or
- The extent to which, at the time that ORR sets the WACC for CP4, Network Rail has locked into existing rates in the forward swap market. As noted in Section 3.3.4 above, we think that it is reasonable to expect that efficiently financed entity to carry out some hedging where this is cost effective. But we do not believe that it is appropriate for us to second guess this.

If either is the case, our judgement is that an appropriate cost of debt is likely to be in the narrower range of 2.7% – 3.00%.

In the absence of either sources of comfort we believe that it would be appropriate for the regulator to allow for an element of mean reversion. This would, however suggest a narrow range of 3.00% – 3.25%[47]. In making the judgement about top end of the range we have considered - as a cross check - what Network Rail's actual cost of debt is and the extent of market tightening that would result in its average cost of debt rising to above 3.25% real[48]. On the basis of this analysis[49] we believe that it would be reasonable to retain the top end of the range at 3.25%.

[46] We note also that there is a 're-opener' in the regulatory regime which allows a periodic review in the event of 15% overrun expenditure. However, it is not clear whether this will include financing costs.

[47] In all of our judgements we abstract from the possibility of 'credit crunches' or disorderly financial market adjustment which persists over a significant period of time.

[48] The estimates in section 3.8 of Network Rail's actual cost of debt are in the range 2.5 – 3.0%. This suggests that the average cost of debt over the remaining 2 years of CP3 and throughout CP4 would need to rise to 3.5% or 4% for network rail's average cost of debt to exceed 3.25%..

[49] Excludes any analysis of financeability e.g of the new unsupported debt.

3.8. Network Rail's actual cost of debt

Introduction

In this section we seek to cross check our cost of debt range for a notional network rail against indicative estimates of the actual costs of debt faced by Network Rail. We do this to ensure that the proposed range is likely to be sufficient to allow Network Rail to finance its debt and to raise new unsecured debt. However, we note that ORR will also need to consider this issue in the context of: (i) the decision on the level of the FIM fee; (ii) and any smoothing of the regulatory settlement.

In what follows we have briefly considered both the maturity profile and cost of Network Rail's current debt (as referenced in section 3.2.2), the likely profile and cost at the start of CP4 and its expected net financing requirements during CP4.

It is important to note that, in order to do this analysis, we have adjusted by the difference in the debt premium between an assumed 'A' rating and Network Rail's current 'AAA' rating which benefits from the FIM. This adjustment is necessary to be consistent with the WACC-based approach on the notional network rail used in this paper.

Network Rail's current cost of debt

Network Rail has provided evidence that its current gross cost of debt, with FIM support, is a (nominal) 5.02%. This figure includes the following:

- Capitalised and amortised fees, which need to be stripped out so that this cost of debt can be compared to the allowed cost of debt. For example, fees on Network Rail's most recent index-linked issue were 0.225%, although removal of such fees is likely to have a relatively minimal impact on the nominal cost of debt.
- Current fixing costs of foreign currency bonds and floating sterling rate bonds.
- Breakeven inflation rates for index-linked bonds (3.2-3.4%)[50].

Network Rail's cost of debt at beginning CP4

As noted in section 3.3.2, Network Rail has announced plans to embark upon a new programme of RPI index-linked bond issues. The first tranche of £1bn was successfully raised in May 2007 having been priced to yield 26 basis points over the 1.125 percent UK index-linked gilt due 2037. The issue was reportedly well received with reports of the order book having been substantially oversubscribed.

[50] Given that market inflation expectations are closer to 3% it could be argued that use of the breakeven rates inflates the actual cost of debt.

In the light of Network Rail's refinancing programme, we have considered the probable cost of debt at the end of CP3. Our analysis, based on assumptions as to the proportion of the programme that is index-linked, suggests that Network Rail's cost of debt will be largely unchanged at end CP3[51].

Comparison of actual with notional cost of debt

In order to adjust Network Rail's anticipated cost of debt to the notional WACC basis used in this report, we simply add the difference in premium between a 'AAA' borrower and an 'A' rated borrower (around 50bp) to Network Rail's cost of debt (current and at the end of CP3). This gives a cost of debt of approximately 5.5% nominal, or 2.5-3.0% real (assuming annual inflation rates of 2.5-3.0%) - which is clearly consistent with the range identified in this paper.

[51] Assuming 50% of refinanced debt is refinanced using long-dated index-linked securities, and using the same breakeven assumption as used by Network Rail. If we were to assume that 100% of maturing / new debt (i.e. around £10bn) is refinanced using long-date index-linked securities the average cost of debt at the start of CP4 is estimated to be around 4.9%

4. COST OF EQUITY

4.1. Introduction and approach

In this section we estimate the expected (post-tax) rate of return for an efficiently operated and financed regulated utility with a similar risk profile to that faced by Network Rail over CP4. As noted in Section 1, the discussion of the cost of equity should not be taken to imply any change in the financial structure of Network Rail. Rather, it reflects the nature of the financial framework proposed by ORR, in which the cost of capital will be set with regard to the WACC of a 'notional' conventionally financed network rail operator.

The terms of reference states that the study should: '[look] at the overall estimate of the cost of equity rather than, for example, the components under a CAPM framework'.

This is broadly consistent with CEPA's approach, which is to focus on the aggregate return on equity (with particular weight given to market evidence) in the broad CAPM framework. It also, we believe, reflects the well-documented practical and theoretical limitations of CAPM – including the tendency for a mechanistic CAPM approach to generate implausible ranges for the cost of equity.

In what follows we:

- Provide a summary of recent regulatory precedent in the approach and the recent estimates of the cost of capital.
- Discuss the historical estimates of returns required on equity.
- Present recent market evidence on the cost of equity for regulated companies[52]. This includes analysis of transactions in both the UK water and gas sectors; analysis of implied required returns on equity contained in current share prices of UK regulated companies; and analysis of returns on equity sought by private equity / infrastructure funds.
- Provide an assessment on the appropriate range for the cost of equity, taking account of a range of factors, and set this in the context of CAPM.

4.2. Regulatory precedent

4.2.1. Approach to the cost of equity

Annex C provides a more detailed assessment of the approaches that have recently been used by other UK regulators in setting the cost of equity.

In summary most regulators have broadly accepted CAPM as the most appropriate theoretical framework in which to estimate the cost of equity, whilst recognising its

[52] This evidence is largely reproduced from CEPA (April 2007): *The Allowed Cost of Capital, Ofgem GDCPR 2008-13*.

weaknesses in practice. This has meant that increasing weight has been given to market evidence of the total required returns on equity[53] and other regulatory precedent.

In the 2004 price determinations by Ofwat and Ofgem, both regulators chose to ignore the evidence of strongly declining equity betas because they gave implausibly low estimates. Instead both regulators chose betas of 1 in order to generate costs of equity that were consistent with other evidence on the actual cost of equity. More recently, Ofgem in particular has chosen to focus solely on the long-run market return on equity and deliberately makes no attempt to estimate the individual CAPM parameters. In this context the value of betas is primarily in providing evidence of the relative riskiness of regulated utilities in different sectors.

Perhaps the main exception to this trend has been CAA, which has tended to place greater emphasis on a CAPM based approach[54]. However, at the time of writing these proposals are still under consideration by the Competition Commission.

4.2.2. Overview of recent regulatory assessments

Table 4.1 below summarises very recent UK regulatory assessments of the cost of equity. It shows that estimates of the cost of equity have ranged from 7.0% - 7.7%[55].

Table 4.1: Recent regulatory decisions on the cost of equity

Regulator	Decision	R_f	ERP	B	CoE Range	CoE Used
Ofgem	GDPCR (2007)[56]				6.5-7.5%	7.0%
CAA	Heathrow (2006) [57]	2.0%	4.5	1.13 – 1.26	7.1 – 7.7%	7.7%
Ofgem	TPCR (2006)	2.5%			6.5 – 7.5%	7.0%

4.3. Historical returns on equity

We have not carried out any new analysis of historical returns on equity. Instead we rely on the Smithers (2004) and (2006) work, commissioned by Ofgem[58]. Smithers' conclusion is that a reasonable range for the historical cost of equity is 6.5% - 7.5% (although we note that the confidence interval around point estimates at the 95% level is significantly wider than this).

[53] By Ofgem and Ofwat in particular.

[54] CEPA (May 2007): *Setting the weighted average cost of capital for Heathrow and Gatwick in Q5*. This paper provides a critique of particular aspects of CAA's approach, particularly their assumption that the asset beta for BAA remains constant, which results in equity betas of significantly greater than 1.

[55] The top end of the range is provided by CAA's recent proposed estimate for Heathrow.

[56] Initial Proposals. 'CoE Used' figure is the modelling assumption.

[57] CAA's initial proposals have been referred to the Competition Commission for review. The referral included separate costs of capital for Heathrow and Gatwick airports. We have included the cost of equity for Heathrow. Gatwick is assumed to have a higher post-tax cost of equity of 8.7%

[58] This work refers extensively to Dimson et al (2001)

4.4. Market evidence and market asset ratios

In this section we report on market evidence on the actual aggregate required return on equity from a range of sources. The findings here draw on the analysis carried out in CEPA (April 2007) as submitted to Ofgem as part of their consultation on GDPCR 2008-13. For ease of reference we reproduce here the explanation for the approach that we have used, and then provide a summary of the key findings.

4.4.1. Market-asset (MR) ratio methodology

One approach to observing required returns on equity in the market is to seek to decompose the difference between the market's valuation of regulated assets and the regulatory asset base (i.e. the premium or discount on the market-asset ratio)

The premise on which MR analysis is based is that if the market expects a regulated company to achieve operating and capital performance consistent with the regulator's assumptions and if the allowed WACC equals the actual WACC then the MR ratio will be 1.0. That is, the discounted expected future net cash flows, or net present value (NPV) should, if the regulator's assumptions are the same as those of the market, equate to the value of the RAB. Equally, if the allowed WACC is higher or lower than the actual WACC then, ceteris paribus, the MR ratio will be greater or less than 1.0 respectively.

The formula for determining the ratio is set out below:

MR ratio = Enterprise Value of regulated entity / Regulatory Asset Base

Where:

Enterprise Value (EV) = market capitalisation + market value of debt

Typically book value of the debt is used as a proxy for the market value.

Once an MR ratio is calculated an implied cost of equity can be derived for given assumptions on the cost of debt and gearing employed. For example, if an MR ratio of 1.2 is observed, and if the figures for the components of the cost of capital are as assumed in Table 4.2 below, then the implied market WACC is 4.17%.

Then substituting an observed actual cost of debt (to strip out that portion of the premium attributable to the differential between the actual than allowed cost of debt) of say, 3.00%, and holding the gearing assumption constant, the derived implied actual cost of equity is 5.33%.

Table 4.2: MR ratio example

	Formula	Illustration
Allowed cost of debt (CoD)	-	3.50%
Allowed cost of equity (CoE)	-	6.50%
Notional gearing (G)	G = D/RAB	50%
Vanilla WACC (WACC)	WACC = G*CoD + (1-G)*CoE	5%
MR ratio (MR)	-	1.2
Implied Market Vanilla WACC	MWACC = WACC / MR	4.17%
Actual cost of debt (ACoD)	-	3%
Implied actual cost of equity (MCoE)	(MWACC – (G*ACoD))/(1-G)	5.33%

The application of this analysis is most robust when applied to listed, 'clean' regulated businesses[59], at the time of an acquisition or disposal (i.e. in which there is a clear acquisition price, and a clear measure of the RAB), and where there is no particular uncertainty about the allowed WACC by the regulator.

In any event, it is important to recognise (as ever) that the results of the analysis are sensitive to the assumptions that are used. Particularly important is the assumption that is made about the actual cost of debt at the time that the MR ratio is recorded. For example, if the actual cost of debt is significantly below that allowed by the regulator it will account for a higher proportion of an MR premium and (for a given WACC and notional gearing) will mean that the observed cost of equity is higher.

For the purposes of CEPA's recent MR analysis we have assumed that the actual cost of debt is at the level implied by the markets at the time. In practice this is unlikely to be the case given the presence of embedded debt. This suggests that our analysis using actual debt costs may be conservative.

4.4.2. Evidence

The evidence that we have looked at comes from three main sources[60]:

- Recent acquisitions of regulated water businesses. Given average MR ratios in excess of 1.2 and assuming actual costs of debt in the range 2.5% to 3% suggest that actual costs of equity at the time of the transactions were in the range 6.2% – 7.2%.
- Evidence from the sale of the gas distribution network companies (GDNs) at a 14% MR premium and assuming actual costs of debt in the range 2.5 – 3% suggests required returns in the range 6% – 7.3%[61]

[59] Where the regulated business accounts for the large majority of the enterprise value. Where this is not the case, we rely on assumptions about the relative value of the regulated and non-regulated businesses.
[60] Note that the range takes account of a wider range for the actual cost of debt than reported in CEPA's report on the allowed cost of capital for Ofgem's GDPCR

- Analyst views of the MR ratio of listed water utilities, which also point to implied costs of equity in the range 6.5-7.0%.
- Evidence on rates of return required by infrastructure funds at the moment (as evidenced by their bid prices). From a number of sources, we understand that infrastructure funds are looking for a post-tax nominal return on equity of around 12.0% (at high gearing levels, e.g. up to 85%). This converts to an implied, real post tax cost of equity (at 62.5% gearing) of considerably less than 6.0% (i.e. around 5.3%). Table 4.3 illustrates these calculations for an illustrative regulated company with RAB of £1,000m.

Table 4.3: Implied return on equity for private equity funds

Notional RAB	Low	Mid
Notional RAB	£1,000m	£1,000m
Gearing	85%	62.5%
Notional EBIT	£47	£47m
Interest Cost (3%)	£26m	318m
Profit after tax (30%)	£15 m	£20m
Return on Equity	10%	5.3%

Given these findings we believe there is good evidence to suggest that the actual returns on equity required by investors in current market conditions have been in the range 5.5 - 7.0%.

These historically low required rates of returns are consistent with the more general market conditions that have been observed in recent years (discussed above in Section 2). In a portfolio investment framework, investors choose between expected returns on cash, bonds, property and equities. Because real returns on cash and bonds have remained very low it is entirely as logical that investors should reduce the expected return on equity. This is particularly likely for investors in infrastructure assets, which are viewed by many as 'quasi-bonds'.

4.5. Conclusion

4.5.1. Range

In this section we have summarised the evidence available on the aggregate cost of equity. We refer particularly to two sources of evidence:

- The Smithers (2004 and 2006) analysis of long run average returns on equity, which identifies a range of 6.5% - 7.5% for the market as whole.

[61] Note that the low end of the range presented here assumes that market expected a further reduction in the allowed cost of debt by the regulator from the 4.1% allowed in DPCR 2004 to 3.75%.

- Recent evidence of the required rates of return required by equity investors in the market. This suggests a range of around 5.5% - 7.0% for the post-tax real cost of equity.

Given this evidence (and taking account of the long-term range historical range for the cost of equity) our judgement is that an appropriate point estimate for the cost of equity for Network Rail is likely to be in the range 6.5 – 7.0%.

4.5.2. CAPM range

As noted above, we have not been asked to explore in detail a bottom-up CAPM estimate of the cost of equity for Network Rail. However, for completeness, we illustrate what plausible estimates of the CAPM parameters might suggest in terms of the cost of equity.

In each case, taking account of the earlier discussion relating to the instability of betas, we have assumed an equity beta of 1 as a simplifying assumption. Other key assumptions are as follows:

- The risk free rate is based on the broad range discussed earlier in the paper of 1.7% – 2.35%.
- The equity risk premium is assumed to be in the range of 4.0% - 4.5%. This is in the lower half of the long-term range suggested by Smithers[62] of 4.0 - 5.0%. We believe that this is a reasonable assumption in the context of the current, particular market conditions (referred to above).

Table 4.4 sets out these ranges. The key point to note is that even using the top end of our ranges for the risk free rate and the equity risk premium the CAPM CoE is less than 7%.

Table 4.4: CAPM calculations

	Low	Mid	High
RfR	1.70%	2.025%	2.35%
ERP	4.0%	4.25%	4.5%
β	1	1	1
CoE	5.70%	6.28%	6.85%

4.5.3. Point estimates

We have not been asked to provide a point estimate for the cost of equity. However, our judgement is that given current market conditions and the nature of the relative riskiness of Network Rail (compared with other regulated utilities) it would be reasonable to conclude that the correct point estimate is not at the top end of the 6.5% - 7.0% range. This would be consistent with our CAPM analysis discussed above, and may still be regarded as conservative (depending on the weight that is given to CAPM).

[62] The Smithers Report, September 2006.

5. SUMMARY ASSESSMENT OF THE COST OF CAPITAL

5.1. Assessment of notional gearing

Evidence of the relationship between gearing and credit ratings is mixed, but it suggests that it is possible to maintain a solid investment grade rating at gearing levels as high as 70%. Given regulatory precedent on the notional gearing levels set for broadly comparable regulated sectors, our assessment is that a 62.5% notional gearing is reasonable. We believe that this would be consistent with a notional network rail maintaining a solid investment grade rating, but would need to be confirmed as part of ORR's final judgements about the overall price settlement[63]. The range that we discuss in Section 2 is 60% - 65%.

5.2. Assessment of pre-tax cost of debt

Our judgement on the appropriate narrow range for the pre-tax cost of debt depends particularly on whether ORR expects to introduce 'trigger' or 'indexation' mechanisms on the cost of debt; or the extent to which (at the point that ORR set the cost of capital for CP4) Network Rail have locked into existing low rates in the forward market for a proportion of its future financing requirements. If either is the case, then an appropriate cost of debt is likely to be in the range of **2.7% – 3.0**%. In the event that there is little or no mean reversion risk it would be defensible to be at the lower end of this range.

In the absence of either sources of comfort we believe that it would be appropriate for the regulator to allow for an element of mean reversion. This suggests a narrow range which is at the higher end of our range, i.e. **3.00% – 3.25**%.

5.3. Assessment of post tax cost of equity

Our judgement is that an appropriate range for the cost of equity for a notional network rail in CP4 is 6.5% - 7.0%.

5.3.1. Post-tax vanilla WACC

Tables 5.1 and 5.2 below provide two possible narrow ranges of estimates for the post-tax vanilla WACC (both assume a gearing of 62.5%). The first range is consistent with the lower range of estimates for the cost of debt – which assumes that ORR introduces 'indexation' or 'trigger' mechanisms. The second assumes that there is no such 'indexation' or trigger' mechanism on the cost of debt and therefore allows for some element of mean reversion

[63] Including the level and profiling of capital expenditure, the required efficiency savings as well as the allowed cost of capital.

Table 5.1 – WACC (with cost of debt 'triggers')

Sample	Lower	Upper
Post-tax Cost of Equity	6.5%	7.0%
Pre-tax Cost of Debt	2.7%	3.0%
Gearing	62.5%	62.5%
Post-tax vanilla WACC	**4.1%**	**4.5%**

Table 5.2 – WACC (without cost of debt 'triggers')

Sample	Lower	Upper
Post-tax Cost of Equity	6.5%	7.0%
Pre-tax Cost of Debt	3.0%	3.25%
Gearing	62.5%	62.5%
Post-tax vanilla WACC	**4.3%**	**4.7%**

ANNEX A – TERMS OF REFERENCE

1. Background

The 2008 Periodic Review (PR2008) will establish Network Rail's required outputs, allowed revenues and access charges for the control period 2009-14 (CP4). A key part of determining allowed revenues will be establishing the appropriate allowed rate of return.

Network Rail is a company limited by guarantee (CLG) that currently benefits from a full faith and credit guarantee from government (the Financial Indemnity Mechanism (FIM)), which is effectively unlimited in terms of both time and amount. As set out in our February 2007 document, the intention is to restrict the use of the FIM from CP4 so that Network Rail has to raise any additional debt on an unsupported basis. It will also be charged a fee for the FIM that reflects the value of the resultant credit enhancement it receives. We believe that this will materially strengthen the incentives facing the company to strive for continuous improvements in performance and efficiency.

We also stated in February that we will provide Network Rail with an allowed rate of return that reflects its risk-adjusted cost of capital.

Part of the return will be used to provide Network Rail with a risk buffer to enable it to manage normal fluctuations in cash flow effectively. To the extent that Network Rail does not use this risk buffer to meet fluctuations in cash flow, it will have discretion over its use, subject to agreed principles. The residual surplus will be funnelled into a ring-fenced investment fund. This fund will be used to deliver required outputs, except in extremis when Network Rail will be able to draw on it for debt service.

Approach to establishing the cost of debt

In order to ensure that Network Rail faces a hard budget constraint and is not able to make easy windfall gains by beating the regulatory financial assumptions, we intend to take the following approach to determining the cost of debt within the overall cost of capital. We will take into consideration the type of financing strategy that an efficiently financed regulated utility could be expected to have in place based on historic, present and forward looking market conditions. In particular, we will consider evidence on the extent to which other regulated utilities have taken advantage of the recent bond market conditions.

By setting out this approach to establishing the allowed cost of capital in February, our intention was to send a strong message to Network Rail that we expect it to finance itself efficiently and consider carefully whether it is appropriate to alter its financing strategy given current market conditions.

We have also stated that, in establishing Network Rail's allowed return, we see merit in principle in indexing (a part of) the allowed cost of debt. The rationale for this is that the increased risk facing customers could be more than outweighed by the resultant lowering in Network Rail's cost of capital, thus improving value for money. However, the

decision as to whether indexation is ultimately appropriate depends in part on the practicalities.

The practicalities of indexation are the subject of a separate but parallel study. However, the decision as to whether to index (a part of) the cost of debt will have implications for the methodology for establishing the allowed return.

2. Required consultancy services

We would like to appoint consultants to undertake a study to scope out the appropriate detailed methodology for establishing Network Rail's risk-adjusted cost of capital in line with the high-level approach that we set out in February, and to provide an estimated range for the cost of capital implied by this methodology.

The study should include:

- An analysis of the way in which the assumed cost of debt embedded within Network Rail's cost of capital could be calculated. This should incorporate both a review of the literature and regulatory precedent. It should also reflect the high-level methodology that we set out in February. It will also need to consider how indexation of (a component of) the cost of debt would affect the approach;
- An analysis of the way in which the recommended methodology could be expected to impact on the incentives facing Network Rail with respect to its financing strategy and any implications for regulatory policy going forward (e.g. vis-à-vis the treatment of embedded debt);
- An estimated range for the cost of debt based on the detailed methodology identified;
- A review of the literature and regulatory precedent on the appropriate cost of equity for capital intensive regulated network industries, together with conclusions on the implications for ORR, including a range estimate, in setting the cost of equity embedded within the allowed return. We anticipate this review looking at the overall estimate of the cost of equity rather than, for example, the components under a CAPM framework;
- A review of the literature and regulatory precedent on the appropriate notional level of gearing to be assumed for a company with Network Rail's attributes, together with a recommendation on the approach to be taken for Network Rail; and
- A range estimate for Network Rail's overall cost of capital based on the above.

We and the Department for Transport have already commissioned some preliminary work on the financial structures of the ten largest regulated UK utilities (excluding Network Rail) and on potential efficient financing strategies based on current market conditions. We will make this analysis available to the successful consultants.

Any emerging themes from the study on indexing (a part of) the cost of debt, referred to above, will also be made available to the successful consultants. However, the study on

indexation is expected to run in parallel with this one, and so only limited material may be available.

ANNEX B - RELATIVE RISK

1. Introduction

This short Annex provides a high-level discussion of the relative risk faced by Network Rail in the current regulatory regime compared with other regulated utilities. This is relevant as background material for our analysis, as well as for comparing the assumptions made by regulators in other sectors with the judgements made about Network Rail. In particular it is relevant to judgements about:

- Notional gearing (Section 2). As part of our analysis of the appropriate notional gearing we consider the regulatory precedent from recent price determinations in other utility sectors.
- Cost of equity (Section 4). Again, as part of our analysis, we consider regulatory precedents regarding the cost of equity used in recent price determinations.

As agreed with ORR, in the time and budget available we have not sought to carry out additional primary analysis of the relative risk of different regulated sectors. Such analysis would expect to consider in particular:

- Volume or market risk, i.e. the level of exposure of the regulated company to changes in levels of demand. Where possible this draws on evidence on operational gearing in the business (i.e. the proportion of total costs in the business that are vary with volume).
- Operating cost risk, i.e. the variability of the costs that the regulated utility faces in the operation of its business, and the extent to which the regulator allows these to be passed through to the customer / users.
- Capital expenditure risk, i.e. the riskiness of delivery of major capital expenditure projects and how capex is treated within the regulatory regime.
- Regulatory risk, i.e. the consistency and predictability of the regulatory regime.

Based on a high-level qualitative assessment of these factors, our overall judgement is the rail regulatory regime is towards the lower end of the "riskiness" range for regulatory regimes, with much of this being linked to market demand risk factors. However, we would emphasise that this judgement is based on CEPA's general knowledge of the other sectors and regulatory regimes, rather than a detail, additional analysis. Within the scope of this work we have not sought to extensively cross-check these judgements.

ANNEX C – RECENT REGULATORY PRECEDENT IN SETTING THE WACC

1. Introduction

This annex reviews the approach and methodology adopted by CAA, Ofgem and Ofwat in assessing the allowed cost of capital in recent price control reviews. In particular the reviews considered are:

- Ofgem transmission price control review (TPCR) (2006)
- Ofgem electricity distribution price control review (DPCR4) (2004)
- Ofwat review of water and sewerage price controls (PR04) (2004)

In preparing this review we have considered various issues in the assessment of the cost of debt and equity and the respective regulators treatment of these. The annex is structured as follows:

- Section 1 looks at the cost of debt and in particular: (i) the basis for determining the risk free rate; (ii) the debt premium; (iii) embedded debt; and split costs of capital.
- Section 2 considers the approaches to cost of equity and in particular whether and how the capital asset pricing model (CAPM) framework has been applied.

2. Cost of Debt

In assessing the allowed cost of debt for the reviews considered regulators have consistently applied the standard uniform approach to the cost of debt, that is:

$$\text{Cost of Debt} = \text{Risk free rate} + \text{Debt premium},$$

and made assessments of the risk free rate and debt premium on a real basis. Regulators have differed, however, in their methodology for estimating the individual components of the cost of debt and in the relative emphasis placed on historical averages in determining forward looking estimates.

Table C1 summaries the costs of debt determined by Ofwat and Ofem. For reference it also includes CAA's 2002 London airports determination and the 2006 London airports initial proposals.

Table C1: Recent regulatory decisions on the cost of debt

Regulator	Decision	R_f	Debt premium	CoD Range	CoD Used
CAA	Heathrow (2006)	2.00%	1.00%	3.00%	3.00%
CAA	Gatwick (2006)	2.00%	1.00%	3.00%	3.00%
Ofgem	TPCR (2006)	2.50%	1.25%	3.75%	3.75%
Ofwat	Water & sewerage (2004)	2.50-3.00%	0.80-1.40	3.30-4.40%	4.30%
Ofgem	DPCR4 (2004)	2.25-3.00%	1.00-1.80%	3.25-4.80%	4.10%
CAA	Heathrow (2002)	2.50-2.75%	0.90-1.20%	3.40-3.95%	3.675%*

**Midpoint*

2.1 Risk free rate

Ofgem DPCR4 (2004)

In DPCR4, Ofgem presented its analysis within the context of the Competition Commission's (CC) then recent decisions on water cases (2000), London airports (2001) and mobile telephony (2002). In these reviews the CC considered the real yield for long-dated (20 year); medium-term (10 year) and short-term (5 year) index-linked gilts. The CC concluded the real risk free rate to be in the range 2.2% - 2.3%.

Ofgem expressed reservations over the likelihood of perceived low risk-free rates remaining throughout the period of DPCR4:

"The issue for DPCR4 is the expected risk-free rate going forward. It is therefore important to come to a view whether current low market rates are likely to persist into the future or whether there are factors, which are not expected to persist, which depress rates at present."

And, in particular, was concerned about the effect of certain institutional factors such as the minimum funding requirement for pension funds and the health of public finances on the observed rates on UK government bonds. Ofgem concluded:

"Given the considerable uncertainty surrounding the expected risk-free rate, it seems appropriate to adopt a cautious approach and hence a relatively wide range at this stage."

On the back of these concerns, Ofgem symmetrically widened the CC range for the risk free rate by 0.25%, adopting a range of 2.25% - 3.00%.

Ofgem TPCR (2006)

For TPCR, Ofgem commissioned Smithers & Co to author a report on certain aspects of the cost of capital which was influential in shaping Ofgem's final assessments. Smithers (2006) highlighted two issues Ofgem needed to address in order to establish an accurate

estimate of the risk free rate. Theses were i) whether regulators should look at yields on nominal or indexed bonds for the cost of debt component; and ii) should a term premium be included in the risk free rate assessment.

With regard to the former, using zero-coupon yields on gilts from the Bank of England, Smithers (2006) argued that using yields on index-linked gilts as a benchmark in setting the cost of debt may include a downward bias:

" the gap between nominal and real yields is not purely a forecast of inflation, but also contains a risk premium element (or, put another way, that indexed bonds have traded at an increasing risk discount)."[64]

They concluded it was more appropriate to focus on nominal yields for all components of the cost of debt, and therefore, the best estimate of the forward-looking risk-free rate is deflated nominal yields on government gilts by the expected inflation rate.

With regard to the latter of the issues Smithers (2006) highlighted, ie the need for a term premium, the authors noted that in the recent past differences between yields at different maturities (ie, term premia) have all but disappeared. Analysis of the determinants of, and long-run data on, term premia suggested there is little reason for expecting the current term premium of essentially zero to revert to some historical average. If the term premium is indeed close to zero, Smithers (2006) argue the best current market-based estimate of the forward-looking risk-free rate is the nominal yield on medium-dated gilts, less the Bank of England's inflation target (2.00%).

Spot and five year average nominal yields on medium term debt were around 4.00% - 4.50% at the time leading Smithers (2006) to suggest a real risk free rate if around 2.00% - 2.50%. The ruling out of the lower end of the range such that 2.00% is the final figure recommended by Smithers (2006) and subsequently applied by Ofgem is not fully explained.

Ofwat PR04 (2004)

Ofwat considered both current and historical evidence on the risk free rate. It principally looked at real yields on index-linked gilts with maturity of ten years and above. In doing so the regulator noted:

"Real yields on medium maturity index-linked gilts (maturity of ten years and above) have averaged just under 2% over the last six months and just above 2% over the last five years. Consequently, the short-term data supports a risk-free rate of just 2.0%. Current gilt yields are significantly below the long-term average…The average gilt yield is 2.5% if averaged over eight years; it is 3.0% if averaged over 13 years."

Ofwat's final decision was based on the historical average level of yields on medium-term index-linked gilts rather than the current market rates. Current yields were considered to be at historically low levels and factors depressing rates were uncertain to persist in the long term. Ofwat concluded that to simply take account of the current market spot rate

[64] Ofgem (2006), 'Transmission Price Control Review: Initial Proposals', page 39.

would not lead to a sustainable WACC over the medium term. In it's final determination, Ofwat used a range of 2.5% to 3.0% for the risk free rate.

2.2 Debt premium

Ofgem DPCR4 (2004)

Ofgem's measurement of the debt premium for DPCR4 was significantly simplified given the large volumes of outstanding distribution network operator (DNO) marketable debt. Analysis of this existing debt enabled the regulator to establish a guideline estimate of the firm-specific cost of debt. Ofgem was particularly concerned with the volatility of DNO debt premia. It considered the average debt premia of all licensees' bonds at a *given point in time* and the (longer-term) average debt premium of licensees' bonds *over time*. Ofgem noted average debt premia had been relatively volatile and although it observed relatively low current debt premia on DNO debt, the regulator expressed uncertainty as to whether low premia would persist going forward into DPCR4.[65]

Ofgem also estimated that a debt premium based on the past two years of data would be 0.93% for UK debt. A more long-term approach indicated an average debt premium of 1.36% for UK debt. Ofgem concluded:

"Given that there seems to be considerable uncertainty surrounding the expected cost of debt, Ofgem has adopted a relatively wide range for the debt premium of 1.0% - 1.8% in its cost of capital calculations."[66]

Ofgem TPCR (2006)

On Ofgem's behalf Smithers (2006) examined long-term average spreads on UK utility bonds to establish a range for the debt premium. The analysis made use of a relatively recent database of UK utility bond yields constructed by Grant Thornton. Their conclusion was:

"corporate bonds appear to be essentially 'commoditised'. Once we know information about a company's credit rating and the other key characteristics of the bond, the most important of which is clearly maturity, there appears to be no evidence of any significant company-specific effect on yields that is not captured by these characteristics."

On this basis Smithers conclude the key consideration in setting the debt premium is to arrive at an estimate of the yield on a chosen benchmark with an appropriate rating and maturity. Smithers (2006) focus exclusively on an A-rated benchmark, and find the long-term average spread for Bloomberg's benchmark A-rate 10 year bond for the UK has been 105 basis points.

Ofgem concurred with these conclusions in its initial proposals[67]:

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[65] Ofgem highlighted the risk, over the five year price control, of an increase in issuance of UK government debt (with demand staying constant) potentially increasing yields on UK corporate debt.

[66] Ofgem (2004), 'Electricity Distribution Price Control Review; Background information on the cost of capital', page 22.

[67] Ofgem (2006), 'Transmission Price Control Review: Initial Proposals'.

"the average spread versus nominal gilts over the last 10 years has been just fewer than 110 basis points for 'A' rated bonds with a ten year maturity (although the current value is lower at around 65 basis points)."

In it's final proposals, Ofgem reasserted that observed premia on utility debt were at historically low levels (within the range 98 to 130 basis points for A and BBB rated debt respectively).[68] They continued to express doubts as to whether these levels were expected to persist over the entire period of the price control or revert to the long term average. Ofgem therefore decided to a use a debt premium figure above that implied by current market levels choosing to base its estimate on long-term average spreads. Ofgem allowed a debt premium of 150 bp compared to (then) current market levels of 100 bp or lower.

Ofwat PR04 (2004)

Ofwat examined the spreads on publicly traded debt issued by water companies to form an assessment of the debt premium required for the water industry during PR04. The regulator also considered the spread differential between A rated and BBB rated bonds in comparison to the spread of A rate bonds over gilts. This was done to illustrate the low spreads observed at the time. Ofwat noted:

"The spread differential between A rated and BBB rated bonds has been more volatile than the spread of A rated bonds over gilts, ranging from 30 to 70 basis points over A rated bonds depending on market conditions."[69]

Ofwat placed greater emphasis on longer term historic averages for the debt premium, adopting a range of 80 to 140 basis points. It argued, based on historical evidence, that the bottom of the range was still representative of very low borrowing costs and it was unlikely these low debt spreads would be sustained throughout PR04. Ofwat argued there was a greater risk that spreads would rise over the control period than that they would remain unchanged or fall. Ofwat allowed a debt premium that exceeded (then) current spreads in order to protect the water companies from the risk that current low rates might increase unexpectedly during the price control period.

2.3 Other issues

Embedded debt

In light of relatively stable trends in real interest rates, Ofgem did not make an adjustment for the cost of historic debt in its assessment of the cost of debt for DPCR4. The regulator argued it was companies responsibility to manage their debt portfolio in an efficient manner such that consumers should only have to pay for efficient financing costs incurred by companies.

[68] Ofgem (2006), 'Transmission Price Control Review: Final Proposals'.

[69] Ofwat (2004): Periodic Review Future water and sewerage charges 2005-10 - Draft determinations, Appendix 3, page 223.

"It is for companies to manage their debt portfolios to achieve an efficient cost of debt. This is not simply a matter of minimising short-run costs or maximising tax efficiently…an efficiently financed company is one that takes a balanced approach to the management of its borrowings, which diversifies its risks cost-effectively (especially its refinancing, interest rate, inflation and duration risks) and which aims at achieving a broadly stable real interest cost over time."

Ofwat also considered the issue of embedded debt and allowing a premium for this in PR04. Their view was that, since the allowed cost of debt placed greater emphasis on longer term historic averages for the risk-free rate and the debt premium and subsequently was at the high end of the range, the need for an embedded debt premium is much reduced. Ofwat concluded that only one water company was justified in claiming an embedded debt. However, the overall cost of debt in the company's business plan (including the high coupon fixed rate element) was lower than the allowed cost of debt in Ofwat's WACC assessment and consequently concluded that no additional premium was required.

Split cost of capital

As part of TPCR, Ofgem considered whether all assets should attract the same rate of return or whether it would be more appropriate for separate asset classes to attract differential rates of return. This was on the grounds of providing an appropriate return on existing assets, while increasing the reward available to licensees in areas where they were perceived to be taking relatively more risk.

In any event, Ofgem took the view that the addition of new assets (at a higher rate of return) to the existing asset RAB (at a lower rate of return) would likely result in a lower rate of return over time and concluded that a similar effect may also be achieved by establishing an appropriate rate of return over the entire asset base, reflecting the risks involved in an investment in both existing and new assets. There was no discussion of split cost of capital in the final decision paper.

3. Cost of Equity

Typically regulators have tended to employ CAPM as the central plank in their assessment of cost of equity. According to CAPM a company's cost of equity is defined by the following relationship:

$$COE = \text{risk free rate} + \text{equity beta} * \text{equity risk premium}$$

That is, a business' cost of equity is a function of: the return on risk-free assets, the additional return required by investors to invest in the equity market and the firms exposure to market risk.

It is now common place for regulators to acknowledge that a mechanistic application of CAPM gives a cost of equity that is implausible.

'It is apparent that applying the CAPM framework on its own could produce a very wide range for the cost of capital. This arises principally because of an extended period of volatility in the capital markets worldwide and the impact of this on some of the components underlying CAPM, particularly the risk-free

rate and equity beta factors. For example, currently beta factors for the listed water companies are around 0.4 – a significant decline since the last review. They were as low as 0.3 in 2002-03. This decline is likely to reflect wider market influences rather than a fundamental change in the business risk faced by the water companies. Another component of CAPM, the equity risk premium, has always been difficult to measure with any precision. In our methodology paper, we recognised that in assessing the cost of capital, it was possible that we would need to supplement a CAPM-based approach using current market data with other techniques and evidence.

Such volatility in the capital markets means that, in our view, and in the view of our advisers, less reliance than at previous price reviews should be placed on the conventional methods of assessing the cost of equity such as CAPM.'

Source: Ofwat (2004) pp220-1

Similarly, Ofgem acknowledged the practical and theoretical limitations of a purely technical, CAPM based approach to setting the cost of equity as part of its 2004 electricity distribution price control review (DPCR4):

'In determining its cost of equity assumption for the final proposals, Ofgem has had regard to traditional methods such as CAPM as well as wider market evidence, including data on the aggregate return on equity over time. As part of this review, Ofgem commissioned Smithers & Co to present a report on beta estimates for a range of companies in the electricity and water sectors. Smithers & Co found strong evidence of parameter instability for several of the companies. This was problematic given that a fundamental assumption underlying the traditional CAPM approach is that beta remains stable over time…Given this background, Ofgem decided also to have regard to other methods in determining the appropriate cost of equity.'

Source: Ofgem (2004), pp105-6

As a result they often move away from observed equity betas and replace these with the market equity beta of 1.0. This engineered approach calls into question the value of the CAPM framework as the primary tool in assessing the cost of equity. More recently regulators, including Ofgem and Ofwat, have reduced the emphasis placed on CAPM and taken account of wider market evidence.

Figure 2 summaries the costs of equity determined by Ofwat and Ofem. For reference it also includes CAA's 2002 London airports determination and the 2006 London airports initial proposals.

Figure 2: Recent regulatory decisions on the cost of equity

Regulator	Decision	R_f	ERP	β	CoE Range	CoE Used
CAA	Heathrow (2006)	2.0%	4.5	1.13-1.26	7.1 – 7.7%	7.7%
CAA	Gatwick (2006)	2.0%	4.5	1.30-1.48	7.8 – 8.7%	8.7%
Ofgem	TPCR (2006)	2.5%		0.9[70]	6.5 – 7.5%	7.0%
Ofwat	Water & sewerage (2004)	2.5-3.0%	4.0-5.0%	1.0	6.5-8.0%	7.7%
Ofgem	DPCR4 (2004)	2.25-3.0%	2.5-4.5%	0.6-1.0	3.75 - 7.5%	7.5%
CAA	Heathrow (2002)	2.5-2.75%	2.5-4.5%	0.8-1.0	4.5-7.25%	6.4%[71]

Ofgem DPCR4 (2004)

Ofgem organised discussion of the expected cost of equity around the components of CAPM for DPCR4. The regulator, however, noted the considerable uncertainty surrounding CAPM inputs, in particular the equity risk premium (ERP) and the risk-free rate of return.

"Both are subject to uncertainty and are sensitive to the methodology adopted and chosen timeframe. Substantial academic literature is devoted to the empirical difficulties in reconciling independently derived estimates of the ERP and risk free rate to total market returns (the 'ERP puzzle')."

Ofgem referenced the conclusion made by Smithers (2004), that the 'ERP puzzle' can be solved, by basing regulatory cost of equity estimates on total market returns rather than the CAPM approach. The relative weight to be placed on this approach, the regulator argued, would be determined by the characteristics of the underlying data, and the extent to which equity risks of the regulated business are similar to the market average.

As discussed above, Ofgem chose not to rely on observed spot market data for the real risk free interest rate and assumed a range for the risk-free rate of 2.25% to 3%. The regulator adopted a range from 2.5%-4.5% for the ERP, based on then recent decisions by the CC.

Ofgem presented analysis on the firm specific parameter of CAPM - the equity beta. The regulator made two key conclusions:

[70] Ofgem moved away from a CAPM approach in its final determination, but had earlier indicated it agreed with Smithers & Co findings of equity beta = 1.0 being generous and proposed a beta of 0.9 for modelling purposes.

[71] 6.38% is the cost of equity (for Heathrow) consistent with the 7.75% pre-tax WACC if the adjustments to the central values used by CAA are assumed to relate wholly to the cost of equity. Detail of this calculation is set out in note 29 of CEPA (July 2006).

- Equity betas of regulated utilities appear to have been falling. Since the peak of the technology, media and telecommunications bubble, there has been a decline in the betas of 'safe stocks' and an increase in the betas of what might be regarded as 'high tech stocks'.
- Smithers (2004) report strong evidence of beta parameter instability for several of their sampled companies. This might make beta estimates more uncertain into the future and hence more weight might be given to the unconditional expectation of unity.

Ofgem TPCR (2006)

For TPCR, Ofgem placed considerably more weight on market evidence and, in particular, the Smithers (2004; 2006) findings that the long term aggregate market return on equity was 6.5% - 7.5%[72]. Smithers (2006) also concluded that statistically, network utilities represent lower than average risk to equity investors, with beta estimates significantly lower than 1. Thus the policy of setting beta equal to 1 for network utilities is generous.

In the regulator's final proposals, Ofgem conclude:

"While beta estimates are presently lower than 1, they have varied significantly around this level since privatisation. It is therefore difficult to assess whether the estimates suggested by the Smithers report are representative of long term trends. In view of the scale of the capital expenditure requirement, it is important that the assumed cost of equity is sufficient to enable companies to withstand unanticipated risks and to attract and retain equity funding. Given these considerations, we propose to place greater weight on the range of total market returns than the components of CAPM."

Indeed, having developed estimates for the CAPM parameters that were consistent with a cost of equity of 7.0% and a risk free rate of 2.3% in their initial proposals, Ofgem effectively further downgraded CAPM by making no change to their cost of equity assessment or amending their parameter estimates when in the final proposals they revised their risk free rate estimate to 2.5%.

Ofwat PR04 (2004)

Having stated its reservation over CAPM (see earlier), Ofwat used the theoretical framework to derive a range for the cost of equity which it then refined through consideration of wider market evidence including:

- the dividend growth model;
- market to asset ratios; and
- transaction based evidence.

The CAPM derived range was 6.5% - 8.0%. Ofwat decided on a cost of equity at the upper end of the range (7.7%) based on the market evidence presented.

[72] On an arithmetic mean basis. This figure is based on the 5.5% geometric return proposed by Dimson et al (2001).

ANNEX D – COMMON DEFINITIONS FOR THE WACC

There are a number of different definitions of the WACC. Here we define three: the post-tax 'vanilla' WACC; the pre-tax WACC; and the post-tax net of debt tax shield WACC. Different definitions are used by different regulators and care is needed to ensure that like is being compared with like and that taxation cost adjustments are appropriate to the chosen definition. The value of the WACC differs depending on the definition used as does the way taxation costs are allowed for.

Post-tax 'Vanilla' WACC

A common formulation of the WACC is:

$$\text{Post-tax vanilla WACC} = r_e \frac{E}{V} + r_d \frac{D}{V}$$

where r_e is the post-tax cost of equity (i.e. equals the after tax rate of return available on alternative equity investments of comparable risk)

r_d is the gross cost of debt (i.e. the sum of the risk free rate and the corporate debt premium available to debt providers for alternative debt opportunities of comparable risk)

D is the value of the firm's debt

E is the value of the firm's equity

V is the sum of $D+E$ [73]

The post-tax vanilla WACC is the return available to providers of debt and equity capital after company tax payments have been accounted for. If allowed revenues to fund the return on capital are set using the post-tax vanilla WACC, the expected taxation costs should be separately and additionally allowed for when setting maximum prices. This post-tax vanilla WACC is the formulation used by, for example, Ofwat and (since 2004) Ofgem.

Pre-tax WACC

Some regulators (including CAA in Q4) use a pre-tax WACC. The pre-tax approach 'grosses-up' the post-tax vanilla WACC to an equivalent pre-tax WACC.

$$\text{Pre-tax WACC} = \frac{r_e}{(1-t)} \cdot \frac{E}{V} + r_d \frac{D}{V}$$

where t = statutory company tax rate

[73] The theory states that D and E should be market values. In practice book values are often used. For the regulated business (D+E) = RAB.

and all other terms are as in the post-tax vanilla WACC formula above.

The pre-tax WACC approach implicitly assumes that the effective tax rate on pre-tax profit is equal to the statutory company tax rate. If allowed revenues to fund the return on capital are set using the post-tax WACC, no further revenue should be allowed to fund taxation costs because the 'grossing-up' has already allowed a notional amount to fund taxation costs and any additional allowance would be double-counting. This pre-tax WACC is the formulation used by CAA in Q4 and, for example, by Ofgem in 1999 (not, however, since 2004).

The 'grossing-up' by *(1-t)* of the post-tax return on equity will *only* give the same post-tax rate of return as using the post-tax vanilla WACC and separately allowing for taxation costs *if* the effective tax rate equals the statutory tax rate. If the effective tax rate is lower than the statutory rate allowed, revenues will overcompensate the company and the actual post-tax WACC will be higher than the allowed WACC.

In practice, because of differences in timing between capital allowances for tax purposes and depreciation allowed in the statutory and regulatory accounts, the effective company tax rate is often significantly lower than the statutory rate.

5.3.2. Post-tax net of debt tax shield WACC

This alternative formulation of the post-tax WACC, called the net of debt tax shield WACC, is defined as:

$$\text{Post-tax WACC Net of Debt Tax Shield} = r_e \frac{E}{V} + r_d (1-t) \frac{D}{V}$$

This differs from the post-tax vanilla WACC in that it adjusts the gross cost of debt directly to a post-tax cost of debt by directly taking account of the tax deductibility of interest. This formulation is appropriate *only if* the regulator makes no further allowance for the tax deductibility of interest when calculating the allowance for taxation costs (i.e. allowed revenue to fund taxation costs should be calculated as if the company were 100% equity funded). This formulation is included here primarily because some city analysts use this definition when setting out their views of the appropriate value of the WACC. If the allowance for taxation costs is correctly made (i.e. as if it were an all equity financed business) and if but only if the effective rate of tax equals the statutory rate then this definition – although giving a different 'headline' allowed WACC – will provide the company with the same allowed revenue as the other definitions of WACC.