Cost of Capital and Financeability at PR09

Updated Report by Europe Economics

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EXECUTIVE SUMMARY

1 Europe Economics has been commissioned by Ofwat to advise on the cost of capital and financeability at PR09. This report, an updated version of an earlier report by Europe Economics published in July 2009[1], sets out our final recommendation on the WACC which should apply to the water industry during AMP5. It also contains our advice on the package of financial ratios which Ofwat should use in its financeability analysis.

2 Our approach has been to employ CAPM as the main estimation methodology, with the Fama-French model, the Dividend Growth Model (DGM) and Market to Asset Ratios (MARs) used as cross-checks. We remain sceptical of the use of "add-ons" to CAPM to justify a small company premium, but have considered within our CAPM framework whether there is any evidence that the WACC differs between WASCs and WOCs.

3 A key issue in our estimation was how to treat current market data, particularly in relation to the cost of debt and the equity risk premium (ERP), given the constraints that have been observed in credit markets. Our approach has been to estimate two separate WACC estimates: a "crisis WACC" based on current market data and a "post-crisis WACC" representing our best view on where the market may settle as the recent constraints in credit markets ease. We have then weighted these two WACC estimates by considering the typical duration of previous financial crises and the profile of the industry's capital-raising requirements over AMP5.

Risk free rate

4 Although new evidence since the time of the Report by Europe Economics published in July 2009 has tended to favour a lower risk-free rate, we continue to recommend a figure of 1.75. Our examination of yields on UK index-linked gilts (ILGs) shows that there is a long-term declining trend in gilt yields, and consideration of ILG yields and other evidence (including the most recent), in isolation of past regulatory precedent, would suggest a risk-free rate below our recommended figure. However, we have placed some weight on the idea that regulatory responses to falls in ILG yields should follow a Bayesian updating process, in which the assumptions made by various regulators on the risk-free rate should fall gradually over time as new data confirms that lower gilt yields are persistent.

5 We recognise that a risk-free rate assumption of 1.75 is lower than the figures used by regulators previously. We have placed some weight on the Smithers & co view, and the view expressed in the recent CC recommendations on the cost of capital for Stansted airport, that the sum of the risk-free rate and ERP is more stable than the individual components. Hence, our ERP assumption (discussed below) is higher than has typically been assumed by regulators in the past, particularly for the "crisis WACC".

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[1] "Cost of capital and financeability at PR09; Report by Europe Economics", Finalised for publication 21 July 2009

Equity betas

6 Our range estimate for the equity beta (prior to relevering to our notional level of gearing) is 0.50 to 0.75, with an indicative point estimate of 0.65. We estimated 1 and 2 year equity betas for the water industry using daily data, with the FTSE All Share Index used to measure market returns. We note that (a) new beta evidence since the Report by Europe Economics published in July 2009 suggests a very slight decline in the beta (though our recommendation has not changed); and (b) that beta estimates have changed very little over the period of the credit crunch, despite great volatility in overall market prices. This tends to support the validity of the underlying theory. Beta is a measure of *relative* risk, so even if overall risk appetites in the market were now less than two years ago, this would not necessarily imply that *beta* had fallen. Market-wide events would be expected to have their main impact upon the Equity Risk Premium, not the beta.

7 When relevered to our proposed notional level of gearing, our point recommendation for the equity beta is 0.62.

Equity risk premium

8 Our view of the long-term evidence, particularly the long-term academic studies (such as DMS 2007), is that an ERP of 5 is appropriate. There is some evidence to suggest that the ERP rises in periods of recession or significant financial crisis – rising by the order of 20 per cent. In the light of this, our recommended figure for the ERP is 6 per cent in the "crisis WACC" and 5 per cent in the "post-crisis WACC".

Capital structure

9 We recommend a notional gearing assumption of 55 per cent both for WaSCs and for WoCs. Subject to the results of Ofwat's financeability analysis, we believe this gearing level would allow all companies to maintain a credit rating of at least A- (and may allow some companies to achieve a stronger rating).

10 Our starting point for thinking about the effect of gearing was the Modigliani-Miller insight that the riskiness of a company depends on the riskiness of its real cash-flows — volatility in the costs and in the demand for its products. We took into account discussions with rating agencies, other contacts in the City, and recent actual gearing levels. Our range assumes that capital expansion will be financed by some balance of new equity and debt — the assumption consistent with the WACC approach — rather than being fully debt-funded. Our analysis of the situation informed by our interview programme suggests that new equity issuance over the period 2010-15 should not be materially more difficult that the issuance of new debt assuming there were appropriate coordinating signals by Ofwat.

11 We note that an alternative approach would be to conclude from recent events that the credit crisis is already easing and that the new post-crisis equilibrium can be seen clearly. On such an approach it would be possible to assume a bond rating of BBB+ and a correspondingly higher level of gearing. We model the implications of this in section 8 of the report (as matters turn out, it does not affect our final, marked-up post-tax WACC

figure). Although we consider this worth modelling, our view remains that it is appropriate to treat the current market environment as potentially no more than a lull (though, as set out below, we have updated our best-estimate of the cost of debt), and to continue with our crisis/post-crisis approach and the corresponding assumption of A- bond ratings.

Cost of debt

12 Our recommended real pre-tax cost of debt is 3.95 per cent for the crisis WACC, comprising a debt premium of 2.2 and a risk-free rate of 1.75. This is somewhat below the figure we recommended in the Report by Europe Economics published in July 2009 for Ofwat, reflecting a decline in corporate bond spreads in recent months. For the post-crisis WACC, our recommended real pre-tax cost of debt is 3.25 per cent, based on a debt premium of 1.5 and a risk-free rate of 1.75. Our cost of debt assumptions are based on all water companies (WaSCs and WoCs) achieving a credit rating of at least A-, although we believe that at our notional gearing level some water companies would be able to achieve a stronger rating than this.

13 In deriving our cost of debt assumption, we looked at spreads on both nominal and index-linked water company bonds, spreads on recent new bond issues by utilities, and spreads for broader market bond indices. We placed most weight on water company data, given that this best reflects the actual risk exposure of the water sector. The debt premium used in the crisis cost of debt is based on current bond spreads, whereas the debt premium used in the post-crisis cost of debt is based on longer term historical data (although we assumed that the low spreads seen from mid-2003 to mid-2007 were unlikely to return).

14 On other issues relating to the cost of debt:

- We recommend that Ofwat makes no adjustment for embedded debt.
- We consider that pre-funding costs are best taken into account by Ofwat including cash balances in its financial modelling, rather than by adjusting the cost of debt assumption.
- We think that transactions costs are adequately covered by the fact that our cost of debt assumption is towards the top end of the range supported by our review of market data, and that it is unnecessary to make a separate allowance for them.

Overall WACC range

15 Our recommendation on the WACC for the water industry during AMP5 is 4.3 per cent on a real post-tax basis, unchanged from our previous recommendation. The derivation of this figure is as follows:

- Based on the WACC components discussed above, our crisis WACC is 4.0 per cent and our post-crisis is 3.5 per cent (both quoted on a post-tax basis);

- Placing a 45 per cent weight on the crisis WACC based on an analysis of the profile of the industry's capital-raising requirements and the duration of past financial crises gives a weighted post-tax WACC for AMP5 of 3.7 per cent.

- Applying a 14.4 per cent mark-up to this figure, to take account of the potential asymmetry of consequences between under- and over-estimating the WACC (see section 7), gives a final WACC recommendation of 4.3 per cent on a post-tax basis.

Table 1: Recommendations on the WACC

	Crisis	Post-crisis	Weighted WACC
Cost of equity			
Risk-free rate	1.75	1.75	
Equity risk premium	6	5	
Equity beta (not relevered)	0.65	0.65	
Asset beta	0.28	0.28	
Re-levered equity beta	0.62	0.62	
Post-tax cost of equity	5.48	4.86	
Pre-tax cost of equity	7.61	6.74	
Cost of debt			
Debt premium	2.2	1.5	
Pre-tax cost of debt	3.95	3.25	
Post-tax cost of debt	2.84	2.34	
Overall WACC			
Notional gearing	55%	55%	
Corporation tax rate	28%	28%	
Pre-tax WACC	5.6	4.8	5.2
Post-tax WACC	**4.0**	3.5	**3.7**
"Vanilla" WACC	4.6	4.0	4.3
Marked-up figures to take account of asymmetric consequences			
pre-tax WACC	6.4	5.5	5.9
post-tax WACC	**4.6**	**4.0**	**4.3**
"vanilla" WACC	5.3	4.5	4.9

WoC cost of capital

16 We recommend that Ofwat applies the same cost of capital to WoCs as to WaSCs. Corporate finance theory does not support a small company premium *per se*, and *ad hoc* adjustments to CAPM-derived estimates such as a small company premium are very likely to lead to an element of double-counting.

17 We considered whether there was any evidence to support a higher asset beta for WoCs within the CAPM framework. However, the qualitative *a priori* evidence tended to point in the other direction (i.e. that WoCs have lower systematic risk), and the empirical data is inconclusive.

18 Although an argument could be put forward for a higher cost of debt for WoCs based on higher specific risks being reflected in a higher default premia, this is unsatisfactory given that specific risks should not affect the underlying cost of capital. Instead, we have chosen a combination of gearing, target credit rating and cost of debt which we think will allow all water companies (WaSCs and WoCs) to raise debt finance, and which may allow those companies able to achieve a credit rating above A- to out-perform Ofwat's cost of debt assumption.

Cross checks to the CAPM

19 We made use of the following alternative estimation techniques: dividend growth model (DGM); Fama French three factor model; Market to Asset Ratios (MARs); and cross checks against city opinions and comparables. Using a one-step DGM the range for the post-tax cost of equity estimate was 5.6 to 7.7 per cent (which includes our point CAPM estimate). Similar results were obtained using a multi-period DGM. The Fama French model results were consistent with those of the CAPM beta estimation although did not provide any additional explanatory power. Our estimates suggest that the water industry MAR (i.e. for listed companies) declined a little following publication of Ofwat's draft determinations and is currently slightly above 1.

Financeability and financial ratios

20 Our discussion of financeability issues concluded that Ofwat should target a credit rating of A-, although we consider that this is a cautious approach since companies may in fact be able to raise debt at lower credit ratings. We suggest that Ofwat should also carry out its financeability analysis for a rating of BBB+. We set out a package of financial ratios for WaSCs and WoCs for Ofwat to employ in its analysis. Our set of ratios for an A- rating is similar (but not identical) to those ratios employed by Ofwat at PR04.

1 INTRODUCTION

1.1 Europe Economics has been commissioned by Ofwat to advise on the cost of capital and financeability for water companies for the period 2010-2015 (referred to as AMP5). This reports sets out our final recommendations for the WACC which Ofwat should use at PR09. The report includes consideration of whether the cost of capital differs between WaSCs and WoCs, and also advises Ofwat on the package of financial ratios which it should consider in its financeability analysis.

1.2 For the purpose of the price control we need to derive a real WACC, and hence we carry out our analysis in real terms rather than nominal terms.

Overview of Methodology

The CAPM-WACC Framework

1.3 Ofwat has stated that it intends the CAPM-WACC framework to be the centrepiece of its cost of capital assessment for PR09, as is the standard policy of UK economic regulators. We now briefly rehearse what this framework is.

1.4 The cost of capital allowed by a regulator in setting price limits should reflect the opportunity cost of the funds invested in assets; it represents the rate of return that an investor would be likely to require in order to invest in a company, given its risk profile compared with other potential investments. It can also be thought of as the discount rate which an investor would use in evaluating the income stream to be expected from investing in the company.

1.5 The weighted average cost of capital (WACC) is computed from (a) the average cost of debt for the various forms of debt held by the company, and (b) the cost of equity. This is the return that investors (shareholders and lenders of various types) require in order to invest in the company.

1.6 Mathematically, the following formula is used:

$$WACC = r_E . \frac{E}{D+E} + r_D \frac{D}{D+E} \qquad [1]$$

where r_E is the cost of equity, r_D is the cost of debt and E and D are the total values of equity and debt respectively used to determine the level of gearing in the company, and so giving the relative weights between the cost of equity and debt finance.

Cost of debt

1.7 The cost of debt measures the combination of interest rates charged by banks to the company and the return paid by the company on any corporate bonds or other loan instruments issued. It is standard practice to conceive of this as being made up of a risk free component and a company-specific risk premium.

$$r_D = r_f + debtpremium \qquad [2]$$

1.8 Since payments on debt are generally fixed (in contrast to the variable returns on equity), "risk" in this context principally means the risk of non-payment. One potential measure of the risk of non-payment is the rating on the company's debt, provided by ratings agencies. Thus, one way to calculate a company's debt premium is to consider the rating(s)[2] of its debt and then take market data on spreads on bonds with this rating.

1.9 Recent events in credit markets call into question whether calculations based on current and recent data are indeed those most relevant to the period 2010-2015. This is explored in more detail below.

Cost of Equity

1.10 The capital asset pricing model (CAPM) is used to determine the cost of equity, r_E, applying the following equation:

$$r_E = r_f + \beta_E * MRP \qquad [2.3]$$

- r_f is the return on a risk free asset, usually proxied by a measure of the rate on medium to long-term government bonds.
- β_E is the correlation between the risk in company returns and those of the market as a whole, which can be estimated from primary market data.
- *MRP* is the market risk premium over the risk free rate, an economy-wide parameter.

1.11 Thus in the standard CAPM there are three determinants of the expected return on any asset: the return on a riskless asset; the market premium over that riskless rate that is earned by investors as a whole, reflecting systematic risk; and the particular company's exposure to systematic risk. As discussed further below, company specific risks do not enter the cost of capital, as they can, by definition, be diversified away by investors.

1.12 As in many parts of this review, current market conditions create concerns about estimates of the risk-free rate and estimation of the MRP (this latter typically being estimated via the proxy of the equity risk premium — the risk premium associated with shares).

[2] Different ratings agencies may assess a company's debt differently. Thus there may be more than one rating to consider, even after allowing for differences in definition between different ratings agencies.

Approach to risks

1.13 Under CAPM, risks are divided into two major categories:

(a) Systematic risks; and

(b) Specific risks.

1.14 Systematic risks are risks that affect the whole market. Systematic risks relate to outcomes that cause the whole market to move, such as economic growth or recession, or wars. Even fully diversified investors are subject to systematic risk, and require a compensation for it through the cost of capital. The amount of compensation (the level of the cost of capital) they require from a particular company or a project depends on how exposed that company is to systematic risks.

1.15 The specific risks affecting an individual firm are those risks that can be offset by investors diversifying their investments. These are not taken into account in CAPM because it is assumed that in an efficient capital market investors can protect themselves against such risks by holding a diversified portfolio — implying that specific risks do not affect the rate of return to investors that the company has to cover through its cost of capital.

1.16 Consider an industry in which there is no systematic risk (and no industry-specific risk), but each of the companies in the industry faces company-specific risk. CAPM predicts that the rate of return in this industry would be the risk-free rate. Since there is no systematic risk, an investor with equal shares in all the companies in the industry would be guaranteed to receive the risk-free rate every period — the company-specific risks taken that turned out badly in some companies would exactly balance those that turned out well in others (that is precisely what it means to say that there is no systematic risk).[3]

1.17 An example of a specific risk would be cost shocks caused by failure of the engineering solutions adopted by a water company.

Treatment of the financial crisis

1.18 A central issue relates to how the current financial crisis should be treated in our WACC estimation. Currently, corporate bond premia are at historically high levels and it can be argued that the ERP has risen as well. However, Ofwat is setting the cost of capital for 2010-15 and not for today, and it is plausible (and in our view likely) that the current constraints will have eased by partway through AMP5. Hence, there is a danger of over-reacting to short-term data and setting a WACC which will prove to be too high once AMP5 is underway. On the other hand, companies will need to raise some finance during

[3] Note that industry-wide industry-specific risks can be diversified by investors, in an analogous way to that set out in the thought experiment above, through holding shares across industries.

the early years of AMP5 when the crisis may still plausibly be affecting financing costs, particularly given pre-funding requirements.

1.19 Our approach to this issue is to derive, initially, two separate WACC estimates: a "crisis WACC" based on current market data and a "post-crisis WACC" based on our best view of where the market may settle after the crisis, informed by longer term historical data.

1.20 In order to arrive at an overall WACC figure for use in the price control, we weight our crisis and post-crisis WACC estimates by looking at the typical duration of previous financial crises and the potential profile of water companies' capital-raising requirements over AMP5.

Comparing WaSCs and WoCs

1.21 We are very sceptical about both the methodological appropriateness of employing *ad hoc* adjustments such as a "small company premium" and of the specific evidence supporting the scale of such a premium if it were to be employed.[4] Our view remains that the best approach in this area is to employ the CAPM framework to the full, considering whether there is evidence or reasoning to support the idea that particular companies (or groups of companies) are subject to different systematic risk from the rest.

1.22 The potential such division we investigate in our report is that between WaSCs and WoCs since differences in business model might give rise to differences in systematic risk. In pursuing this approach, there is an important trade-off to mention. Some WaSCs, in their submissions to Ofwat, have urged that there is difference in systematic risk even between WaSCs and that this should be taken into account. It could be asked, if one concedes the principle that WaSCs and WoCs might differ, why would one seek to calculate a single cost of capital across all WACSs? In response to this, we note that in corporate finance theory a cost of capital is properly applicable to *projects*, not firms. Despite this, regulators do no typically determine costs of capital for individual projects. One reason for this is clearly because it would be highly cumbersome and impractical to calculate a cost of capital for every new investment project. But there is also an additional reason, namely that estimates of the cost of capital are subject to estimation error but by aggregating across projects we reduce the estimation error. The businesses of firms tend to be sufficiently similar internally that this gain in terms of reduced estimation error typically dwarfs the loss in terms of heterogeneity of investment projects (i.e. differences in the cost of capital between investment projects).

1.23 In much the same way, although there may be differences between WaSCs, there is a strong case that by aggregating the estimate of the cost of capital, quite apart from greatly reducing the cost of conducting the review, one increases the accuracy of cost of capital

[4] See section 8 for more detail.

estimation compared to the calculation of individual company-based estimates. We explore this further below.

Cross-Checks on CAPM

1.24 Although the CAPM-WACC framework is the centrepiece of the cost of capital estimation conducted here, it is useful to cross-check the results against those that would have been produced by other approaches. We consider four such here: the Fama-French model; the Dividend Growth Model (DGM); Market-to-Asset Ratios (MARs); and "reality checking" against analyst forecasts/estimates, previously regulatory determinations, and comparators in other sectors.

Structure of Report

1.25 In the rest of this report we begin by considering the parameters of the CAPM:

- Section 2 analyses the risk-free rate;
- Section 3 examines the evidence on equity betas;
- Section 4 discusses the equity risk premium;
- Section 5 considers capital structure (gearing);
- Section 6 analyses the cost of debt.

1.26 Section 7 considers the cost of capital specifically for WoCs.

1.27 The results of these sections are then drawn together in Section 8, which presents an estimate of the overall cost of capital calculated using the CAPM-WACC framework.

1.28 In Section 9, our CAPM-WACC estimates are cross-checked against a number of alternative approaches.

1.29 Section 10 turns to our recommendations on the package of financial ratios which Ofwat should consider in its financeability analysis.

1.30 Section 11 presents our conclusions.

1.31 Appendix 1 sets out our response to a proposed method for assessing the risk-free rate put forward by NERA on behalf of the industry. Two further appendices summarise regulatory precedents on the cost of capital and financeability.

2 RISK-FREE RATE[5]

2.1 This section discusses evidence on the risk-free rate and sets out our recommendation on the figure that Ofwat should use at PR09. It is structured as follows:

(a) the use of index-linked gilt yields

(b) the use of nominal gilt yields

(c) regulatory precedents, including the recent CAA decision on the cost of capital for Stansted airport

(d) conclusion – our suggested range.

Index-linked Gilt (ILG) Yields

2.2 The yields on UK government index-linked gilts (ILGs) have traditionally been regarded as a good proxy for the risk-free rate because governments were considered to be one of the entities least likely to default on a loan, and so the rate of interest is considered to be about as close to risk-free as it is possible for a borrower to obtain. In addition, the use of index-linked gilts means that observed yields are already in real terms, without the need to strip out expectations of inflation. Previous regulatory decisions in the UK have tended to focus on ILG yields.

2.3 The following Figure shows Bank of England data on the yields on index linked gilts[6] for terms to maturity of 5, 10 and 20 years.

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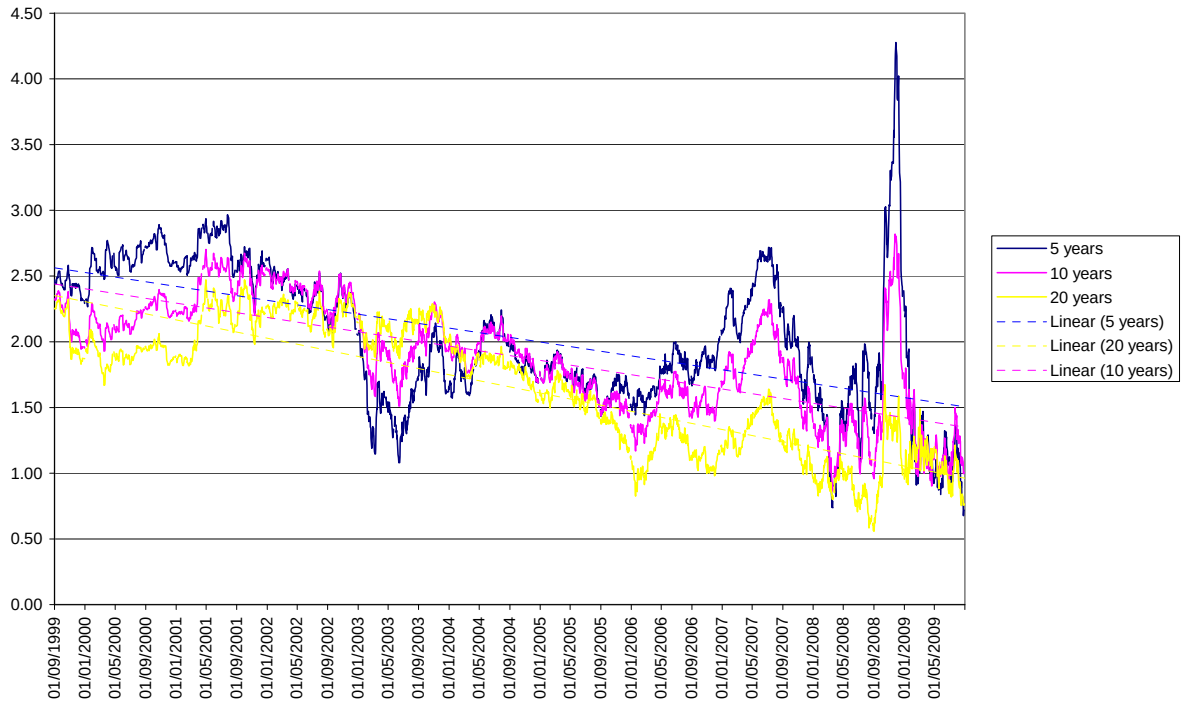
5 Please note that unless otherwise stated the data used in this and later sections is subject to a cut-off as at 31 August 2009. However, due to the August Bank Holiday weekend in the UK, the last available data point for UK gilt data is 28th August 2009.

6 These data are real spot curve rates — these are the interest rates calculated for index-linked zero coupon gilts where the principal is indexed to the RPI index.

Figure 2.1: UK ILG yields for the 10 years to 31 August 2009



Source: Bank of England

2.4 The above figure shows real gilt yields. As can be seen from the figure, yields for the three maturities have tended to move together with, apart from a period in 2003/04, shorter term yields tending to be higher than yields on longer term gilts.

2.5 There has been a declining trend with yields on 5, 10 and 20 year ILGs declining over time (shown by dashed lines on the chart). To verify that the clear visual trend was statistically robust, we carried out a linear regression of yield on a time trend for each maturity. This confirmed a statistically highly significant declining trend which became more pronounced as maturity increased (i.e. there was a greater declining trend for maturities of 20 and 10 than for 5 years).[7]

2.6 The following table summarises real gilt yields in the UK over different time periods.

[7] When yield was regressed against time (as represented by daily data) t-statistics were as follows: 5-year ILGs:--34.77; 10-year ILGs: -55.94; 20-year ILGs: -82.16. This represents average yearly decreases of 0.102 per cent for 5-year; 0.106 for 10-year; and 0.135 per cent for 20-year ILGs.

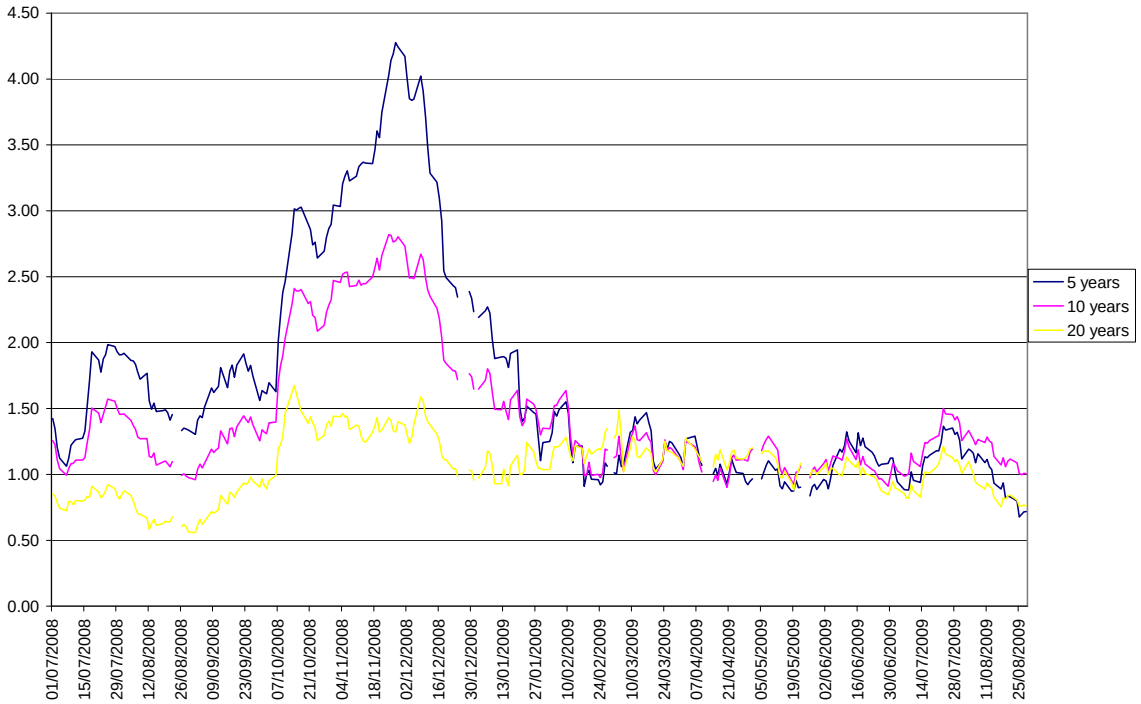
Table 2.1: UK Index-linked Gilt Yields

	5 years	10 years	20 years
Latest market data			
Spot rate on August 28th 2009	0.72	1.01	0.76
October 2008 onwards	1.70	1.50	1.13
Longer run averages			
September 08 to August 09	1.70	1.47	1.10
April 05 to July 07	1.88	1.65	1.31
September 04 to August 09	1.79	1.59	1.25
September 99 to August 09	2.03	1.90	1.66

Source: EE calculations using BOE data from up until 31st August 2009. In the Competition Commission (CC) recommendations for the cost of capital for Stansted airport, the CC explained the falling yields on longer term ILGs in recent years by reference to pension fund regulatory requirements such as the minimum fund requirement which have encouraged pension funds to hold longer term gilts, and have thus, according to the CC, depressed their yields.

2.7 During the recent turbulence affecting credit markets, real yields on gilts rose and then fell very substantially. The following figure illustrates for the last 14 months (July 2008 to August 2009).

Figure 2.2: UK real gilt yields for the last 14 months



Source: BOE data

2.8 As can be seen from the above Figure, in the period July 2008 to August 2009 there have been steep rises and then falls in the yields on index-linked gilts for all three maturities. Rises were particularly sharp in the period October to December. However since mid-November yields have fallen sharply.

2.9 One question of interest is whether the recent large variations in real yields reflected a change in the underlying risk-free rate (i.e. investors required a higher return to hold a risk-free asset) or whether it reflected an increased perception of risk associated with holding gilts or some other distortion. Further, if ILGs were giving a distorted and hence poor indication of the risk-free rate in the period October to mid December 2008, how was this distortion caused?

2.10 There are a number of possible explanations for the recent variations in ILG yields. These include:

(a) Increased perceived risk of sovereign default. This could be due to either (i) due to increased concerns over public borrowing, or (ii) a perceived risk associated with a nationalised bank defaulting.

(b) Deflation expectations. Evolving opinions on the risk of deflation may have resulted in changes in demand for index-linked lending and hence variations in yields.

(c) Following the nationalisation of Fannie Mae and Freddie Mac and the subsequent collapse of the Lehman Brothers Bank, there was an unwinding of hedge fund positions in inflation swap markets. This may have created a short term and temporary impact on UK ILG yields.

2.11 Whatever is the best explanation of this spike, it is clear from Figure 2.1 that gilts yields have, as of the time of writing of this report, returned to close to their ten-year trend, and our view is that the spike of Autumn 2008 should be treated as a passing event.

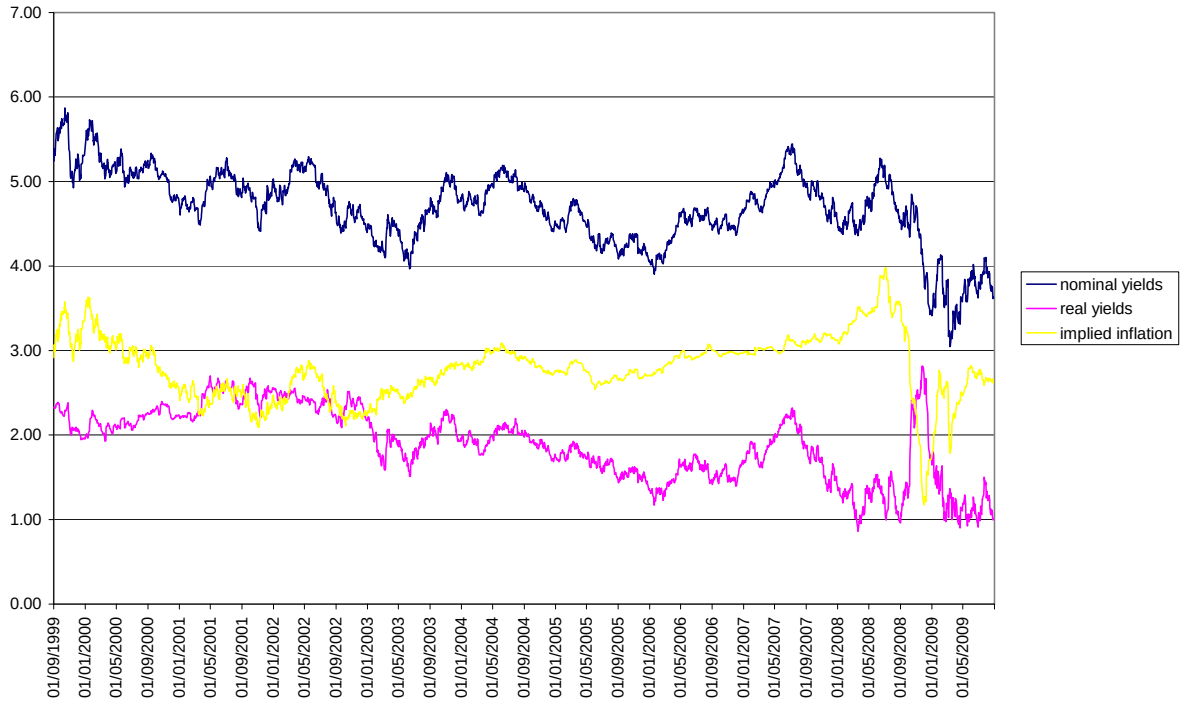
Nominal Gilts Deflated using Inflation Expectations

2.12 Theoretically the yields on index-linked gilts should equal the yields on nominal gilts minus inflation expectations and an inflation risk premium. Therefore nominal gilt yields can be used as a cross-check for the risk-free rate indicated by yields on index-linked gilts if inflation expectations are estimated or assumed, and then stripped out. [8]

2.13 The following Figure shows implied inflation (RPI) expectations calculated as the difference between yields on nominal and index-linked gilts with term to maturity of 10 years along with implied inflation (calculated as the difference between nominal and real yields).

[8] In theory, an inflation risk premium should also be deducted from nominal yields. However, given the difficulty in quantifying the inflation risk premium and the fact that we are only using nominal yields as a cross-check, we do not carry out this step.

Figure 2.3: Comparison of nominal and index-linked UK gilt yields with maturity of 10 years



Source: BOE data

2.14 As can be seen from the above Figure, there has been some volatility in implied inflation in recent months.

2.15 An alternative view of inflation prospects is shown in the following table, which gives the Treasury's RPI projection for the following 5 years. This is shown as a percentage change on previous years.

Table 2.2: Projected UK RPI over the next 5 years

	Outturn 2007-08	Estimate 2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
RPI (September)	4	5	-3	1.75	3.75	3.75	3

Source: 2009 Budget report

2.16 As can be seen from the above table the Treasury view is that there will be significant RPI deflation in 2009-10. As index linked gilts are linked to movements in the RPI index this would have the effect of causing nominal yields on gilts of one year maturity to fall below real yields.

2.17 The average RPI inflation rate, over five years, implied by these figures is 1.82 per cent. This is 14 bps above the average of the independent forecasts of the RPI for the next 5

years (collated by the Treasury in its publication "Forecasts for the UK economy: a comparison of independent forecasts"[9]) — at 1.68 per cent.

Nominal yields and inflation expectations as an estimate of the risk free rate

2.18 In the current volatile and uncertain inflation environment, we have doubts about whether inflation forecasts can be used to produce a robust cross-check on risk-free rate estimates obtained from index-linked gilts. However, we have made a number of comparisons using gilts with maturities of 5, 10 and 20 years and inflation forecasts for different time periods.

2.19 Our first comparison compares the latest spot rates for nominal gilts with a term to maturity of 5 years minus the average of the "independent forecasts" of the RPI for the next 5 years with the current spot rate for index linked gilts. This is shown in the following table.

Table 2.3 : Comparison using nominal ILG yield and inflation forecast – 5 years

	Yield (%)
5 year average RPI (average of "independent forecasts")	1.68
Spot rate (28 August 09) nominal 5 year gilt	2.69
Calculated risk-free rate (nominal spot rate — inflation expectations)	1.01
Spot rate (28 August 09) index linked 5 year gilt	0.72

Source: EE calculations with BOE and Treasury collated data on independent forecasts

2.20 Deducting average inflation of 1.68 per cent from the spot rate of 2.69 per cent gives a calculated risk-free rate of 1.01 per cent. The rate of 1.01 per cent is 0.29 per cent higher than the latest available spot rate on index linked gilts.

2.21 The following two tables show the same exercise, this time for gilts with maturities of 10 and 20 years. The inflation forecasts used are based on the latest RPI forecasts available for 5 years, adjusted for the longer time periods according to the RPI rates consistent with the BOE target of 2 per cent for CPI.[10]

[9] HM Treasury: Forecasts for the UK economy – A comparison of independent forecasts, August 2009. No 268.
[10] We assume a CPI target of 2.0 per cent equates to an RPI value, on average over time, of 2.8 per cent.

Table 2.4 : Comparison using nominal ILG yield and inflation forecast — 10 years

	Yield (%)
Expected 10 year average RPI	2.24
Spot rate (28 August 09) nominal 10 year gilt	3.63
Calculated RFR (nominal - inflation expectations)	1.39
Spot rate (28 August 09) index linked 10 year gilt	1.01

Source: EE calculations with BOE data and inferences based on Treasury collated data on independent forecasts

Table 2.5 : Comparison using nominal ILG yield and inflation forecast — 20 years

	Yield (%)
Expected 20 year average RPI	2.52
Spot rate (28 August 09) nominal 20 year gilt	4.11
Calculated RFR (nominal - inflation expectations)	1.59
Spot rate (28 August 09) index linked 20 year gilt	0.76

Source: EE calculations with BOE data and inferences based on Treasury collated data on independent forecasts

2.22 The calculated risk free rate using gilts with a maturities of 5, 10 and 20 years are higher than the relevant ILG rate. The differences range from 0.29 bps (5 year gilts) to 0.83 bps (20 year gilts).

2.23 As shown by the above tables, our estimates of the risk free rate using nominal gilts stripped of inflation expectations differ materially from the rates implied by ILG yields. One interpretation is that market expectations (as indicated by gilt yields) are currently at odds with independent forecasts of inflation — and in a period of considerable uncertainty over the inflation outlook that is an explanation that it is difficult to gainsay.

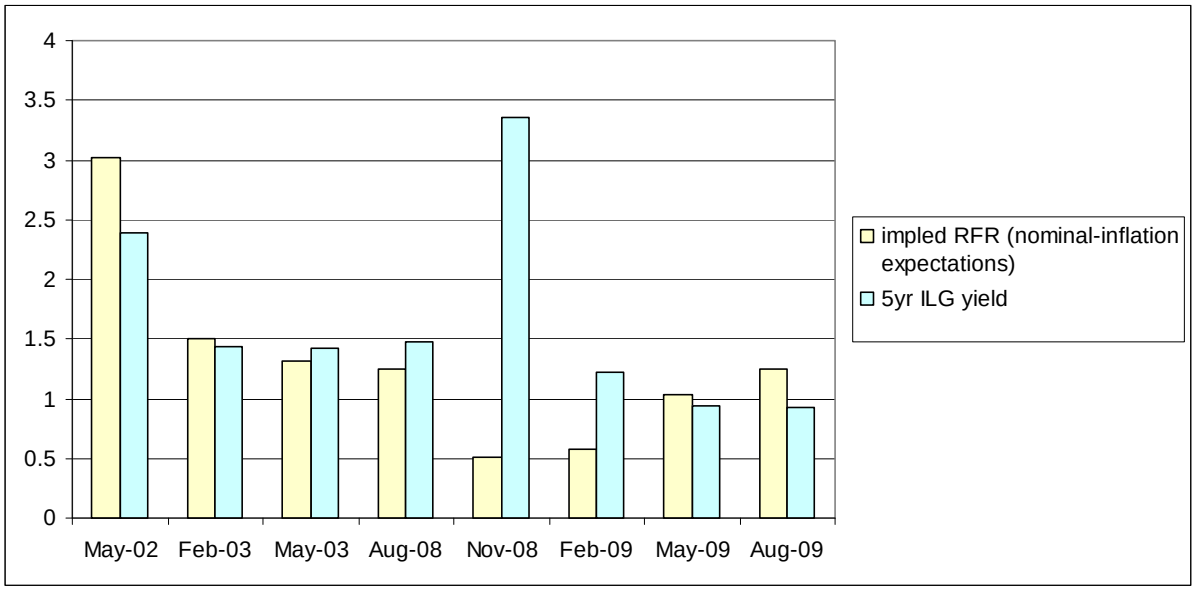
Historical ILG spot rates as compared to the risk free rate implied by nominal gilt rates minus inflation expectations

2.24 As a further comparison we examine historical ILG spot rates compared to nominal gilt rates minus inflation expectations for particular dates.

2.25 Table 2.3 shows 5 year ILG spot rates as compared to the implied risk free rate on particular dates.[11] Note that owing to data availability constraints the dates given are not equally spaced.

[11] Spot rates are 15th relevant month. Inflation forecasts are the independent average as calculated in the Treasury publication "Forecasts for the UK economy – a comparison of independent forecasts" for the relevant month.

Table 2.6 : Deflated 5 year nominal gilt yields using Treasury averages of independent RPI forecasts

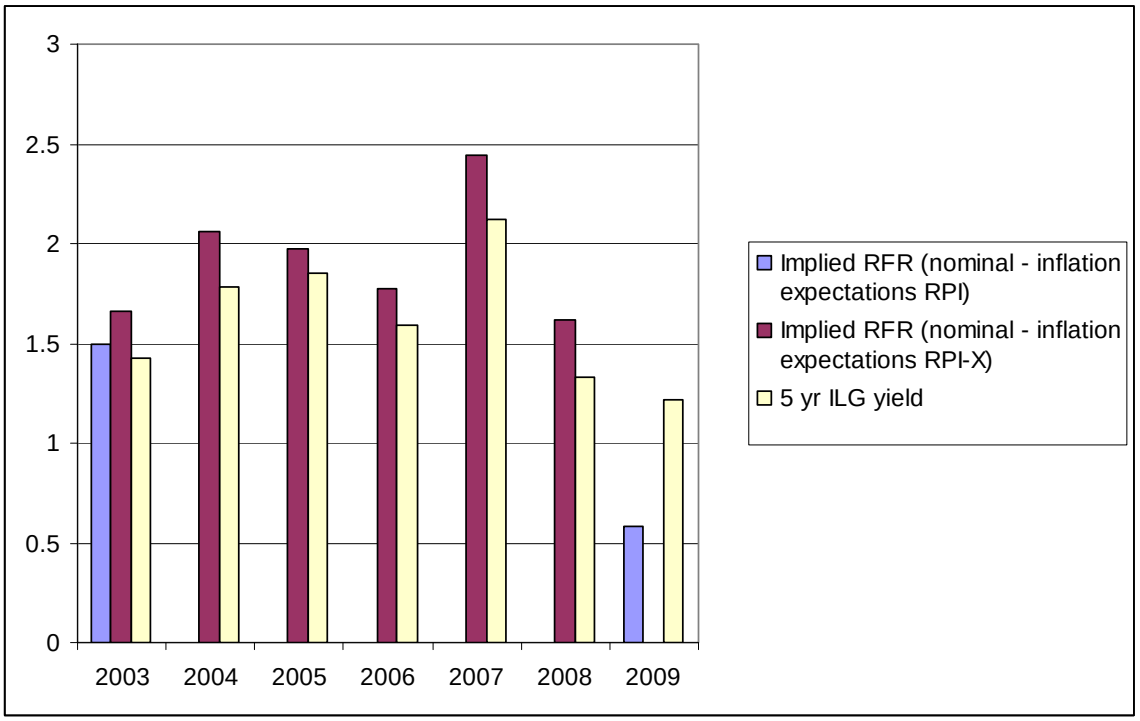


Source: Treasury comparisons of independent forecasts, BOE

2.26 The above figure shows that for a number of months the implied risk free rate calculated using nominal gilt yields and inflation expectations was a reasonably good approximation of the ILG rate. However, for November 2008 the implied risk free rate was more than 2 percentage points lower than that the ILG yield.

2.27 RPI forecast data were not available throughout the period. Hence, for some years we have used RPI-X forecasts (again, drawn from the Treasury panel of independent forecasters) as a proxy for RPI. Table 2.7 below shows 5 year ILG yields and implied risk free rates calculated using nominal gilt yields and inflation expectations from 5 year RPI and 5 year RPI-X forecasts for the month of February.

Table 2.7 : Deflated 5 year nominal gilt yields using Treasury averages of independent forecasts using RPI-X as a proxy for RPI



Source: Treasury comparisons of independent forecasts (February), BOE

2.28 As in Table 2.6 above, Table 2.7 shows a reasonably consistent relationship between the implied risk free rate calculated using nominal gilt yields minus inflation expectations and the ILG rate in the years 2003 to early 2008. However, this relationship appears to have broken down in early 2009, although the gap between the implied risk free rate and the ILG rate is closer in February 2009 than it was in November 2008. This may be due to a more volatile inflation environment, which could mean that independent inflation forecasts become a less reliable and up-to-date measure of market expectations of inflation.

International Perspective

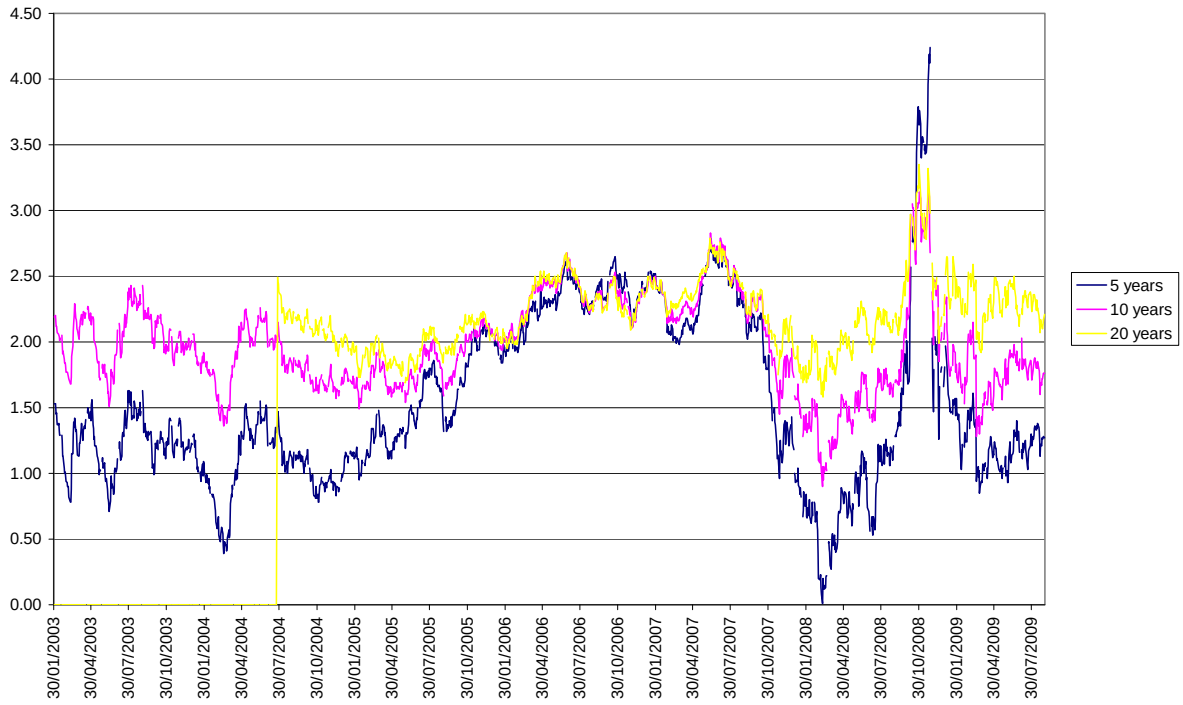
2.29 If capital markets are internationally competitive, if there is perfect mobility of capital across borders, and if there is limited lumpiness in uncertainty (e.g. that it is not the case that, in each country, uncertainty about international conditions, about the interpretation of data, and the robustness of financial contracts is very much greater than uncertainty about the same things domestically), and if other issues such as tax differences do not create market segmentation, there will be a meaningful common international risk free rate. Though it is highly doubtful whether all these conditions are met — a fact acknowledged by, for example, regulatory programmes, such as the EU's Financial Services Action Plan, the point of which is to attempt to increase integration at the EU level (and if capital markets are not near-fully integrated even at the pan-EU level,

integration will of course probably be even less at the global level) — for reference, we now compare yields on UK ILGs with those in the US.

US index-linked gilt yields

2.30 The figure below shows real gilt yields for the US.[12,13] (We note that, as in the UK, there was a short-lived spike in US gilt yields at the peak of the financial market chaos that followed the nationalisation of Fannie Mae and Freddie Mac and the subsequent bankruptcy of Lehman's. However, gilt yields have now returned to levels typical of or even below those in the period before the credit crunch began in the summer of 2007)

Figure 2.4: US gilt yields



Source: US Treasury data

2.31 The following table summarises real gilt yields in the US over different time periods[14].

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12 Note that the data for 20 year gilts starts in 2004.

13 For the index linked gilts the principal is indexed to the US CPI rather than RPI as with UK index linked gilts.

14 Note that we only have data available for 5 and 10 year US gilts from 2003 and so no 10 year average is given. Data for 20 year gilts starts in 2004.

Table 2.8 : US Index-linked Gilt Yields

	5 years	10 years	20 years
Latest market data			
Spot rate on August 31st 09	1.27	1.76	2.21
October 2008 onwards	1.63	1.99	2.42
Market data excluding recent months			
September 2008	1.55	1.85	2.27
Over 3 months (July to Sept 2008)	1.18	1.70	2.17
Over 6 months (April to Sept 2008)	0.98	1.59	2.10
Over 1 year (Oct 2007 to Sept 2008)	1.03	1.61	2.03
Over 3 years (Oct 2005 to Sept 2008)	1.85	2.08	2.24
Over 5 years (Oct 2003 to Sept 2008)	1.58	1.97	

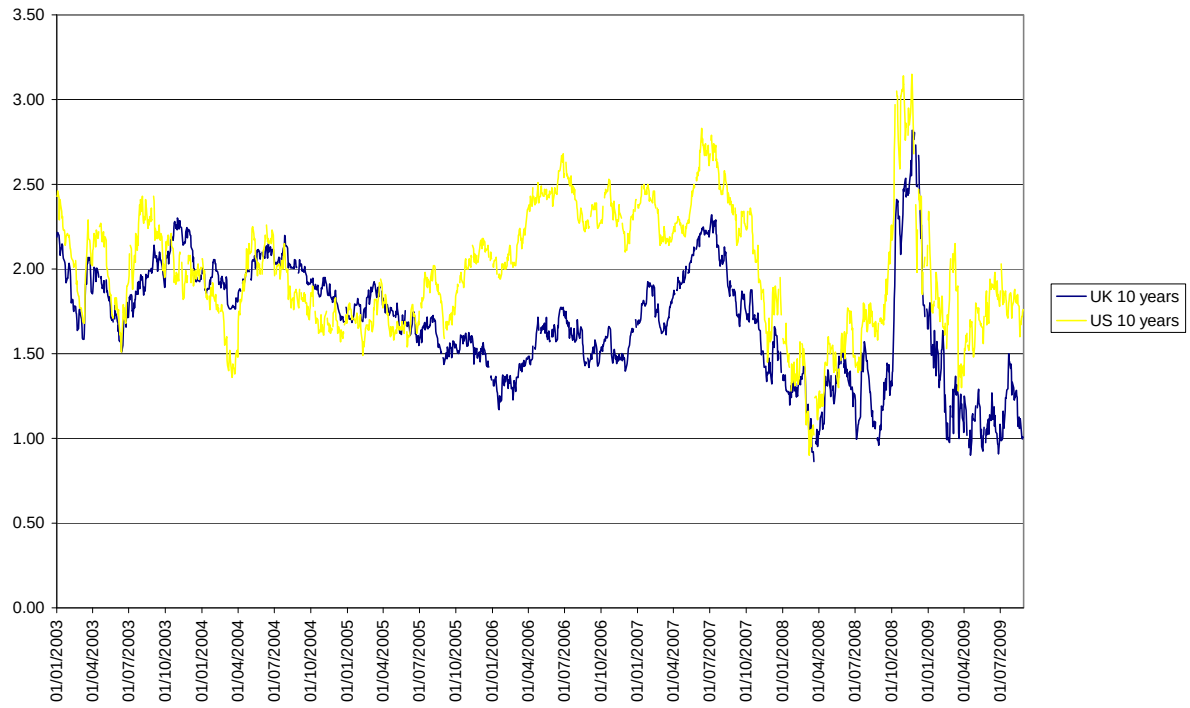
Source: US Treasury data

2.32 The above table shows that yields on longer term gilts in the US tend to be higher than on shorter term gilts (in contrast to the "hump-backed" situation in the UK in which ten year yields are higher than either five year or twenty year yields). For the 3 years up to the period of extreme volatility in Autumn 2008, the average for 5 year gilts was 1.85 per cent; for 10 year gilts it was 2.08 and for 20 year gilts it was 2.24. These figures are higher than the averages in the past 11 months for 5 and 10 year gilts, which are 1.63 per cent for 5 year gilts, 1.99 per cent for 10 year gilts but lower than the average for the past 11 months for 20 year gilts of 2.42 per cent.

2.33 The following Figure compares yields for index linked gilts with a maturity of 10 years in the UK and US.[15]

[15] Note that index-linked gilts in the US are indexed against US CPI rather than RPI as in the UK.

Figure 2.5: Yields on UK and US index-linked gilts with maturity of 10 years



BOE and US Treasury data

2.34 As emphasized above, we do not believe that it should be expected that the US data should match the UK. Nonetheless, we note two points of potential interest:

(a) If US gilt yields have any downward trend since the early 2000s, it is neither so pronounced nor so clear as that for the UK.

(b) US 5- and 10-year index-linked gilt rates are comfortably below 2 per cent on almost all measures and time periods, with the exception of the period of extreme volatility since the Autumn of 2008.

Regulatory Precedents

2.35 We now review estimates of the risk-free rate used in previous regulatory decisions. The following table summarises regulatory decisions on the risk-free rate.

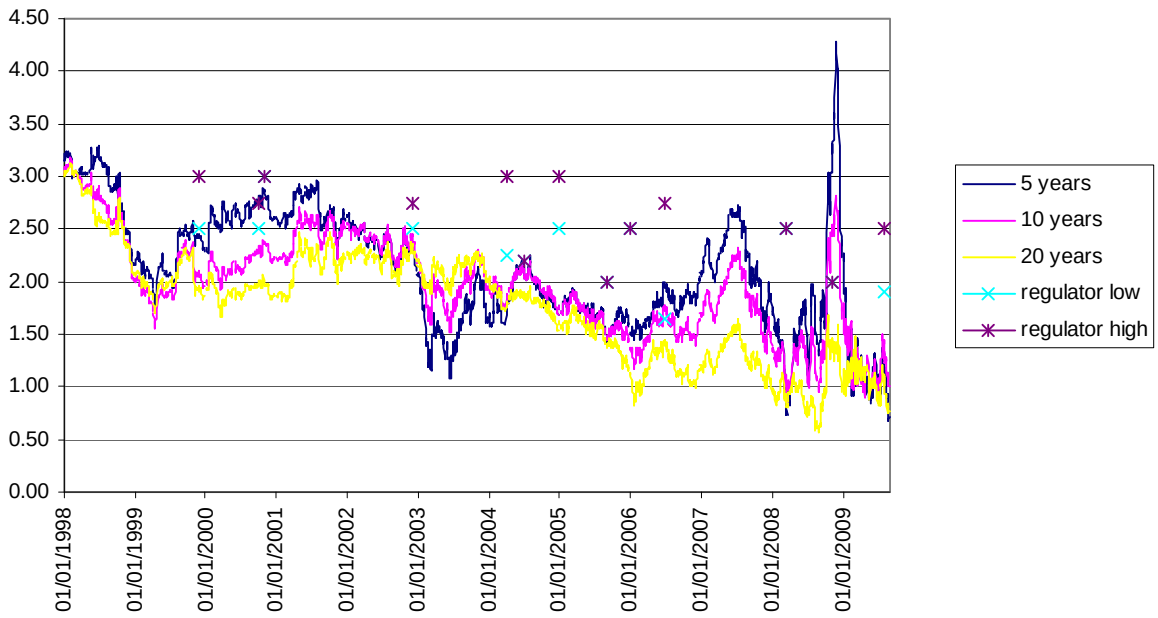
Table 2.9 : Previous regulatory decisions on the risk-free rate

Regulator	Case	Real risk-free rate (%)
Ofgem	Electricity distribution (2009 – views of Ofgem's advisers for draft determinations)	1.9-2.5
CC	Stansted (2008)	2.0
CAA	Heathrow and Gatwick (2008)	2.5
CC	Heathrow and Gatwick (2008)	2.5
Ofgem	Transmission (2006)	2.5
Ofcom	General approach – applied to BT (2005)	2.0
CAA	NATS (2005)	2.5
Postcomm	Royal Mail (2005)	2.5
Ofwat	Water and sewerage (2004)	2.5-3.0
Ofgem	Electricity distribution (2004)	2.25-3.0
Competition Commission	BAA (2002)	2.5-2.75
ORR	Access charges (2000)	3.0
Competition Commission	Mid Kent Water (2000)	3.0
Ofgem	Transmission (2000)	2.5-2.75
Ofwat	Water (1999)	2.5-3.0
Lowest figure		1.9
Highest figure		3.0

Source: Regulatory determinations

2.36 These are also shown in the following Figure which illustrates the relationship between the return on UK ILGs and the risk-free rate used in previous regulatory decisions.

Figure 2.6 : Previous regulatory decisions on the risk-free rate



Source: BOE data and EE review of regulatory determinations

2.37 As can be seen from the Figure, regulators have frequently used ranges above government gilt yields. In general these have been a material number of basis points — in some cases more than 100 — above the risk-free rate as measured using ILG data. Nonetheless, over time, regulatory decisions have fallen from a range of 2.5–3.0 early in the decade to a range of 1.9–2.5 in more recent years, as shown in the table.

2.38 One interpretation of this evidence is that regulators have implicitly engaged in a form of Bayesian updating of beliefs, in which a prior belief about the risk-free rate has been only gradually lowered as sustained reductions in ILG yields have provided evidence that the risk-free rate has fallen.

2.39 It is useful to dwell on this issue of Bayesian updating for a moment. If one had a prior belief that the average height is 5'10", but then sees ten people in a row who are 5'4" or less, that might not initially drive one to reduce one's view of the average height. Perhaps the people one had seen were unusual in some way. But, eventually, sustained observation of figures far below one's prior must, if that evidence carries any weight at all, lead to some updating downwards in one's view.

2.40 This is where we believe things lie in regulatory judgement. Regulators began believing that risk-free rates were around 2.5 to 3 per cent. Then gilt yields fell. When yields first fell it was reasonable for regulators to hold on to their prior belief in a higher value for the risk free rate — after all, perhaps the lower gilt yields were a random statistical result or the consequence of some passing distortion as markets adjusted to some investment regulation or other? But, as index-linked gilt data consistently lay well below the

regulatory judgements made before, and indeed fell further and further below, the gap between regulatory judgements and the data become anomalous. This led some commentators to suggest that the regulators had implicitly ceased to base their view primarily on the index-linked gilts data and had come to accept some flaw in the use of these figures. Indeed, some regulators, perhaps, become concerned on this point and came to place greater weight upon past regulatory judgements than upon the index-linked gilts data themselves.

2.41 Our view is that there is no good reason to doubt the index-linked gilts data, and that the period for being concerned that the drop in gilts yields was a passing phenomenon is now long expired. Regulatory judgements should accept the consistent and sustained message of the gilts data that the risk free rate has fallen considerably.

2.42 Nonetheless, given the large gap between past regulatory judgement and the current data, there may still be some case for not moving all the way to the index linked gilts data, retaining some limited inertia in estimation to reflection the Bayesian concern.

Conclusion

2.43 There is no precise method for determining the risk-free rate and a certain amount of judgment is necessary. Recent market turbulence resulted in sharp rises and falls in the yields on ILGs in the latter months of 2008 and early months of 2009. However, the latest gilt yield data has been more stable, and is in line with the downwards trend that pre-dated that period of turbulence.

2.44 The following table presents the latest market data as of 28th August 2009.

Table 2.10 : Summary of ILG rates

Rates on 28th August 2009	%
5 year UK ILG spot rate	0.72
10 year UK ILG spot rate	1.01
5 year US ILG spot rate[16]	1.27
5 year UK ILG, 5 year average September 04 to August 09	1.79
10 year UK ILG, 5 year average September 04 to August 09	1.59
20 year UK ILG, 5 year average September 04 to August 09	1.25

Source: BOE; US Treasury; Bloomberg; and UK Treasury data

2.45 Our preferred point estimate for the risk free rate is **1.75 per cent**. If one were to set aside previous regulatory precedent and look at the data afresh, our view is that the natural conclusion would be for a risk free rate of 1.5 per cent or perhaps even less. Indeed, the most recent data strengthens further the case for opting for a figure below

[16] Spot rate given is for 31st August 09 as unlike the UK, the US did not have a non-trading day on 31st August.

1.75. However, as explained above we continue to place some weight upon the Bayesian updating implicit in past regulatory decisions, and for that reason, despite the recent data, we continue to recommend a 1.75 per cent figure for the regulatory judgement. Although this figure is higher than current yields as shown in Table 2.10 above, it is supported by longer-term averages (see **Error! Reference source not found.**).

2.46 The 1.75 per cent figure is lower than that used in previous regulatory decisions. However, as discussed at length earlier we believe there is a long term trend for the risk free rate to decline and that there is no good empirical reason not to broadly reflect this fall in the regulatory judgement.

2.47 This estimate of the RFR has an effect on the ERP given we place some weight on the Smithers & co view, and the view expressed in the recent CC recommendations on the cost of capital for Stansted airport, that the sum of the RFR and ERP is more stable than the individual components. This is one factor in our choice of ERP in a later section – where we recommend a higher ERP than has typically been used by regulators in the past.

2.48 The range of risk-free rates from which we believe a regulatory judgement might be plausible is 1.5 to 2.2. The lower figure reflects more of the underlying downward trend than does our point estimate, whilst the upper figure places more weight upon past regulatory precedent and upon the data in the period October to December 2008.

3 EQUITY BETA ESTIMATION

Introduction

3.1 This section discusses the estimation of the "beta" parameter, which measures a company's exposure to non-diversifiable risk.

Methodological Issues

3.2 The equity beta measures the covariance between the company return over the safe rate with the market return over the safe rate.[17] The equation to be estimated is usually:

$$R_{it} = \alpha + \beta R_{mt} + e_{it}$$

where R_{it} is the log excess return on asset *i* at day *t* (log return net of the logarithmic safe rate), R_{mt} is the log excess return on the market, α is a constant and β is the equity beta. e_{it} is the random noise error term in estimation — the non-systematic component of the return to the asset. The hypothesis in estimation is that α is zero and β is one (for the average stock).

3.3 The excess return is constructed as a data manipulation prior to estimation, defined more exactly as:

$$R_{it} = \ln\left(\frac{P_t + D_t}{P_{t-1}}\right) - \ln\left(1 + R_{ft}\right)$$

where P_t is the price today, D_t is dividend per share that becomes known today, P_{t-1} is the price yesterday, and R_{ft} is the safe rate available today.

3.4 Smithers & Co (2003) suggest using daily LIBOR data as a proxy for the safe rate. However, the use of LIBOR is problematic at the moment, given the significant increase in the wedge between LIBOR and the Bank Rate which has occurred due to the credit crunch. *We decided to carry out beta estimation without netting off the risk-free rate from individual share and market index returns, to avoid introducing exogenous potential biases into our analysis*. In addition a substantial body of academic and regulatory literature supports that the idea the potential bias from not netting off the risk is negligible in most cases.[18]

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[17] Note that the weaker is this correlation, the greater the contribution that the stock could make to an investor wishing to reduce her exposure to systematic risk, and therefore the lower the expected return required.

[18] See for example NERA (2008), Patterson (1995) and Roll (1969).

Industry versus single companies' beta

3.5 In the past, regulators have often used beta estimates for individual companies to inform their estimate of the beta that should be assumed for the industry in setting an industry-wide cost of capital.

3.6 However it is established best practice in other settings (see for example Gregory and Michou (2007)) to employ an "industry beta". The use of an industry beta delivers more accurate estimates. Brealey and Myers (2000) find that the estimation standard error can be reduced by more than a half by calculating an industry beta rather than estimating single companies' betas. Hence the use of the industry beta produces more reliable estimates both for the single companies (also increasing the number of observations), considerably reducing the width of the estimated range, and for the industry as a whole. The main intuition behind this result is that the reduction in the estimation error dominates the degree of intra-industry heterogeneity.

3.7 We think that for the UK water sector there is a strong case for estimating an industry-wide beta directly using aggregate returns data for all listed water companies and estimating betas for the companies individually to further inform our analysis.

Our approach

3.8 We constructed a portfolio composed by the following listed UK water companies from December 2001 to 31 March 2009: United Utilities, Severn Trent, Pennon, Kelda, Northumbrian, Dee Valley, Bristol Water and East Surrey. We did not include Anglian Water (delisted in 2006) in our analysis, since there were no available data on returns and prices for this company.

3.9 Companies' weights in the portfolio are determined by their capitalization (obtained by multiplying the share prices by the number of shares at different points in time).[19]

Data frequency

3.10 The choice here is between daily, weekly or monthly data. Using daily data provides the most observations over any given time period, and therefore the most accurately estimated betas — the more data available for estimation, other things equal, the smaller the standard error in the estimation. This straightforward answer, however, relies on some assumptions about the properties of the stock price.

3.11 High frequency returns, such as daily returns, may be serially correlated. This would not affect the unbiasedness of beta estimates (which would still pick the central estimate correctly), but could mean that the errors in the estimation are understated.

[19] Data on both prices and the number of shares have been downloaded from Bloomberg.

Heteroscedasticity (non-constant variance of the error terms) may also be a problem in daily data, with a similar effect.

3.12 Both of these problems, however, can easily be dealt with of by using robust standard errors in estimation (calculated through the use of the Newey-West estimator).[20] In practice it is likely that daily data provide the smallest standard errors, even when corrected for serial correlation and heteroscedasticity.

3.13 Thin or thick trading could also be a potential problem when using daily data to estimate companies' beta. However the use of an industry portfolio makes this issue less material.

Our approach

3.14 We estimated the industry portfolio beta, using daily and weekly data, employing the Newey-West estimator.

3.15 To further inform our analysis we also calculated single companies' beta using both daily and weekly observations. For some companies we were not able to get statistically significant estimates in both cases: for those companies we presented LBS beta estimates based on monthly data.

Estimation period

3.16 Equity betas vary over time. This might be because of changes in gearing or changes in the underlying correlations between company and aggregate returns (i.e. asset betas). It would be sensible, therefore, to choose an estimation window that is as recent as possible, because today's observation is the forward looking estimate, while still giving reasonably accurate estimates.

3.17 Smithers & Co (2003) investigate the matter, noting that gains in estimation accuracy become less as more observations are added. For example, going from one year to two years of daily data (i.e. 250 observations to 500 observations) will reduce the standard error by 40 per cent, but going from three to four years only reduces the error by 15 per cent.

3.18 It would be possible to use an explicit time-series estimation technique to account for the time variation. However, these techniques, as noted by Smithers & Co (2003), are susceptible to over-fitting and can find apparent time variation where none exists. The techniques are also non-linear and not widely used for regulatory purposes.

3.19 We have therefore adopted the Smithers & Co (2003) recommendation of calculating one and two years rolling betas from 2003 to 2009 (hence going back to one year before the last price determination). As we will show the industry beta appears stable and did not

[20] which are available as a standard feature in Stata, the estimation software used.

materially change as some companies left the industry portfolio. This supports the use of an industry portfolio.

Choice of the market portfolio

3.20 The choice of the market portfolio could be a more significant factor. An index relating to the UK stock market, such as the FTSE All Share, would be an obvious choice. Another possibility would be to employ a "typical UK investor portfolio", aiming to reflect the portfolio of holdings of the typical investor in the UK water sector. Smithers & Co (2003) suggest that, doing this for UK utilities, one might place a high weight on UK equity returns, a small but significant weight on UK bond returns and smaller weights on European, Asian and US stocks.

3.21 The approach that we have adopted here, and Smithers & Co (2003) endorse to some extent, is to estimate betas on the UK only index (FTSE All share), and, as an internationally-based robustness/context check, alternative betas based on a regression against the MSCI European Index.

Adjustments to estimated betas

3.22 Two main adjustments, the so-called Bayesian and Blume adjustments have been used in some past estimations of beta, with the effect of bringing the estimated betas closer to one.

3.23 The argument for Bayesian adjustment is that the estimation of beta ignores the fact that the beta of an average company is by definition equal to one.[21] The Bayesian adjustment takes account of measurement uncertainty (as estimated explicitly in the calculation of the raw beta) by employing a weighted average between the beta estimate for the company and a constructed average beta for the market as a whole that would be equal to one. The weights are based on the relative uncertainty in measurement — the higher the uncertainty in the company beta estimates relative to the variance of all betas in the market, the less weight is placed on the company beta:

$$\beta_{adj} = \beta_{OLS} \times \frac{Var(\beta_{pop})}{Var(\beta_{pop}) + Var(\beta_{est})} + 1 \times \frac{Var(\beta_{est})}{Var(\beta_{pop}) + SE^2(\beta_{est})}$$

3.24 The Blume adjustment is based on an empirical observation (made in 1971) that betas tended to move towards one over (long) time. Mean reversion is sometimes offered as an explanation for this observed movement. In later investigations, however, Blume found that the reasons for the movement in the betas had to be explained by some real changes in the perceived risks of the companies — the tendency for companies to evolve

[21] Note that this concerns the *average* company. It is straightforward to test whether the estimated beta of an individual stock or portfolio is statistically significantly different from one.

could mean that companies of extreme risk (high or low) tend to have less extreme risks over time.[22]

3.25 We did not employ any particular adjustment on our estimates. Our view is that the use of the Blume adjustment is arbitrary and inappropriate. While a Bayesian adjustment has a stronger theoretical rationale, Smithers and Co (2003) found that in practice it may not make much difference if daily data are used in the estimation. Finally, adjustments for low trading frequency do not seem necessary when estimating an industry beta since stocks potentially suffering from this problem (e.g. stocks in Dee Valley) have low weight in the portfolio.

Data and Estimation

3.26 The equity data were downloaded from Bloomberg, and are:

(a) the total return of water companies' equity (including dividends)

(b) the number of shares, used to calculate different companies' market capitalization to construct the industry portfolio.

(c) the FTSE All Share total return.

(d) the MSCI European equity index returns for the beta estimations against the broader indices.

3.27 The beta parameter was estimated for the industry portfolio and for different water companies by the Newey-West estimator, using the total returns data against the indices with one and two year windows of rolling daily and weekly data.[23]

3.28 Using two years of daily data up to 31/08/2009 and the FTSE All Share total returns as the market index produces the following result for the industry portfolio:

	Estimate	**Standard error**	**t**	**[95% Conf. Interval]**	
Beta	0.64	0.05	13.36	0.51	0.76

3.29 The corresponding asset beta estimate is 0.27 with a confidence interval of 0.21 – 0.32.

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[22] Blume, M.E: "Betas and their regression tendencies" Journal of Finance, 1975 and "Betas and their regression tendencies: further evidence", Journal of Finance, 1979

[23] One of the hypotheses underlying the efficiency of the OLS estimator (Gauss Markov Theorem) is that errors are serially uncorrelated. Newey and West (1987) and Gallant (1987) suggested nonparametric kernel estimators that are consistent and efficient even when there are serial correlations and conditional heteroskedasticity of unknown forms. Such estimators were further elaborated by, among others, Andrews (1991), Andrews and Monahan (1992), Hansen (1992), and Newey and West (1994). These estimators are usually referred to as the Newey-West estimator in the econometrics literature.

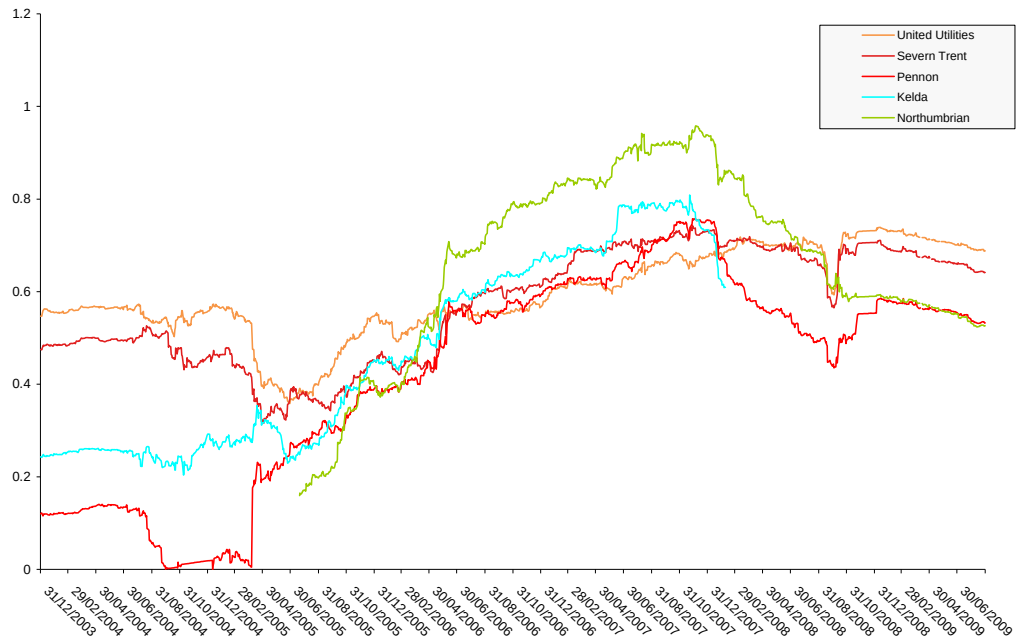
3.30 The two year equity beta for the industry portfolio on 31/03/2009 is therefore approximately 0.64, with a 95 per cent confidence interval between 0.51 and 0.76. This estimation therefore rejects a hypothesis that the equity beta is equal to one.[24] We note that the latest data suggests a very slight (0.01) decline in beta since the time of our initial recommendations.

3.31 The point estimate on one year of daily data is 0.63, with a 95 per cent confidence interval between 0.52 and 0.77. Again the hypothesis that equity beta is equal to one is rejected. The weighted average gearing level of the portfolio used for estimation is 58.2 per cent as of 2007/2008.

3.32 There seems to be strong consistent evidence that the water industry portfolio equity beta, as measured against a UK portfolio, is around 0.65 at the end of August 2009.

3.33 We report in Figure 3.1 the 2 years daily rolling beta for companies for which we obtained significant estimates for most periods:

Figure 3.1: 2 years rolling water companies' raw beta



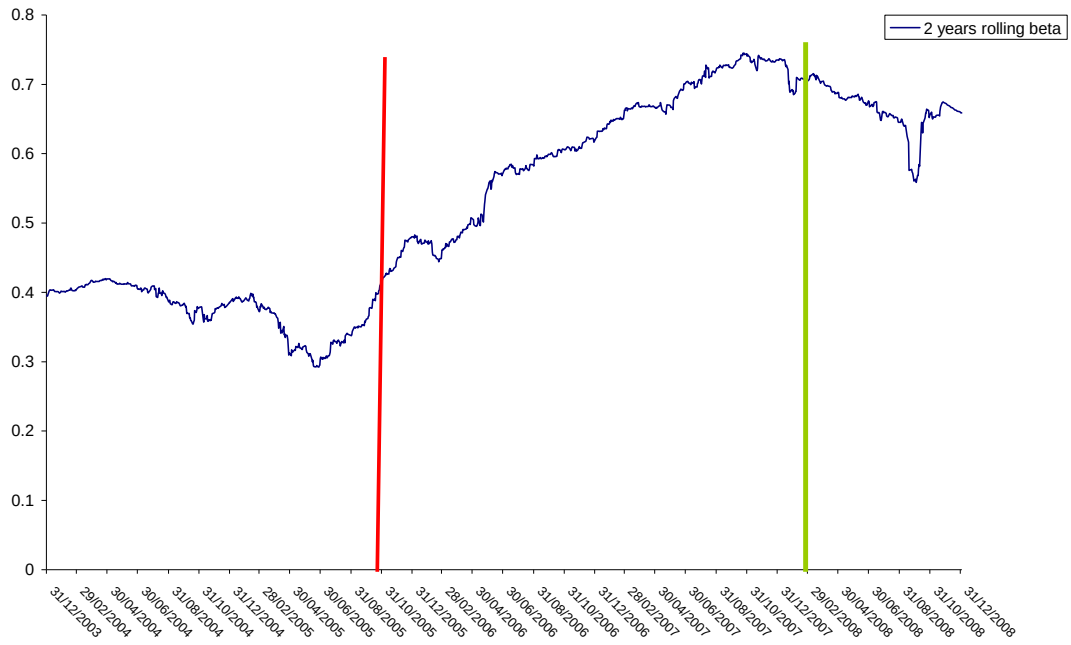
Source: Europe economics elaborations on Bloomberg data.

[24] The t value of 13.36 indicates that the value of beta found is statistically highly significant (any value above 1.96 would satisfy this).

3.34 The betas shown in Figure 3.2 are the two years water portfolio's rolling daily betas from 1/12/2003 to 31/08/2008. Weekly betas exhibit a similar behaviour, yet with higher standard errors. Dates in which companies were delisted and the composition of the water companies' portfolio changed (15 October 2005 East Surrey, 8 February 2008 Kelda) are highlighted through vertical bars. We preformed the Chow test to check for the stability of the beta estimate: the tests performed reject the hypothesis that the industry beta was affected by the delisting episodes with a 99 per cent level of confidence.

3.35 It is also interesting to note that the exposure to systematic risk (as measured by beta) has been quite stable during the financial turmoil, one of the most significant systematic shocks in recent times. This firstly increases the significance of the parameter as a measure of different companies' exposure to risk, and secondly supports the stability of our estimates and the validity of the underlying theory — one would expect a market-wide shock to have its impact mainly on the Equity Risk Premium, rather than the beta (which, remember, merely measures *relative* riskiness).

Figure 3.2: 2 years rolling industry portfolio daily beta



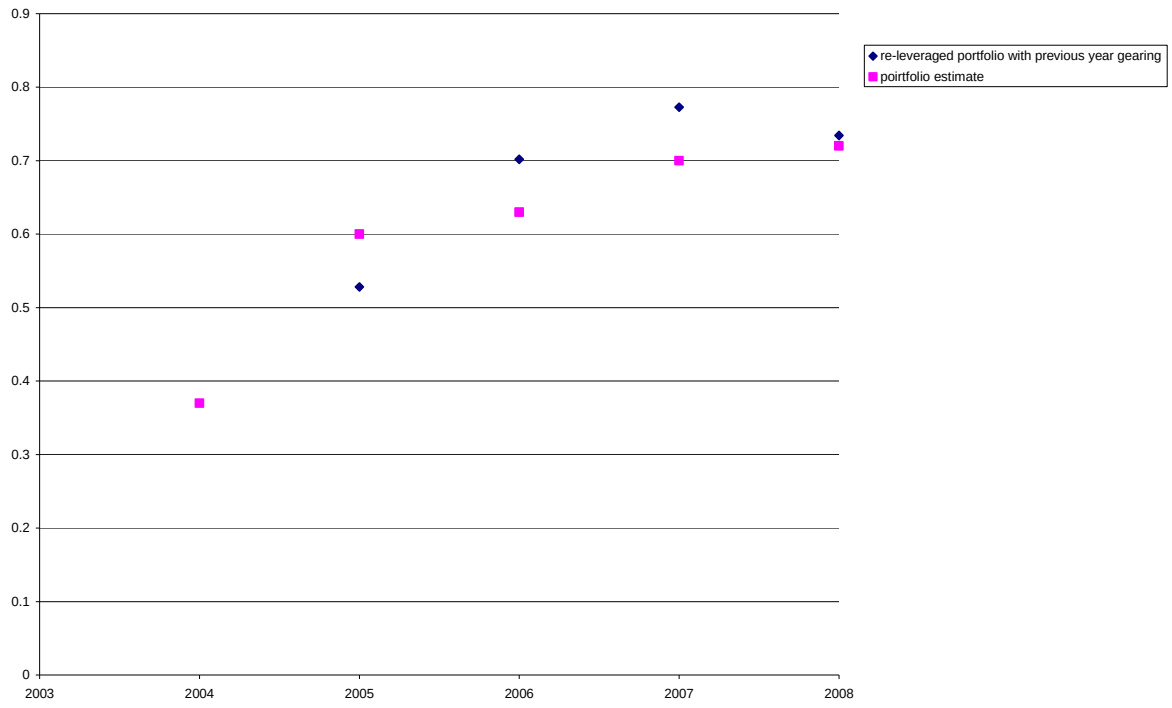
Source: Europe economics elaborations on Bloomberg data.

3.36 Industry beta has steadily increased since the second half of 2005, gradually falling over the later months of 2007. The fall in betas thereafter appears to coincide with the start of the credit crunch – consistent with the view that water companies may have benefitted in the credit crunch through a "safe haven" effect.

3.37 During the (dominating) periods of stability, the equity beta point estimate has been in the range 0.45 to 0.8. The hypothesis of an equity beta equal to one is rejected also by this piece of evidence.

3.38 The figures quoted above are "raw" beta estimates, ignoring differences in leverage. According to the standard theory of capital structure, and in particular to the Modigliani-Miller theorem (explained in more detail in a later section), increases in gearing (*ceteris paribus*) should result in increases in the equity beta and vice versa. Thus, the question arises to what extent these raw beta estimates have been influenced by gearing changes. We report in Figure 3.3 the industry beta estimate (as of December 2004, 2005, 2006 and 2007) together with the industry beta figure for the previous year re-leveraged with the industry gearing level for the year in question.

Figure 3.3: Estimated and re-leveraged industry beta



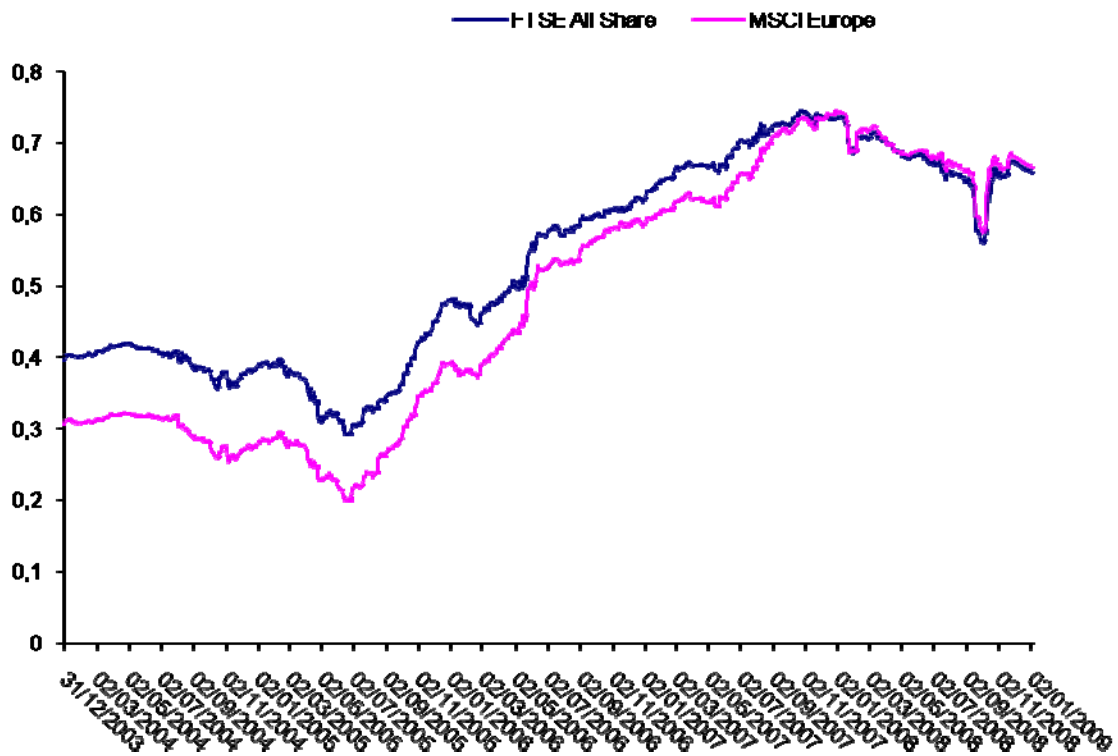
Source: Europe economics elaborations on Bloomberg data.

3.39 Note that a significant, but not dominating, part of the increase in the industry beta from 2004 to 2007 can be explained by the increasing path of the gearing level in the industry. We find that from 2004 to 2008, 27 per cent of the total change in the industry beta is attributable to the increased use of debt by water companies.

Wider indices

3.40 Estimating the industry beta using the MSCI Europe index produced on average lower beta estimates than using the FTSE All Share index, as one would expect. The results (2 years rolling daily betas are reported) are shown below:

Figure 3.4: Betas relative to international indices



Source: Europe economics elaborations on Bloomberg data.

3.41 It is however interesting to note that the estimates obtained using different indices tend to converge gradually over time, becoming statistically undistinguishable from 2007. This result again supports our range estimate.

Comparator asset betas

3.42 As a cross-check, we report below the asset betas of comparator sectors such as UK energy networks and utilities[25] together with the estimate for the water sector. These comparator betas have been sourced directly from LBS, and hence would need to be interpreted with caution due to differences in the methodology used to estimate them.

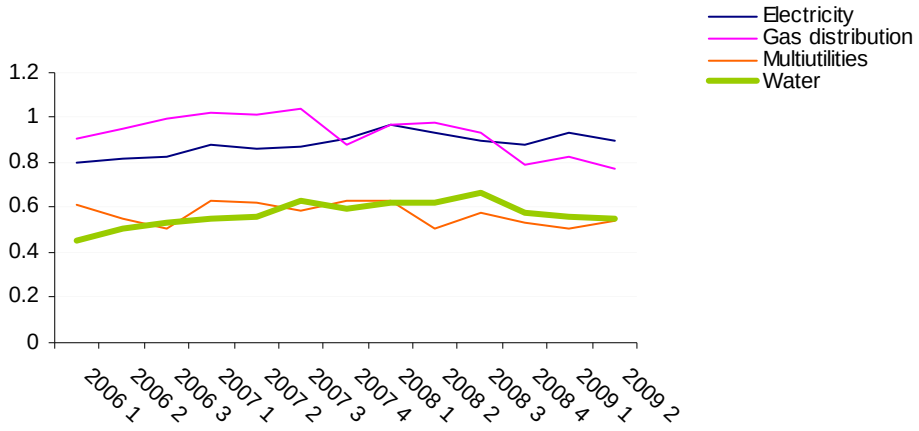
LBS betas are based on monthly data and are adjusted for thin trading and corrected through the Vasicek methodology.

3.43 The most recent equity beta estimates are in the range 0.50-0.90 for all the relevant comparators. The latest estimate for the water sector is 0.59, supporting our water industry portfolio estimate of 0.65.

3.44 It is also interesting to observe that also other comparable sectors' betas started to significantly decline in the second part of 2007.

3.45 Looking at the asset betas we note that water sector equity appears to be materially less exposed to systematic risk (and so should be expected to have a lower average cost of equity), than equity in the electricity and gas distribution sectors.

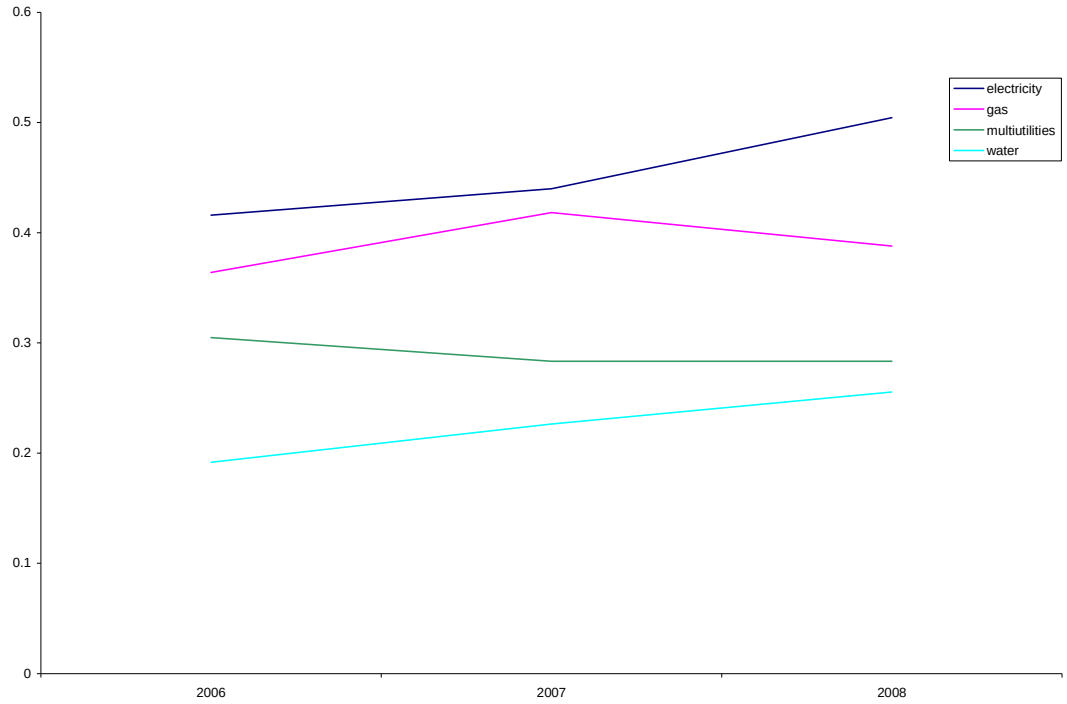
Figure 3.5: Comparator equity betas



Source: LBS

[25] The portfolios are weighted by the market capitalization of the different companies in the sector.

Figure 3.6: Comparator asset betas



Source: Europe Economics elaborations on LBS data

Water companies' betas

3.46 Using two years of daily data up to 31/08/2009 and the FTSE All Share total returns as the market index produces the following result for listed UK water companies:

Table 3.1: Water companies' beta

	Beta estimate	confidence interval 95%	
UU	0.70	0.58	0.84
SVT	0.64	0.48	0.79
PNN	0.53	0.41	0.65
NWG	0.52	0.42	0.59
DVWA*	*	*	*

** not statistically significant*

3.47 All the single companies' betas are in the range 0.52-0.70, whilst the confidence intervals range from 0.41-0.84 (as expected, wider than the confidence interval of the portfolio). Using weekly instead of daily data produced very similar estimates for all the companies, but with larger standard errors and wider ranges, as expected.

3.48 The estimation did not produce any significant beta estimate for Dee Valley (neither using weekly data), mainly due to the extreme illiquidity of its shares. Hence, for reference we report the LBS figure for Dee Valley beta, based on monthly data and corrected through the Vasicek adjustment:

	LBS estimate as of August 2009
Dee Valley	0.2

3.49 We also report below Dee Valley's beta path over the past years, again sourced from LBS. We can observe that it exhibits a similar pattern, albeit exaggerated, to the other water companies, with a decline during much of 2008. (We discuss the issue of comparing WoCs and WaSCs in more detail in a later section.)

Figure 3.7: Dee Valley beta over time

Source: LBS

Re-leveraged equity beta

3.50 In our analysis of the equity beta we had to compare the betas of firms with different levels of gearing. The correct way of controlling for changes in gearing is to obtain an estimate of a firm's underlying asset beta, using the formula shown below as:

$$\beta^A = \beta^E (1-g) + g\beta^D$$

where g is the gearing level, β^E is the equity beta and β^D is the debt beta.

3.51 In a final step we can re-lever the asset beta to obtain an equity beta consistent with a given gearing level (e.g. a notional gearing of 55-65 per cent), through the following formula:

$$\beta^{ERE} = \frac{\beta^A - \beta^D g^T}{1 - g^T}$$

Where g^T is the target notional gearing.

3.52 We report the results of this exercise, deleveraging equity betas with gearing figures sourced from Ofwat in Table 3.2. In Table 3.3 re-leveraged equity betas are shown for two different notional gearing levels and for different assumptions about the debt beta[26]:

Table 3.2: Asset betas

	Gearing	Beta estimate	Asset beta with debt beta = 0	Asset beta with debt beta = 0.1
United Utilities	0.53	0.70	0.3	0.38
Severn Trent	0.58	0.64	0.27	0.3
Pennon	0.58	0.53	0.2	0.28
Northumbrian	0.58	0.52	0.21	0.28
Dee Valley	0.54	0.2	0.10	0.15

3.53 Water companies' asset betas, as illustrated in Table 3.2, seem to stay within the range 0.10 to 0.40. The next table, Table 3.3, shows equity betas for individual companies relevered to a notional gearing level of 55 per cent.

[26] A non-zero debt beta has been assumed in some recent regulatory precedents. See for example the Competition Commission determination for both Stansted and Gatwick and Heathrow Airports.

Table 3.3: Re-leveraged equity betas with different notional gearing levels

	Re-levered beta with debt beta = 0		Re-levered beta with debt beta = 0.1	
	g^T =55%	g^T =60%	g^T =55%	g^T =60%
United Utilities	0.73	0.82	0.73	0.81
Severn Trent	0.60	0.67	0.60	0.67
Pennon	0.49	0.56	0.50	0.55
Northumbrian	0.49	0.55	0.49	0.54
Dee Valley	0.2	0.25	0.2	0.24

Conclusion on Equity Beta

3.54 We estimated the equity beta for the water industry.

3.55 We adopted the approach of estimating the beta for the industry portfolio with daily data using the FTSE All Share index to measure market returns. We conducted several robustness checks using weekly data, calculating 1 and 2 years rolling betas over time, estimating different companies betas over different time spans and we cross-checked our estimations against wider market indices. We also looked at comparator sectors betas.

3.56 Our point estimate at this stage is 0.65. Our analysis suggests a range from 0.50 to 0.75 for the water industry "raw" equity beta, prior to re-levering to our suggestion notional gearing. This is based largely upon the statistical confidence intervals around our "raw" equity beta estimate. The hypothesis of a "raw" equity beta equal to one is strongly statistically rejected.

3.57 We then obtained water companies' asset beta by deleveraging equity beta estimates with the latest available actual gearing figures, with two different assumptions on debt beta. Water companies' asset beta seems to stay within the range from 0.10 to 0.40.

4 EQUITY RISK PREMIUM

The Equity Risk Premium

4.1 The CAPM equation[27] states that the expected return on a capital asset is equal to the return required on a risk-free asset plus a degree of non-diversifiable risk that is inherent to the market. The right hand side of the CAPM equation therefore includes a term defined as the Market Risk Premium (MRP) ($E(R_m)-R_f$). Strictly speaking, a fully diversified portfolio might include assets such as land or gold, and no usable all-assets index exists. The normal proxy employed is the Equity Risk Premium (ERP) — the implicit assumption being that stock markets are, by themselves, sufficiently diverse to span all risks and allow of perfect diversification with a stocks-only portfolio. The ERP is the difference in the rate of return expected by shareholders for holding risky equities rather than risk-free securities.

4.2 We note that it is sometimes asserted that stock markets do not have this property and that therefore the CAPM is not strictly correct. This does not follow — CAPM requires only that a fully diversified portfolio could, in principle, be constructed from all available assets (not merely shares). But it might follow that the ERP is an imperfect proxy, so that measured estimates of the CAPM did not perfectly capture the cost of capital. Specifically, it would mean that the risk on a maximally-diversified pure equity portfolio included risk that was specific to equities but could, in principle, be offset (diversified) in a wider asset portfolio. Hence the ERP would be greater than the MRP. Thus, the risk that stock markets do not permit full diversification is the risk that using the ERP results in an over-estimation of the cost of capital. Similarly, if periods of high stock market volatility are also are periods in which stock markets temporarily lose function with the consequence that they lose some of their ability perfectly to diversify, a consequence will be that ERP estimates for those periods will over-estimate MRPs.

4.3 Standard practice of most financial economists estimating ERP is to measure the historical equity premium over fairly long periods and make extrapolations based on this about the expected ERP. Prior to the end of the technology bubble (2000), the most widely cited US source was Ibbotson Associates' figures, whose equity premium history starts in 1926. Before research by Dimson, Marsh and Staunton (2002) raised the bar for both data and methods used to estimate the ERP, the most widely cited sources for the UK were the studies published by Barclays Capital and CSFB, with both of their equity histories starting in 1919.[28]

4.4 An often cited survey conducted by Welch in 1998 of the opinions of 226 financial economists who were asked to forecast the thirty-year arithmetic mean equity risk

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[27] CAPM states that $E(R_i) = R_f + \beta_i (E(R_m) - R_f)$.

[28] Dimson, Elroy, Marsh, Paul and Staunton, Mike (2002) "Global evidence on the equity risk premium" London: London Business School.

premium, showed that a large number of correspondents were calibrating their forecasts relative to the longest-run historical benchmark available from Ibbotson, and then altering the historical number downward based on subjective factors.

4.5 To find the expected future risk premium, extrapolation from the past is not sufficient; consideration has to be given to the question whether the future is likely to reveal a difference in the market preferences or institutional factors that have determined the historic risk premia. There are particular problems if extrapolation is based on a short time period.

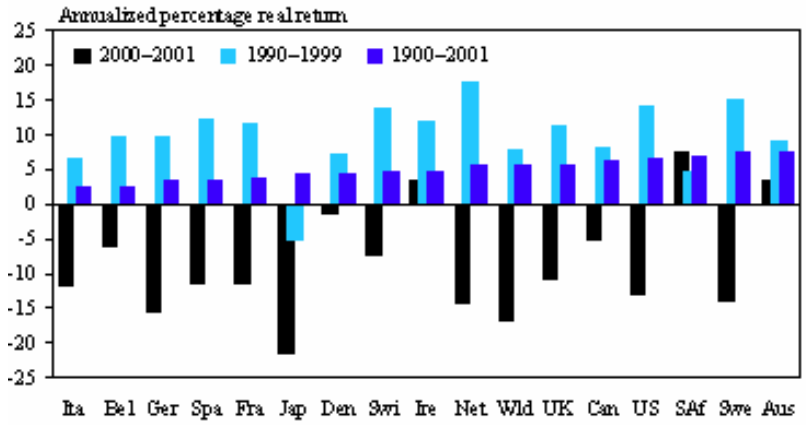
Methodological Issues

Limitations of Estimates of the Risk Premium based on short time periods

4.6 Short term time frames clearly do not provide a solid basis for generalising about future returns — stock markets are far too volatile on a year to year basis for good predictions to be made. A common choice of timeframe has been ten years, but even looking over a decade will not produce robust results since it is not long enough to cancel out "good and bad luck" (or negative risk premia and excess risk premia). The high corporate growth rates during the late 1990s and the subsequent 'burst' of the technology bubble, is an example of extremes which cannot be relied upon for future predictions. For such reasons, Dimson et al. argue that judgements should be informed by the full extent of financial history.

4.7 Using achieved risk premia to forecast required risk premia depends on having a long enough period. Even with 102 years of data, market fluctuations have ome impact. In addition, the underlying MRP could vary over time (e.g. as tastes for risk evolve). It is moreover important to take into account the fact that stock market outcomes are influenced by many factors. For example, non-repeatable events (such as the removal of trade barriers) would feasibly mean projected premia should differ from past premia. The figure below shows how the difference in time frame used can impact the estimated returns, and therefore the ERP.

Figure 4.1: Short-term and Long-term Real Returns on Equities from Around the World



Note: the country names listed in abbreviated form along the horizontal axis are (from left to right) Italy, Belgium, Germany, Spain, France, Japan, Denmark, Switzerland, Ireland, the Netherlands, the world (weighted average of the sixteen individual countries), the United Kingdom, Canada, the United States, South Africa, Sweden and Australia.

Source: Dimson, Marsh and Staunton, 2001

4.8 This problem can be illustrated by comparing the first and second halves of the twentieth century. Several factors may have contributed to the large risk premia achieved during the second half of the twentieth century. These include:

(a) Unprecedented growth in productivity and efficiency and great technological change have led the market outcome to exceed investor expectations. (But higher growth in corporate cash flows then became known to the market and presumably built into higher stock prices.)

(b) Stock prices rose relative to dividends because of a fall in the required rate of return due to diminished business and investment risk. Factors reducing business risk included increased international trade flows and the end of the Cold War. Investment risk may also have diminished through diversification.

(c) Transaction and monitoring costs fell materially over the century.

4.9 A major shortcoming of the Ibbotson Associates, Barclays Capital and CSFB reported premia is the historical success of the US equity market and survivorship bias, alongside bias in the index construction due to narrow coverage.[29,30] Dimson et al. point out that even when indices are constructed to account for survivor bias within countries, the very

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[29] Survivorship bias refers to the tendency for markets (and therefore estimates of returns) to include equity from only companies that have been successful but not account for those which have folded, thereby overestimating returns. Dimson et al point out that even when indices are constructed to account for survivor bias within countries, the very fact that certain markets did not survive through the very long run (a century) means that certain countries had to be omitted such as Poland, Russia and China. These markets are likely to have had smaller ERPs than those in the sample.

[30] Dimson, Elroy, Marsh, Paul and Staunton, Mike (2002) "Global evidence on the equity risk premium" London: London Business School.

fact that certain markets did not survive through the very long run (a century) means that certain countries had to be omitted such as Poland, Russia and China. These markets would have been likely to have had smaller measured ERPs than those in the sample.

Arithmetic or Geometric Mean?

4.10 Discussions of the ERP explore the implications of using the arithmetic or the geometric mean of historical equity premia.[31] There are reasons for using each. In theory, the arithmetic mean treats each estimate as independent of the others (consequently it is considered to be "forward looking"), and therefore corresponds to the "true" expectation. The geometric mean necessarily tracks past estimates, and will therefore always be smaller than the arithmetic mean in the presence of market volatility. Its stickiness renders it a superior indicator of the magnitude of past returns.[32]

4.11 The two means are linked by volatility when returns are distributed along a lognormal distribution, which is commonly assumed in long term equity markets.[33] Lognormality can often characterise observed returns which exhibit a skewed distribution, allowing returns to be unbounded above zero, but to not drop below -100 per cent (i.e. the distribution is one-tailed).

4.12 The relationship between the arithmetic and geometric mean is perhaps more easily understood through a mathematical explanation, proof and example. Jensen's inequality implies that, under lognormal distribution, the arithmetic average risk premium is approximately equal to the geometric average risk premium plus half the variance.[34] To be clear, if (in the impossible scenario that) there were no volatility in annual returns, the arithmetic mean risk premium would equal the geometric mean one. While the difference between (arithmetic) mean log returns and the geometric mean is typically very small, this relationship gives rise to the counter-intuitive result that an asset may have negative geometric mean returns but positive arithmetic mean returns (i.e. if an investor loses money over a long period of time).

4.13 Formally, the arithmetic mean log return may be expressed as a linear approximation as

$$E(r_{jt}) + \frac{\sigma^2(r_{jt})}{2},$$

where

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31 What is conventionally referred to as the "geometric mean" is technically the compound average return — or the geometric average of $1 + R_{jt}$, minus one.

32 Abrams, Dr. Jay (1996) "Arithmetic vs. geometric means: empirical evidence and theoretical issues." www.abramsvaluation.com/pdf/Arith_geom.pdf.

33 Wright, Stephen, Mason, Robert, and Miles, David (2003) "A study into certain aspects of the cost of capital for regulated utilities in the UK" London: Smithers & Co Ltd.

34 Gregory, Alan (2007) "How low is the UK equity risk premium?" XFi Centre for Finance and Investment paper number 07/09, University of Exeter.

– $E(r_{jt})$, the expected log return on some financial asset — directly related to the expected mean value;[35] and

– $\sigma^2(r_{jt})$ is the variance (volatility) of the returns.

4.14 Wright et al show that the above expression is closely related to the geometric mean return, whose linear approximation is $E(r_{jt})$, or the log arithmetic mean return minus its variance. The geometric mean return, $G(R_{jt})$, can be expressed as:

$$1 + G(R_{jt}) = \exp(E(r_{jt})) .$$

4.15 To a linear approximation,

$$G(R_{jt}) \approx \log(1 + G(R_{jt})) = E(r_{jt}) .$$

4.16 As an example, Dimson, Marsh and Staunton (2001) suppose that a general estimate for the standard deviation[36] of equity market log returns (over a 102 year period) is 0.2. Let us assume that the true distribution of returns is normal. Then the difference between the arithmetic and geometric mean is approximately $(0.2)^2/2=0.02$. A two percentage point difference between the two mean returns is non-trivial. Moreover, as volatility increases, the difference grows more rapidly; for volatility levels of 0.3, the gap becomes 4.5 per cent.

Now let us assume that the true distribution of returns is lognormal: if $E(r)$=0.04, the geometric mean return is $\exp(0.04) - 1$, or 4.08 per cent — a very small difference.

4.17 Experts that assume lognormality of returns (Campbell, Dimson et al) opt for using geometric means for part or the entirety of calculating the expected premium. Others such as Fama and French believe that the arithmetic mean is stable and should therefore be used because changes in returns are serially uncorrelated. A sound approach may be found in the report written by Wright et al for Smithers & Co (2003):[37]

> Given the absence of a clear consensus on the best way to model the underlying properties of returns, the only clear-cut recommendation must be to deal consistently with the difference between the two averaging methods, to be precise in noting which estimate

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35 The relationship between the arithmetic mean and log arithmetic mean is: $E(R_{jt}) \approx \log(1 + E(R_{jt})) = E(r_{jt}) + \frac{\sigma^2(r_{jt})}{2}$.

36 Standard deviation is the square root of the variance ($\sigma = (\sigma^2)^{1/2}$).

37 p. 27: Wright, Stephen, Mason, Robert, and Miles, David (2003) "A study into certain aspects of the cost of capital for regulated utilities in the UK" London: Smithers & Co Ltd.

is being used in any context, and to be aware of the potentially significant differences between the two.

Historical Estimates

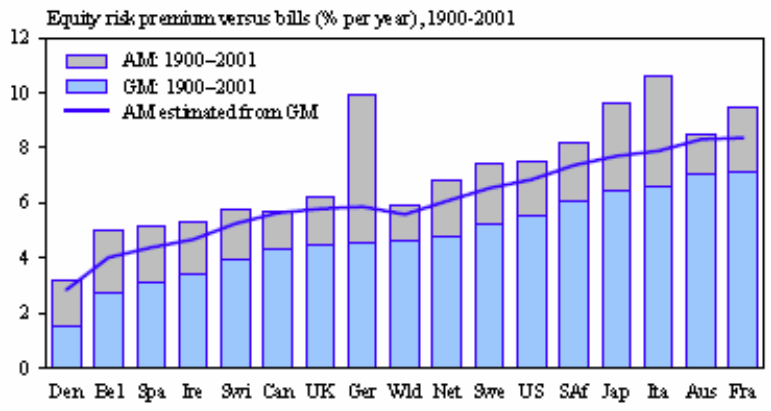
Dimson, Marsh and Staunton

4.18 Dimson et al. (2002) created a database of long-run international returns comprising annual returns for sixteen countries from 1900-2001. This overcomes some problems in the previous indices (specifically, concerns about biases), through extending the time frame back to 1900, when returns were lower (partly due to events in the lead up to, and including, WWI), and by including premia from countries other than the US (from their data, in fact, the premia for two-thirds of other countries in this sample were lower than for the US).

4.19 Before the pivotal Dimson et al. dataset was developed long-run studies took US or UK premia. The twentieth century was a period of remarkable growth in the US and UK economies, which probably exceeded the expectations held by investors in the early twentieth century.

4.20 To extrapolate the prospective risk premium from historic ones, Dimson et al. deduct the impact of the growth in cash flows and the gain from falls in the required risk premium. This means that this estimate is lower than the raw historical risk premium, and the estimates given by finance academics in surveys. To reconcile the difference between arithmetic and geometric means, the authors replace the historical difference between the two with a difference based on contemporary risk estimates.[38] The following figure illustrates the effect of this method, which the authors describe in their 2001 estimation.

Figure 4.2: Arithmetic Mean Equity Risk Premia Relative to Bills (1900-2001)



[38] Dimson et al assume a single volatility level for all sixteen national markets used (for simplicity) of 16 per cent, and for the world index of 14 per cent.

Source: Dimson, Marsh and Staunton, 2001

4.21 Their prospective arithmetic risk premia for the US was 5.3 per cent, for the UK 3.6 per cent and for the world index is 3.9 per cent. They also argue, given the increasingly international nature of capital markets, it may be more appropriate to take a global rather than a country by country approach to determine the prospective equity risk premium. This is also a consequence of between-country differences being attributable to individual country shocks that are not likely to repeat themselves. Dimson et al suggest, that due to the inherent difficulty of using historical data to predict future premia, that it may be better to use a "normal" equity premium most of the time, and to deviate from this when there are compelling economic reasons to suppose expected premia are unusually high or low.

Smithers & Co

4.22 In the seminal 2003 "Smithers Report", Wright et al derive a (global) geometric ERP of 3 per cent and an arithmetic ERP of 4-5 per cent. In the context of cost of capital estimation, the authors argue the importance of starting with average cost of equity returns and working backwards (i.e. subtracting the safe rate), due to greater historic uncertainty levels over the ERP than over costs of equity.

4.23 Wright et al claim that the safe rate is hard to explain, and appears to be unstable in the data. To some degree this is a consequence of the many problems of assuming a constant riskless rate when estimating the ERP over long time spans. Siegel (1998) showed that in the period between 1830-1998, while thirty-year stock returns appear to move within a relatively narrow range, those returns for bonds and bills were much less stable. This concern may be exacerbated by the so-called "risk-free rate puzzle", which is unable to reconcile historically low average risk-free rates with consumer preferences modelled to prefer consumption today over consumption tomorrow.

Other estimates

4.24 Alan Gregory (University of Exeter) argued in 2007 that previous estimates of the UK arithmetic risk premium exhibit an upward bias, resulting from three components:[39]

(a) It is inconsistent to use two differing proxies for risk free assets for the two right hand side components of the CAPM equation, which is what has been done conventionally (the historical and the current risk free rates).[40]

(b) A further disparity between the risk free rates arises because *ex post* realised returns are not completely insulated from inflation risk.

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[39] Gregory, Alan (2007) "How low is the UK equity risk premium?" XFi Centre for Finance and Investment paper number 07/09, University of Exeter.

[40] This point is also emphasised in the Smithers Report.

(c) In the context of a state of "excess volatility" in the market, when adjusting from geometric to arithmetic averages of historical ERP in order to estimate future ones, the arithmetic premium estimates are likely to be over-estimates.

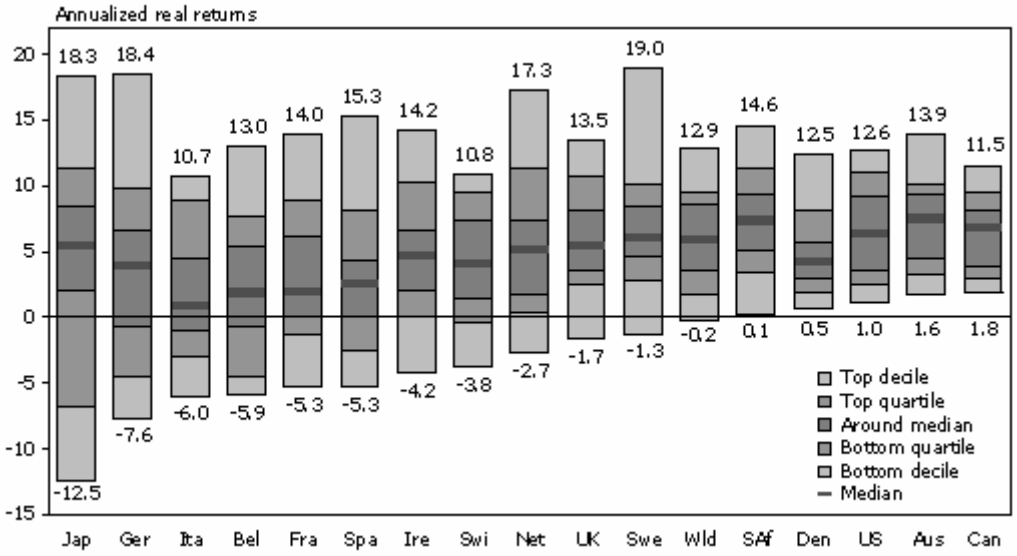
As such the author re-estimates the ERP and concludes that the arithmetic premium ranges between 2 and 4.3 per cent, and the geometric equivalent ranges between 1.5 and 3.3 per cent.

4.25 Other recent estimates include a range of 2.5-6.5 per cent from Schaefer (2007) and 4-6 per cent from Myers (2008).

Extrapolation of Future ERP from Historical Estimates

4.26 Dimson et al (2003) exposed what they believed at the time to be the predominant trend of "irrational optimism" of investors regarding the expected performance of world stock markets. According to the authors rewards were being overestimated and risk underestimated. Granted, based on historical experience in the US markets, forecasts were pointing to favourable years to come. However, during the 20th Century the US stock market had both higher real returns and lower volatility (as discussed above in paragraph 4.8) than many other countries which should not be overlooked, especially in an increasingly global financial system: looking at long run (20 year) return horizons, just two markets outperformed the US between 1900 and 2002 (see figure below). Thus when historic returns were calculated based on world markets, the ERP became much lower than had been previously estimated. The authors concluded that a plausible, forward-looking ERP for the world's major markets would be **3 per cent**.

Figure 4.3: Percentiles of the Distribution of 20 Year Returns (1900-2002)

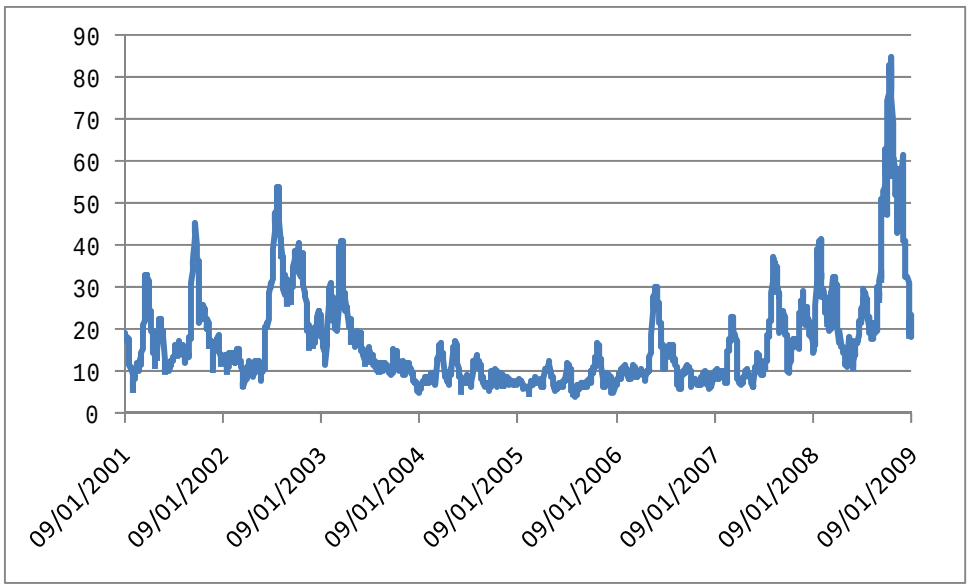


Source: Dimson, Marsh and Staunton, 2003.

4.27 Dimson et al expect riskiness of markets to continue, not just in terms of business risk, but also in counterparts of the 20th Century World Wars and Cold War: wars on terror, drugs, or climate change. The current financial crisis may potentially involve, *inter alia*, some change to the forward-looking ERP. However, the effects of this would not appear in the measured data for many years. In the short term, as volatility in markets is high we should expect to see increases in the ERP as measured over the short period. But, as discussed above, this might well be a poor indicator of the true risk premium on equities over a longer timescale. However, in 2007 Dimson et al revised their estimate back up to a geometric world average of 4.1 per cent and arithmetic average of 5.2 per cent, and UK values of 4.2 and 5.4, respectively..

4.28 Figure 1.3 below gives an idea of the recent volatility experienced by equity markets.

Figure 4.4: FTSE All Share Historic Volatility



Source: Bloomberg, 2009

4.29 The following table displays Dimson, Marsh and Staunton's 2007 ERP estimates and volatility levels for a number of countries.

	Arithmetic mean	Geometric mean	Standard error
Belgium	4.6	2.8	1.9
France	6.2	4.0	2.2
Germany	8.5	5.5	2.7
Ireland	5.4	3.9	1.8
Italy	7.8	4.5	2.9
Netherlands	6.1	4.0	2.1
Spain	4.6	2.6	2.0
USA	6.6	4.6	1.9
UK	**5.4**	**4.2**	**1.6**
World	**5.2**	**4.1**	**1.4**

Source: Dimson, Marsh and Staunton, 2007

Regulatory Precedents

4.30 Table 4.1 presents some recent regulatory ERP estimations. For further discussion of regulatory precedents please see the Literature Review section.

Table 4.1: Regulatory Precedents of ERP Estimates

Regulator	Year	Sector/company	ERP
Ofwat	2004	Water (WaSCs and WoCs)	higher end of 3.5% - 5.0%
Ofgem	2004	Electricity DNOs	higher end of 2.5% - 4.5%
Ofcom	2005	BT	4.0% - 5.0%
Smithers & Co for Ofgem	2006	Four electricity and gas licensees	higher end of 2.5% - 4.5%
Ofgem	2007	GDNs	2.5% - 4.5%
Competition Commission	2007	Heathrow and Gatwick (BAA)	2.5% - 4.5%
Civil Aviation Authority	2008	Heathrow and Gatwick (BAA)	4.5%
CEPA for Office of Rail Regulation	2008	Network Rail	3% - 5% but may be as high as 7%

Sources: Regulator respective reports

Limitation of the Historical Approach

4.31 The use of the DMS methodology, which we still consider the most robust approach to infer about the ERP, presents some problems in the current financial and economic context, in which consistent variations in risk premia are likely to be observed.

4.32 For example evidence reported in De Paoli and Zabczyk (2009) suggests that the size of this risk premium depends on whether the economy is in a period of stagnation or prosperity. In particular, investors seem to require higher premia during economic slowdowns than during booms. This empirical regularity has been termed "premium counter-cyclicality".[41]

4.33 We will now employ a methodology based on the use of the (forward-looking) information contained in the observed debt premium to make inferences on the possible future evolution of the ERP.

Forward Looking ERP

Equity risk premium and the debt premium

4.34 An alternative method to estimate a forward looking measure of the ERP is the use the (forward-looking) information contained in the observed debt premium (the difference between interest rates paid by businesses when borrowing and the risk-free rate.).

4.35 Since default on debt is more likely to occur during recessions than booms, there will typically be a systematic component to the risk premium on debt. However, the debt premium observed in spreads is likely also to include an element of insurance against default on the debt, regardless of whether the default occurs for systematic or idiosyncratic factors. Hence it will not typically be appropriate to think of all of the debt premium, or spread, as an indicator of market covariant risk covered by the debt beta beta — indeed, one might expect the greatest part to be a reflection of specific company risks — and an adjustment of debt premiums based on "promised" returns on debt will be necessary to obtain the relevant CAPM concept: the beta associated with the expected return on debt.

4.36 By definition, the Market Debt Premium (MDP) for a company is given by:

$$MDP \equiv r - r_f$$

where: r = the risk-free rate, and r = the market rate for debt

r is not equal to the expected return from holding debt (the relevant concept for CAPM), since:

(a) there is some probability of default, leading to no return

[41] See B. De Paoli and P. Zabczyk (2009) "Why do risk premia vary over time? A theoretical investigation under habit formation. Harvey (1989) showed that US equity risk premia are higher at business cycle troughs than they are at peaks. Subsequent results of Bekaert and Harvey (1995), He, Kan, Ng and Zhang (1996) and Li (2001) con_rmed these _ndings. Cochrane and Piazessi (2005) finnd that the term premium is countercyclical in the United States while Lustig and Verdelhan (2007) document strong countercyclicality in the exchange rate risk premium. The two most popular asset pricing models attribute this variation either to countercyclical changes in risk aversion (Campbell and Cochrane (1999)) or to changes in the volatility of the consumption process (Bansal and Yaron (2004))

(b) there is some probability of losing the initial investment, even on secured debt

(c) there is some probability of the perceived risk of default falling after purchase of the bond but before maturity, leading to the value of the bond rising (and so the actual return being greater than the market rate)

4.37 The worst-case scenario is that whenever there is a default, the whole value of the bond is lost. The expected return from holding debt is:

$$1 + E(r) = (1 + r).(1 - p)$$

where, p = the probability of default

4.38 The expected return on debt, expressed in CAPM terms, considers only systematic risk:

$$E(r) = r_f + MRP.\beta_D$$

Hence, in this worst-case scenario

$$r_f + MRP.\beta_D = (1 + r).(1 - p_d) – 1$$

$$= (1 + r_f + MDP).(1 - p) – 1$$

$$= r_f + MDP – p(1 + r)$$

4.39 More generally, when there is some element of loss of principal as a result of default (as opposed to total loss), the ERP can be calculated as:

$$ERP = \frac{r(1 - p_D) - pLGD - r_f}{\beta_D}$$

Where LGD is the loss given default and β_D is the debt beta.

4.40 The approach set out above falls entirely within the CAPM framework — for, as mentioned, CAPM models expected returns, and the above procedure simply adjusts promised returns to generate expected returns.

4.41 The data needed for implementation are:

(a) the probability of default;

(b) the amount of loss from the default;

(c) the debt premium and the risk free rate for the market return;

(d) the debt beta

Debt beta

4.42 With the exception of Oftel/Ofcom & CAA, UK regulators have made the simplifying assumption the debt beta is zero. In the London Airports price control, the Competition Commission recommended the use of a debt beta of 0.1. Some foreign regulators' determinations have been in the range 0.10-0.25.[42]

4.43 The approach we adopted to measure debt betas for this exercise is to estimate it using co-variation between bond returns and the returns on a general market index, as for the equity beta. The caveats about estimating the debt beta include that the type of systematic risks affecting the bond market could be different from those affecting the equity market, which could increase the noise in the estimation. Also, the transfer of information from movement in the equity markets to the bond markets might take more time than within equity markets. These facts may lead to highly inefficient estimates.[43]

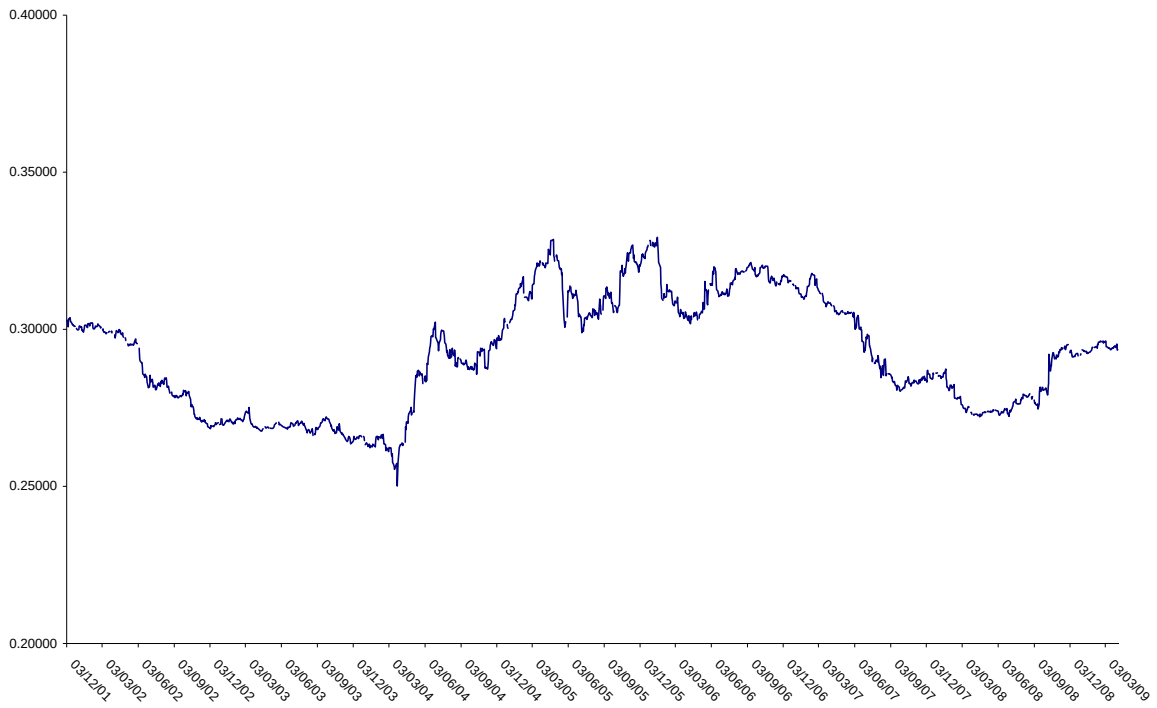
4.44 Since our scope is to calculate a UK ERP we used market wide bond indices for estimation.

4.45 In particular we calculated the one-year rolling daily debt beta using the JP Morgan Eurosterling All Sectors Bond Index and the FTSE All Shares, using both daily and monthly data:

[42] See for example the Qeensland Competition Commission (2004) and the Essential Services Commission (2002).

[43] Europe Economics calculated debt betas for BAA. The result was a statistically significant beta estimate of 0.17. However the confidence interval was wide and the explanatory power of the regression was very low. See Europe Economics, 2006, "Supporting paper XIII Cost of capital – estimating separate costs of capital for Heathrow and Gatwick", Report for CAA.

Figure 4.5: JP Morgan Eurosterling All Sectors bond index, rolling daily beta (Blume adjusted)[44]



Source: Europe Economics elaborations on Bloomberg data

4.46 The latest point estimate is of 0.29 with a 95 per cent confidence interval of 0.18-0.35.

4.47 Given the well known statistical problems of using high frequency data in bonds markets we also computed one year rolling monthly debt beta: the path over time is very similar with slightly lower latest point estimate at 0.25 with a 95 per cent confidence interval of 0.16-0.30. We cross-checked or results with the EUR UK (A) Index (composed of fixed-rate Euro-denominated debt of UK issuers with ratings of A+, A and A- from S&P, Moody's, Fitch and/or DBRS) obtaining a slightly lower result in the range of 0.13-0.18.

Probabilities of default and Loss Given Default (LGD)

4.48 We used the Idealized Moody's Idealised Expected Loss Tables, created from expected default probabilities and LGD rates, in order to estimate market wide probabilities of default and LGDs. Again we decided to focus on market wide data rather than water industry or specific rating data since our aim is to estimate a measure of market equity risk premium.

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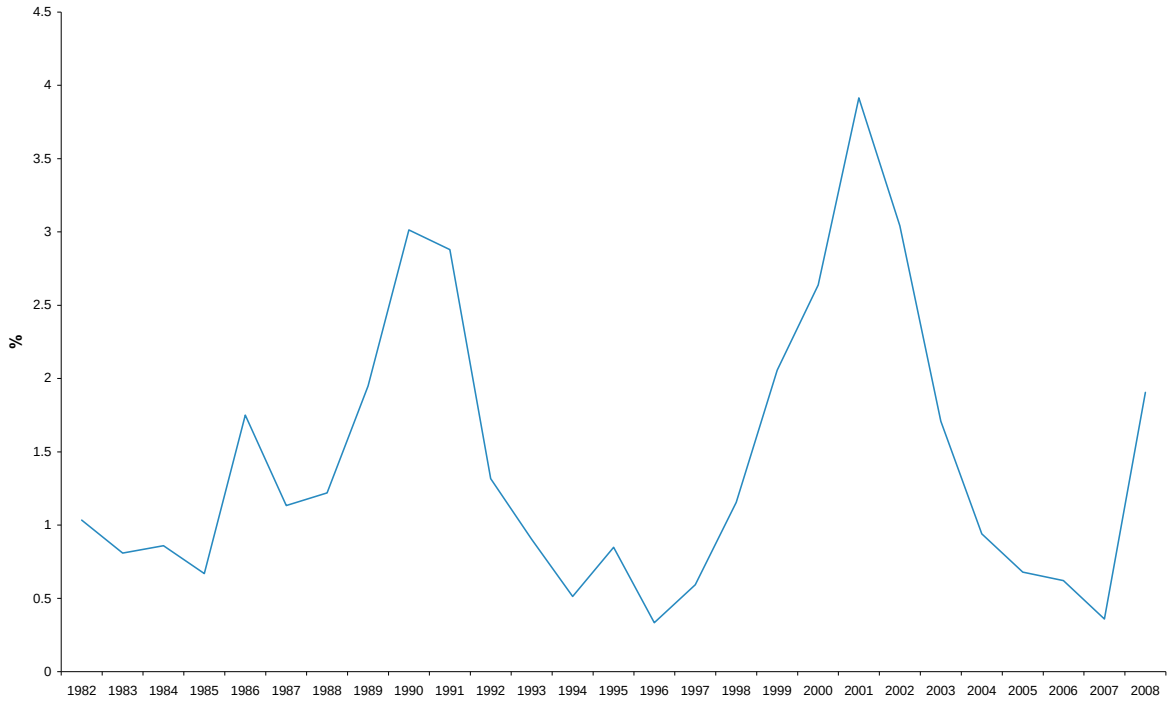
44 Note that the Blume adjustment here comes from Bloomberg.

4.49 Moody's credit ratings are opinions of relative expected credit losses upon default, which are functions of both the probability of default and severity of default (LGD). Figure 4.6 shows annual implicit default probabilities from 1982 to 2008 for Moody's-rated corporate issuers. In 2008 the implicit probability of default has increased to 1.9 per cent from 0.3 per cent in 2007. The whole period average probability of default has been 1.43 per cent while the average LGD rate has been 58 per cent.

Figure 4.6: Moody's probabilities of default over time



Source: Moody's Corporate Default Rates 1920-2009.

4.50 Going forward Moody's notes that "The ongoing banking crisis and global economic downturn make it almost certain that default rates will continue to climb sharply during 2009. The only outstanding questions are to what levels they will rise and how quickly. Because the impact of the current economic downturn on corporate debt issuers is likely to be more severe than for the two most recent credit cycles of the early 1990s and 2000s, Moody's expects that the speculative-grade default rate will exceed the peaks of 11.9 per cent and 10.4 per cent reached in those cycles, respectively. Indeed, the speculative-grade default rate could exceed the 15.4 per cent record level set in 1933, when the speculative-grade market was solely a fallen angel market comprised exclusively of downgraded investment-grade issuers. Moody's formal forecasting model, the Credit Transition Model (CTM), indicates that the global issuer-weighted speculative-grade default rate will hit a peak of 16.4 per cent in November. If this forecast materializes, the speculative-grade default rate will almost quadruple from a level of 4.1 per cent at the end of 2008. In terms of the absolute numbers of the defaulters, the model forecast implies roughly 300 defaulters in 2009. "

4.51 The all rated weighted default rate could then increase to 6-7 per cent in 2009.

Equity risk premium

4.52 Putting the different pieces together and using the formula discussed above we obtain the following figures, for different values of estimated probabilities of default, for the ERP:

Probability of default	3.00%	4.10%	2.00%	2.90%
LGD	60.00%	60.00%	60.00%	60.00%
debt beta	0.15	0.15	0.15	0.15
rf	1.75%	1.75%	1.75%	1.75%
Debt premium	2.75%	2.75%	2.75%	2.75%
r	4.50%	4.50%	4.50%	4.50%
r*(1-p)	4.37%	4.32%	4.41%	4.37%
pLCD	1.80%	2.46%	1.20%	1.74%
r*(1-p)-plcd-rf	0.81%	0.11%	1.46%	0.88%
ERP	5.43%	0.70%	9.73%	5.86%

4.53 It is important to stress (as it can be noted from the table above) that the results are highly sensitive to small changes in parameters and hence need to be carefully interpreted. For example a change of 1 per cent in the probability of default changes the estimated ERP by almost 5 per cent.

4.54 More importantly estimates turn out to be extremely sensitive to unobservable parameter values (in particularl the probability of default), on which it is difficult to have a strong prior.

4.55 Our conclusion is that, in the absence of a more robust independent basis for estimating default probabilities, this debt premium decomposition methodology cannot serve as a basis for estimating a forward-looking ERP. However, we will employ the results from this exercise to inform our conclusion on the appropriate ERP to use.

Variation in the ERP in Periods of Recession

4.56 Extensive empirical evidence supports the view that risk premia tend to be higher in recession and stagnation periods.[45] Cochrane and Piazzesi (2005) argue that the ERP increases by almost 20 per cent in period of crisis, coming back to its previous "normal level" after three years after the end of the recession, on average.

[45] See footnote to paragraph 4.32.

Europe Economics ERP Choice

4.57 Drawing particularly on the DMS 2007 estimates of the UK ERP (between 4.2 and 5.4 per cent) and on recent regulatory precedent (above), Europe Economics' view is that the appropriate ERP for a non-crisis period would be 5.0. We believe that the DMS range of 4.2-5.4 is the appropriate range from which plausible regulatory judgements might be formed.

4.58 The forward-looking methodology suggests that the ERP may currently be elevated above 5, though by precisely how much would depend so sensitively upon the (unobservable) probabilities of default that we are unable to use the forward-looking estimation basis to produce a specific figure. However, since Cochrane and Piazzesi argue that in periods of crisis ERPs increase by 20 per cent, that implies that the ERP might be 6 at present.[46] We note the implication of the earlier discussion that if the financial crisis impairs financial market function, and implication might be that ERPs overstate MRPs, and thus we regard this 20 per cent markup as conservative. We thus consider that the range for ERP increase in crisis is 0 to 20 per cent (so, if our point estimate recommendation of 5 for the non-crisis ERP were accepted, that would imply a crisis ERP of 5 to 6).

4.59 Hence bearing in mind the uncertainties associated with recent financial market events, the arguments about the counter-cyclicality of the ERP, and the results of the debt premium decomposition methodology we recommend an ERP of 6 per cent in the current crisis and 5 per cent after the end of the turmoil.

[46] 5 x 1.2 = 6

5 CAPITAL STRUCTURE

5.1 In calculating a WACC estimate, it is necessary to make an assumption about the gearing level of the company so as to know the weight which should be placed respectively on the cost of equity and the cost of debt. However, as discussed below, the choice of gearing does not necessarily affect the post-tax cost of capital, since both the cost of equity and the cost of debt change with gearing. The choice of gearing does, however, affect the tax liabilities which Ofwat has to allow for elsewhere within price limits.

5.2 The notional level of gearing on which the WACC calculation is not intended to represent second-guessing of companies' decisions about their optimal financing structure or to provide any guidance on the gearing level that firms should adopt. How companies choose to raise their finance is up to them.

Capital Structure and CAPM: MM Proposition I

5.3 The starting point in thinking about the effect of gearing is the Modigliani-Miller insight (MMI) that the riskiness of a company depends on the riskiness of its real cash-flows — volatility in the costs and in the demand for its products. The implication is that where there are no taxes, incentive or information problems, the way a project or firm is financed does not affect its value or its cost of capital — the market value of any firm is independent of its capital structure. This is because the overall risk on the company's asset base), the asset beta, does not change with the capital structure of the firm (i.e. the chosen combination of equity and debt).

5.4 This section first explains the MMI more fully, and then investigates situations where the proposition may not apply.

Understanding MMI

5.5 A company can be thought of as a bundle of investment projects (installation of different physical assets, different marketing schemes, etc). MMI is easiest to explain in terms of raising finance to undertake a project. A project can be represented by a stream of uncertain, future cash flows or (net) revenues. Each set of future revenue is equivalent to some amount of cash today; the exact amount is obtained by discounting by the cost of capital. Adding all the cash equivalents together gives the total value of the project, V, say.

5.6 Suppose the project costs an initial amount C. Then the project is worth undertaking if and only if $V > C$, that is, if and only if it contributes positive net value. This brings us back to MM proposition I, as follows. The financiers of the project — who put up the C — have to get their C back. They can get it back in a variety of ways: they could be given a share s of future revenues, where $sV = C$, or they could get some debt (risk-less or risky) that

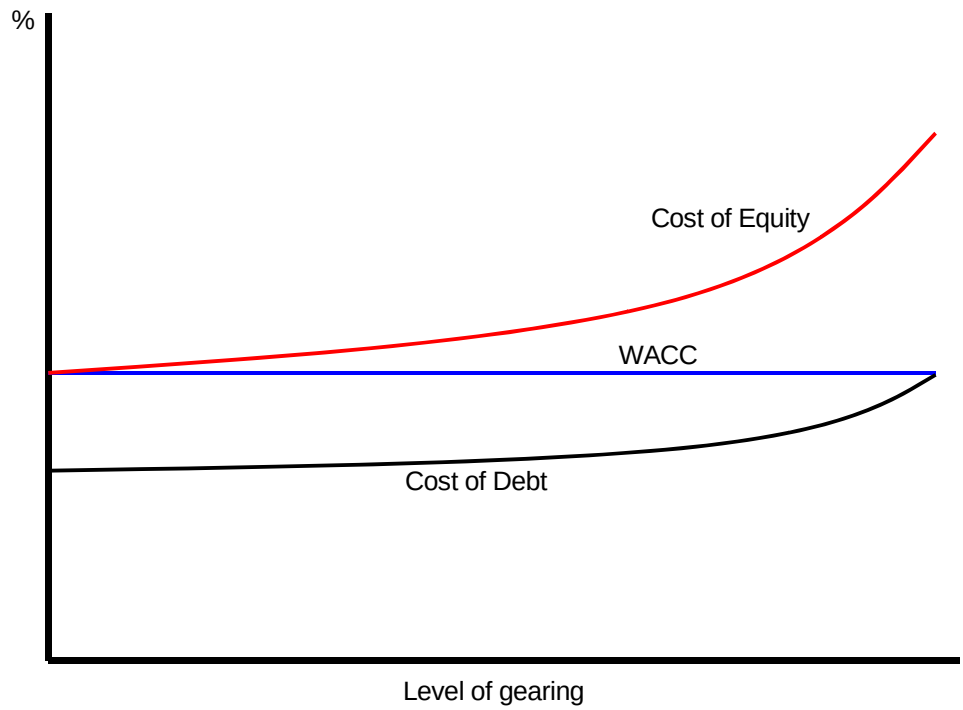
has a present value equal to *C*. Regardless of the method, they must get *C*, and simple arithmetic tells us that the entrepreneur that sets up the project will get the remainder *V - C*. That is, from the entrepreneur's point of view (and from the financiers') the method of financing doesn't matter. (It does not matter how the C is sliced up.[47])

5.7 Since the riskiness of the asset is determined by its real features, not its method of financing, causality runs from the asset cost of capital to the costs of debt and equity, via the capital structure, rather than the other way around. Many people, first encountering corporate finance, have a thought along the following lines — if the cost of equity is 11 per cent, the cost of debt is 1 per cent, and the gearing level is 50 per cent, then the cost of capital will be 6 per cent (0.5 x 11 + 0.5 x 1). But (they think) if gearing rises to 75 per cent, then the cost of capital must fall to something like 3.5 percent (0.25 x 11 + 0.75 x 1). If that were so then causality would run from the costs of debt and equity to the overall asset cost of capital, via the capital structure (the cost of capital would depend on the costs of debt and equity and the gearing). The Modigliani-Miller theorem reverses this, saying that the asset cost of capital is fixed by the real nature of the asset, so, in fact, it is the costs of debt and equity that depend on the level of gearing, not the asset cost of capital.

5.8 The proposition is illustrated in Figure 5.1 below. At zero level of gearing the weighted average cost of capital is equal to the cost of equity. As gearing increases, the weight on the (lower) cost of debt increases. However, cost of equity and debt both adjust such that the combined WACC remains unaltered, until at 100 per cent gearing WACC simply equals the cost of debt.

[47] Miller used to illustrate MM proposition I with one of baseball legend Yogi Berra's famous (mis-)sayings: "You better cut the pizza in four pieces because I'm not hungry enough to eat six."

Figure 5.1: Modigliani-Miller proposition I



5.9 Since capital structure is irrelevant according to MMI, if that were all there were to it, we might expect to see completely random capital structures of companies. But we do not. MMI then points us to the reasons why capital structures might matter for a company, particularly through noting for us the matters from which MMI abstracts.[48] These are the things the proposition abstracts from:[49]

(a) Taxes — differential tax treatment of equity and debt finance may imply that increasing gearing will save tax and in this way increase company value;

(b) Costs of financial distress — in the absence of other distortions, the expected costs of financial distress will rise with the level of gearing, at least partially offsetting the potential benefit from tax effects;

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48 Note that it is sometimes naively asserted that the MMI result "does not hold" — i.e. that it is not true that the cost of capital is invariant to the level of gearing — if the assumptions the MMI theorem's proof requires do not hold. That is fallacious. For example, if we take as an assumption given, that my sister is currently in my house, it follows that my house has not fallen down (there is a quasi-logical proof). But just because my sister is not, in fact, currently in my house (just because our assumption does not hold) it does not follow that my house has, in fact, fallen down. Likewise, we are not entitled to assume, upon observing a world of information asymmetry or costs of bankruptcy, that *therefore* the cost of capital will vary with the capital structure. That remains to be proven one way or another. Many claims concerning conditions that, if they held, the MMI result would not hold, have turned out upon subsequent analysis not to be convincing. The MMI result, once one understands the intuition, is amongst the most compelling, elegant, and universal in all corporate finance theory, and has been recognised as such ever since its publication.

49 MM proposition I also assumes efficient well functioning capital markets, but that is an assumption we will keep throughout this paper.

(c) Incentive problems — financial structure may affect incentives that for example the managers have to maximise the net present value of the company;

(d) Information problems — the information that different market participants have access to at different times might vary; and

(e) Transaction costs — for example in changing the level of gearing.

5.10 The table below illustrates possible effects these factors might have on the market value of the company. The horizontal line represents the situation under the MMI – the level of gearing has no effect on company value. Once we move to a situation with taxes, however, gearing may have an effect due to the tax advantage of interest payments, as illustrated by the rising straight line. Considering only the effects of taxation would imply that the best possible capital structure involved holding no equity.[50] However, as gearing rises, so do the risks and expected costs of financial distress. Therefore there is some optimal level of gearing as illustrated by the higher of the curved lines in Figure 5.2. If in addition there are some incentive problems associated with high levels of gearing, the optimal level of gearing might be lower still, as represented by the lower of the curved lines in Figure 5.2.[51]

5.11 The same can be shown with the rate of return on the vertical axis rather than the market value of the company. Table 5.2 shows the effects of the value of the tax shield in pre- and post-tax WACC settings. A pre-tax approach allows the company to earn a return out of which to settle tax expenses. In a post-tax approach on the other hand, taxes are modelled separately from the return (WACC) as a cost item. Therefore as gearing increases, pre-tax WACC falls due to the value of the tax shield, until the expected costs of financial distress begin outweighing the benefit from the tax shield.

5.12 In a post-tax setting the WACC allows only for returns to investors, after taxes have been paid. Therefore only the costs of financial distress show on the WACC diagram (we are here ignoring the other possible distortions), and it would seem there is no obvious optimal level of gearing. This is, however, more apparent than real — taxes have merely been moved out of this equation. Their effect, including the tax shield value that varies with the level of gearing, still exists in the separate modelling, and the company will take their value into account when selecting its financial structure.

5.13 We will turn to the effects outside of MMI after considering the basic proposition in the CAPM framework in slightly more detail.

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50 Taxation however introduces a distortion, such that the value in a world with taxation will never actually reach the value of the company in a world without any taxation, as in the MMI. Hence the MMI line lies above the "world with distortions" lines.

51 The drawing of the "incentive problem line" in Figure 5.2 is not intended to imply that incentive problems arise before significant effects on cost of financial distress. This does not have to be the case, and the titling of the curved lines could as easily be reversed.

Table 5.1: Illustration gearing and market value of company

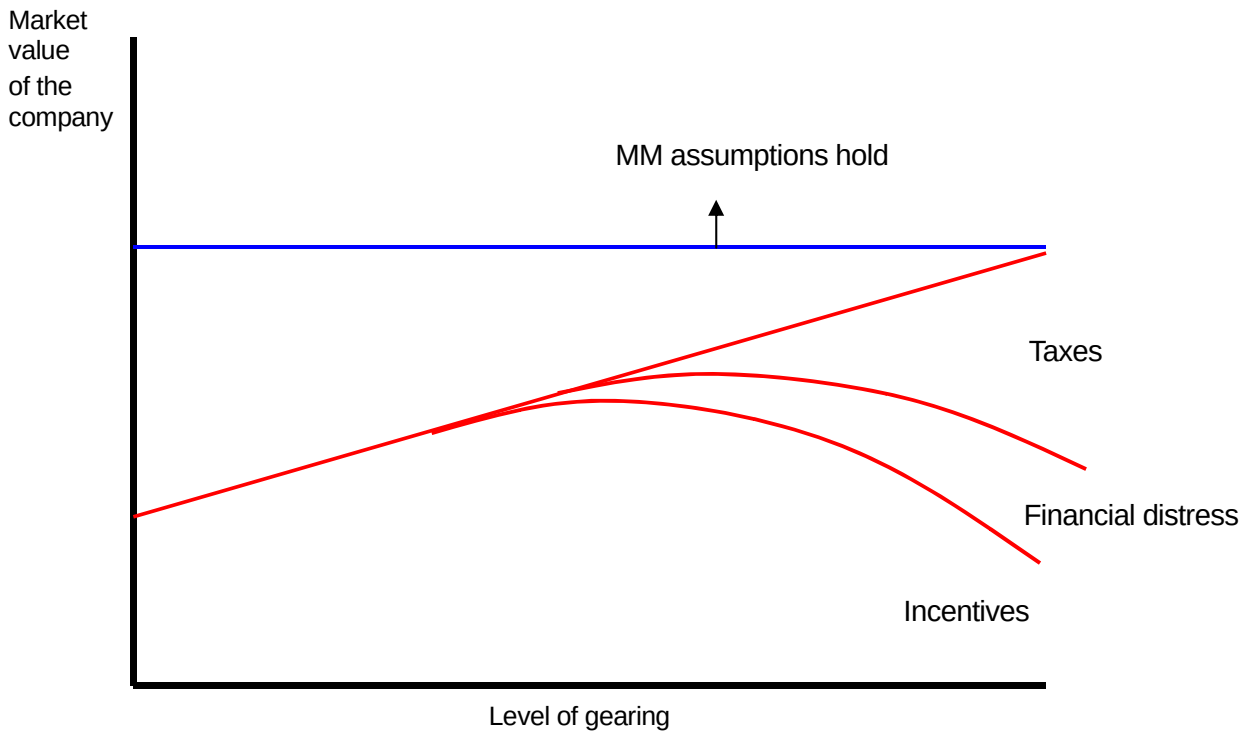
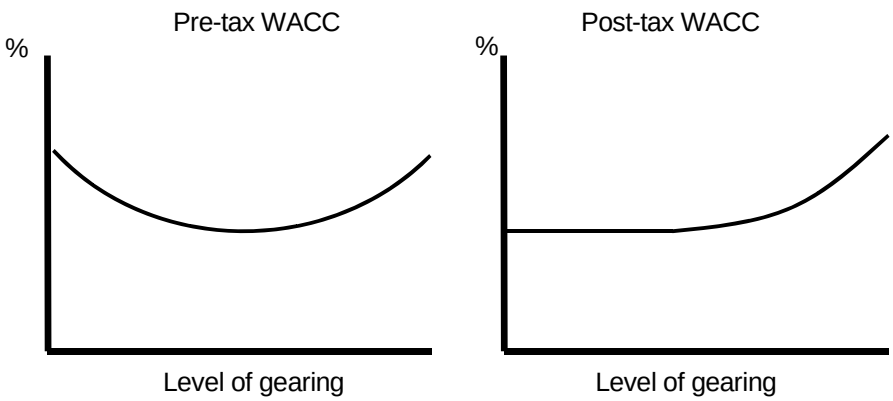


Table 5.2: Gearing effects with pre-tax and post-tax cost of capital



Implications within the WACC Framework

5.14 In order for the financiers of the above project to be willing to put up the cost of the project, they must determine what level of risk they are taking on, and therefore, what level of return they require for their investment. To do this in a CAPM framework, they have to estimate the risk on all of the company's stock, the asset beta. As discussed in previous sections, the asset beta is a measure of how the net returns on the asset as a

whole (the relevant "asset" in this context being the whole water industry) is correlated with changes in returns across the wider economy.

5.15 The asset beta is relevant to the total WACC of the company, as opposed to just the cost of equity:

$$WACC = r_E \cdot \frac{E}{D+E} + r_D \frac{D}{D+E} \; ; \; \beta_A = \beta_E \cdot \frac{E}{D+E} + \beta_D \frac{D}{D+E}$$

5.16 If the firm uses no leverage, then the shareholders get all the project revenues, and $\beta_A = \beta_E$. However, when the firm uses debt as well as equity, β_E overstates the risk of the company, and the equity beta must be "un-levered" to get the asset beta. This is straightforward in the well functioning capital markets we are still assuming — we can utilise the above formula.

5.17 Recalling MM proposition I, the value of the company is determined by its future revenues, and how those revenues are split between different types of financiers does not matter. This means that the asset beta is constant — as the company gears up (D increases), the weight on the equity beta decreases relative to the weight of debt beta, and therefore something has to adjust to compensate (as typically $\beta_D < \beta_E$). Assuming that the risk on the debt providers does not change, the risk on equity holders must increase. This in fact is the case; the risk on the firm's equity is affected by its capital structure as well as the riskiness of the underlying business.[52]

5.18 We have now illustrated MMI in the CAPM framework. In perfect capital markets, the fact that a company gears up does not matter because the risk on equity rises in proportion to exactly compensate, leaving the asset beta, and therefore the company WACC, unaffected. In fact, it is the asset beta that drives the level of equity and debt betas — the overall risk on the asset base is what matters, the cost of equity and debt only adjust to reflect this depending on their relative amounts.

5.19 However, things are not as clear as we relax the assumptions behind MMI. The most clear-cut effects are those associated with taxation, which can be directly analysed in the CAPM framework, and to which we now turn.

Value of Tax shield in CAPM

5.20 Bringing taxation into the picture, it is now possible that a company's value is affected by

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[52] Occasionally, studies are produced in which the cost of equity appears to be invariant to issuance of new debt, with the argument offered that this is incompatible with MMI. But that is not correct — for example, something happening to reduce the company's cost of capital (e.g. greater certainty ov er its future revenue stream) might naturally be associated with a decision to issue additional ("securitizing" those future revenue streams). It might well be natural for the amount of debt issued in such a circumstance to be that amount that leaves the cost equity as it was before the cost of capital fell. (This is particularly likely if the determinant of the capital structure operates through or has the effect of placing a cap on the cost of equity — debt issuance would continue until that cap was reached.)

its capital structure due to the tax advantage enjoyed by debt finance — interest payments are tax deductible, whereas dividends and capital gains are not.

5.21 Roughly speaking, the impact of a change in the level of gearing on the WACC due to the change in the tax shield value could therefore be calculated as follows. First, estimate the values of the debt and the equity beta for the previous level of gearing, and using them construct the asset beta. Also remember that as gearing increases, the company value might be affected by the factors described in paragraph 5.9, such that the trade-offs imply that an increase in gearing would not be desirable above a certain point.

5.22 Second, remember that the asset beta will change only as a result of the change in the present value of the tax shield due to gearing up, which would have to be projected throughout the regulatory price review period. If there is no additional value from the tax shield compared to current gearing (i.e. current gearing is optimal), the asset beta can either only stay the same or *increase*, leading to a fall in the company valuation (as, other things being the same, the discount rate on the future income is now higher).

5.23 Aiming for an "optimal capital structure" implies equating the marginal benefit of debt financing with its marginal cost. Optimal gearing ratios are likely to vary by sector and even, in principle, by company.[53] Historically the water sector has been characterised by stable technology and inelastic demand; as such, notional gearing ratios have tended to be relatively high in the absence of scope for frequent business risk.[54]

Determining Notional Gearing Levels

Notional gearing and financeability

5.24 As discussed below, we believe that the notional gearing assumption should be chosen so as to address any perceived financeability problems.

5.25 Ofwat describes financeability in terms of making sure that, if reasonably efficient, a company's revenues, profits and cash flows should allow it to raise finance on reasonable terms in the capital markets. In practice, this has typically meant ensuring that projected financial ratios (calculated using a notional gearing assumption) will allow companies to maintain an appropriate credit rating.

5.26 Financeability issues can arise as a result of cashflow timing issues. Currently UK regulatory price caps are intended to deliver stable real revenues based on a combination of a real allowed rate of return and an inflation linked asset base. In this context, the use of nominal debt may make it difficult for companies to finance large investment programmes. This is because in the early years of an asset's life the (real) return and

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53 Of course, the same arguments applied elsewhere about measurement errors dominating heterogeneity apply here also, and we intend to apply a single notional gearing level across at least WaSCs and at this stage across the whole water industry.

54 Department of Trade and Industry and HM Treasury (2004) "The drivers and public policy consequences of increased gearing" London.

depreciation allowed on the asset may be lower than the nominal costs of financing it, which can lead to financial ratios becoming strained. This effect may be reversed in later years of the asset's life.

5.27 At PR04 Ofwat dealt with the issue of financeability by making upward adjustments to the revenue allowances derived from the basic "building block" approach to setting the price limits. There was a total of £430m in financeability adjustments made at PR04, the bulk of which were allocated to the WaSCs, all of which received an adjustment, with the adjustment amounting to an average increase of 0.3 per cent in the allowed rate of return over 2005-10. The WoCs received less than £10m in financeability adjustments which was less than a 0.1 per cent increase in the allowed rate of return.

5.28 However, in our view it is unnecessary to make similar adjustments to price limits in PR09. The cost of capital is by definition the rate of return that an investor requires in order to invest in a company, given the firm's risk profile compared with other potential investments. Hence, if there cost of capital has been set at the correct level then investors should be able to raise finance without further adjustments to price limits.

5.29 In our view, if financeability problems are driven by the use of large amounts of nominal debt, then the appropriate solution is for companies to use less nominal debt (instead using other financing arrangements such as equity or index-linked debt). Hence, this implies that financeability issues should be addressed through the choice of the opening notional level of gearing, through the assumptions made about the type of debt issued by companies and/or through assuming new equity formation partway through AMP5. This is in line with Ofwat's preference for market-led solutions to any perceived financeability problems.

5.30 It may be imprudent for Ofwat to assume material new issuance of index-linked debt by water companies over the price control period, given that the availability of such debt has been affected by the financial crisis, and the extent to which it will be widely available again in the future is unknown. (We note that, after a period in which such issuance was absent, there has been some issuance of index-linked debt by water companies in recent months.) At the same time, we consider that it is reasonable for Ofwat to assume that water companies have at least some existing index-linked debt, given that many companies already have this on their balance sheet.

5.31 However, we see no reason at all why companies cannot engage in new equity formation if this is necessary to address any financeability issues. This could be done either through retaining earnings (i.e. a change in dividend policy) or through a new rights issue. Indeed, in recent months a number of water companies have received injections of new equity from their owners.

5.32 In conclusion, we believe that Ofwat should resolve problems with financial ratios by choosing a notional gearing level compatible with the financial ratios and credit rating which it thinks water companies need to achieve to raise finance efficiently. Any perceived financeability problems arising part-way through AMP5 should be dealt with by

assuming new equity formation — an approach consistent with the use of a WACC which implicitly assumes a combination of debt and equity funding.

Actual gearing and regulatory precedents

5.33 Since the 1990s, there has been a trend for water companies to gear up. This was driven by reduced opportunities for efficiency gains from cutting operating costs, leading to companies seeking out other ways of generating value, namely through borrowing.[55] At PR04 Oftwat assumed a notional gearing level of 55 per cent for both WoCs and WaSCs. However, gearing levels have substantially increased since.

5.34 Actual gearing data for 2007/08 show an industry average of 66 per cent.[56] On average, WaSCs had gearing levels of 66 per cent and WoCs of 61 per cent. This is a marked increase from 2006/07 figures, which averaged 62 per cent: 62 per cent for WaSCs and 60 per cent for WoCs.[57]

5.35 Table 5.3 shows recent notional gearing choices of UK regulators. Although there is some time variation in the table, we can see that Ofwat's 2004 decision ranks among the higher gearing ranges, with an upper limit matched only by ORR. A more detailed discussion of these decisions is in the Literature Review.

Table 5.3: Recent Regulatory Notional Gearing Decisions

Regulator	Year	Sector/company	Notional gearing
Ofwat	2004	Water (WaSCs and WoCs)	55-65%
Ofgem	2004	Electricity DNOs	57.5%
Ofcom	2005	BT	30-35%
Smithers & Co for Ofgem	2006	Four electricity and gas licensees	60%
Ofgem	2007	GDNs	62.5%
Civil Aviation Authority	2007	Heathrow and Gatwick (BAA)	60%
Civil Aviation Authority	2008	Stanstead	50%
CEPA for Office of Rail Regulation	2008	Network Rail	60-65%

Source: Individual regulator reports

Suggested notional gearing figure

5.36 In setting the notional level of gearing we have taken a cautious approach and have sought to choose a level of gearing consistent with both WaSCs and WoCs maintaining a credit rating of at least A-. We believe that this is a conservative approach since water companies may in fact be able to raise debt finance at lower ratings than this.

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55 Department of Trade and Industry and HM Treasury (2004) "The drivers and public policy consequences of increased gearing" London.

56 Ofwat (2008) "Financial performance and expenditures of the water companies in England and Wales 2007-08" Birmingham.

57 Ofwat financial returns data (2007).

5.37 We held discussions with rating agencies to understand how different levels of gearing and other financial ratios might affect the credit rating obtained by water companies. It is important to note that gearing does not on its own determine water companies' credit ratings in a mechanistic way — ratings will also be affected by other financial ratios as well as by qualitative considerations.

5.38 Based on our discussions with rating agencies, we concluded that WoCs would typically achieve a lower credit rating than WaSCs for any given level of notional gearing. Broadly speaking, our view based is that a gearing range of 50 to 60 would be consistent with WoCs maintaining a credit rating of A-, whereas WaSCs could maintain a credit rating of A- with gearing in the range 60 to 68. For the water industry as a whole, this would imply a range of 50 to 68 for notional gearing. However, we consider it unhelpful to use such a wider range, and hence we propose a narrower range for notional gearing of **55 to 65 per cent**. This is identical to the range which Ofwat proposed during PR04 in its methodology paper for that review.

5.39 Within this range, we suggest using a point figure in the lower half of this range, on the grounds that we think this would be consistent with even WoCs achieving a credit rating of A- (with WaSCs potentially being able to achieve an A rating). Prior to receiving the results of Ofwat's financeability analysis, our recommendation for a point estimate is for the very the bottom of this range — **55 per cent**. To put matters another way, our view is that, as matters stand, the best forward-looking point estimate is 55 per cent, whilst all uncertainties tend to lie on the upside, drawing that figure higher. For instance, it might be appropriate to choose a higher point estimate within the range in the future if market developments confirm that water companies can raise sufficient debt finance at a rating of BBB+ such that a less cautious approach is needed in relation to the target credit rating.

5.40 Our gearing figure of 55 cent should be understood in the context of the increased costs of raising debt due to the credit crunch, and our reflection that a less conservative notional gearing range may encroach upon the ability of firms to finance their debt.

5.41 We recommend the use of this same notional range for WaSCs and WoCs. An alternative approach would be to employ a notional gearing level that differed between WoCs and WaSCs, in each case with the gearing being sufficient to achieve an A- rating. This would imply a gearing of 60-68 per cent for WaSCs, and if this approach were to be adopted we would recommend a WaSC gearing of 60 per cent. As explained in a later section, we do not believe there is sufficient evidential base for assigning differing costs of capital to WoCs and WaSCs (in particular, their exposure to systematic risk does not appear to be different). But if Ofwat chose to employ differing notional gearing levels, we note that it is by no means obvious that small differences in gearing (say, of the order of 5 per cent — the difference between the actual gearings of WaSCS (66 per cent) and of WoCs (61 per cent)) imply overall differences in the cost of capital (as we explained above in the discussion if the Modigliani-Miller theorems). Thus, even if Ofwat concludes for small differences in notional gearing for WaSCs and WoCs, it will not necessarily follow that it should therefore determine differing WACCs.

5.42 We note that a gearing level of 55 per cent gearing might imply some new equity issuance. We also assume that capital expansion will be financed by some balance of new equity and debt — the assumption consistent with the WACC approach — rather than being fully debt-funded. (The assumption that only debt finance will be raised appears to have been the working assumption of some market players in recent years. Indeed, it has been put to us that the previous use of upwards financeability adjustments was interpreted by the market as an assumption on Ofwat's part that all new finance would be through debt, and was in flat contradiction to the use of a WACC.)

5.43 Our interview programme and our own analysis of the situation suggests that there is no good reason to suppose that new equity issuance will, over the period 2010-15, be materially more difficult than issuance of new debt.

5.44 On the other hand, it has been suggested to us, and we consider it plausible for theoretical reasons, that without some signal by Ofwat that new equity issuance is expected, it might be difficult under *current* market circumstances to issue new equity as this might be interpreted as a signal of financial distress. Though plausible, we believe, first, that this will not apply by the period of the price control, even if credit market conditions were to continue to be difficult by then; and second, that this is a matter that could be substantially solved by appropriate coordinating signals from Ofwat (to the effect that new equity issuance is to be expected).

6 COST OF DEBT

6.1 This section analyses the cost of debt for water companies during AMP5. This is a crucial part of the analysis in the context of current constraints in capital markets, which saw bond spreads rise to historically high levels, particularly in the Autumn of 2008.

6.2 The discussion in this section is set out under the following headings:

(a) Our approach to estimation of the cost of debt;

(b) Evidence from spreads on water company bonds;

(c) Evidence from wider market indices;

(d) Analysis of the impact of the credit crunch;

(e) Embedded debt adjustments;

(f) Liquidity and transactions costs;

(g) Conclusions on the cost of debt.

Our Approach to Estimation of the Cost of Debt

6.3 There are a number of methodological choices which need to be made when deciding how to estimate the cost of debt.

6.4 The first issue relates to the credit rating which should be assumed for water companies. As discussed in section 5 on capital structure, our recommended notional level of gearing of 55 per cent would (in the absence of other factors) be consistent with a credit rating of A for WaSCs and A- for WoCs. In practice, credit ratings will also depend on other financial ratios as well as qualitative factors, and hence Ofwat will need to carry out financial modelling to confirm that proposed price limits will allow companies to maintain these credit ratings. However, our working assumption for estimation of the cost of debt is that, for non-securitised financing structures, all water companies (both WaSCs and WoCs) will be able to issue bonds with a rating of A- or above.

6.5 At the highest level, there are two alternative ways in which an estimate of cost of debt can be derived:

(a) The total cost of debt can be observed directly from market data on bond yields.

(b) The cost of debt can be built up by adding a debt premium (informed by market data on bond spreads) to the risk-free rate.

6.6 We have adopted the second of these two approaches on the grounds that it best ensures consistency between the way in which the cost of equity and the cost of debt are determined. In particular, the second approach means that in cases in which the chosen

risk-free rate is above market data on ILG yields (as discussed in section 2), the uplift will apply equally to both the cost of debt and the cost of equity. Nonetheless, we have also looked at total yields on a number of water company index-linked (IL) bonds as a cross-check.

6.7 Another decision which needs to be made is whether the cost of debt assumption should be informed by data on spreads specifically on water company bonds, or whether spread data for wider market bond indices with the target credit rating should be used. While we have examined both types of data, our final recommendation places most weight on water company bonds. This is on the grounds that these bonds most closely reflect the actual systematic risk exposure of the water sector in England and Wales, whereas use of wider market data places unnecessary reliance on the judgment of ratings agencies.

6.8 We have examined both spreads on the secondary market for selected water company bonds and spreads for recent new bond issuance by water companies and other utility companies.

6.9 Perhaps the most difficult issue in the context of the current constraints in credit markets is what weight to place on the current market data given that bond spreads are at historically high levels but Ofwat is setting the cost of capital for 2010-15 and not for today. As explained in the introduction, we have addressed the issue by deriving two WACC estimates: a "crisis WACC" which we see as applicable for the duration of the current crisis and a "post-crisis WACC" representing our view of where the market may settle when credit constraints ease. Broadly speaking, the cost of debt in the "crisis WACC" is based on current market data whilst the cost of debt in the "post-crisis WACC" is based on longer-term historical averages (albeit recognising that the very low spreads observed during 2003-07 may not return). The question of how these two figures are weighted to derive a single WACC figure for 2010-15 is addressed in section 7, although we include some preliminary analysis in this section on the impact and potential duration of the "credit crunch".

6.10 Regulators have sometimes made adjustments within their cost of debt estimates to take account of embedded debt. Adjustments are also sometimes made or proposed to take account of liquidity (the need for companies to pre-finance their CAPEX programmes) and transactions costs. Our approach to these issues is explained later in this section.

6.11 Finally, an important issue is the treatment of the cost of debt for WoCs, given that in the past Ofwat has allowed WoCs a small company premium which was partly based on a premium on the cost of debt. Our approach to the cost of debt for WoCs is discussed in section 7 of the report.

Evidence from Spreads on Water Company Bonds

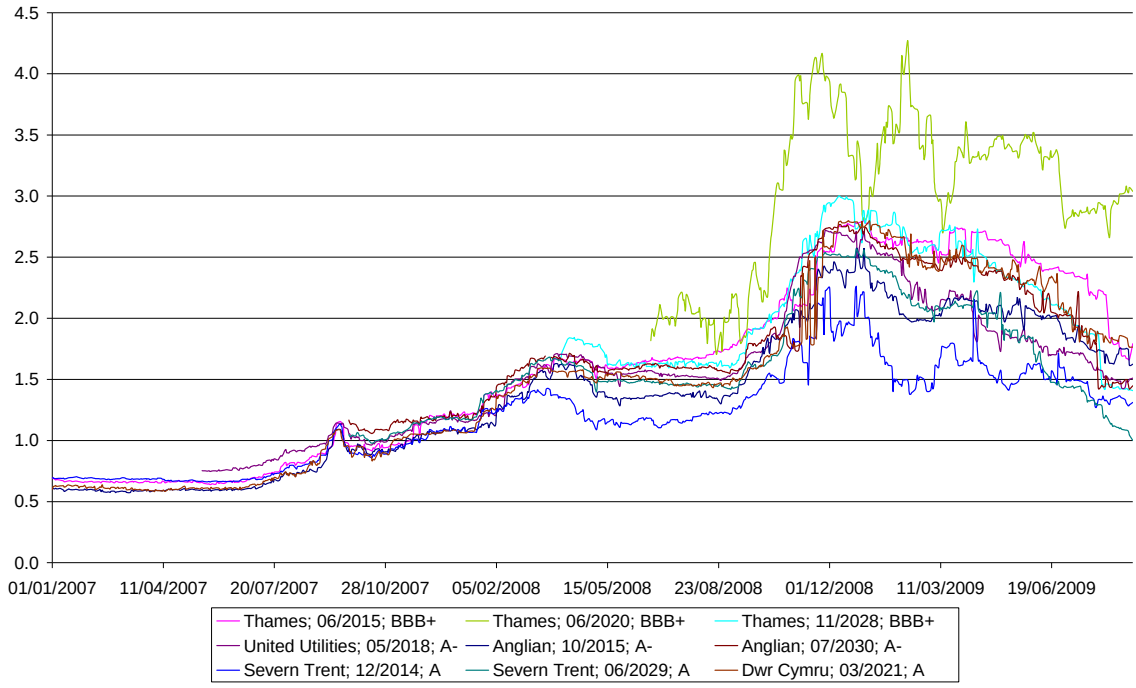
Spreads on selected nominal bonds

6.12 Figure 6.1 shows spread data since January 2007 for selected nominal water company bonds. The bonds were selected to include bonds with terms to maturity of around 5, 10

and 20 years (corresponding with the terms to maturity considered for ILGs in section 2), and with credit ratings of A, A- and BBB+. Although many existing water company bonds have terms to maturity of more than 20 years, evidence on recent new bond issuance (presented later) suggests that new bonds being issued by utilities companies typically have terms to maturity of less than 20 years, confirming the appropriateness of focusing on this selection of maturities. Spreads have been calculated against a nominal UK gilt with a comparable maturity date.[58]

6.13 The data show that from the onset of the financial crisis in mid-2007, water company bond spreads rose significantly. However, spreads have started gradually to decline from the end of March 2009, which could be interpreted as evidence that the crisis is easing (though it would also be compatible with merely a temporary lull, analogous to that in mid-2008).

Figure 6.1: Spreads on selected water company bonds since January 2007



Note: Ratings quoted are those given by Standard and Poor's

Source: Europe Economics calculations using Bloomberg data

6.14 Table 6.1 shows the spreads on these bonds on 31 August 2009. The data show that spreads become progressively higher for lower rated bonds. The A rated bonds have

[58] Spreads are calculated as the difference between the yield on the water company bond and the yield on a UK gilt with a similar maturity date.

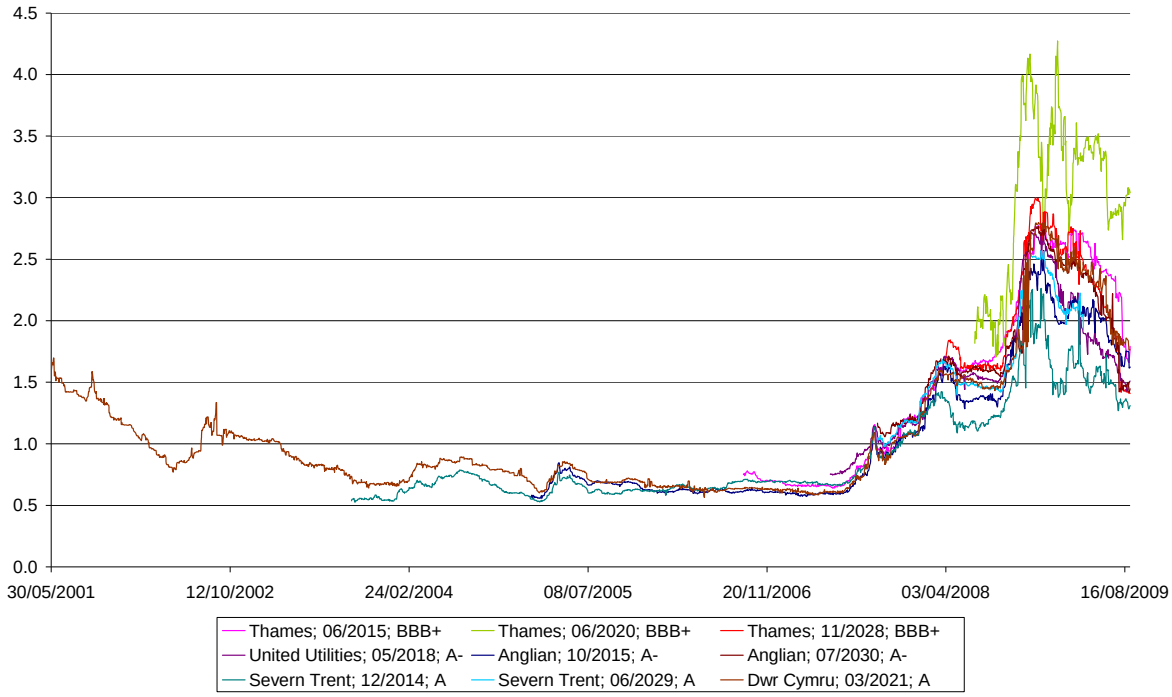
spreads in the range 1 to 1.8 per cent, whereas the A- rated bonds have spreads in the range 1.4 to 1.6 per cent.

Table 6.1: Spreads on selected water company bonds at 31 August 2009

Bond	Spread
Thames; 06/2015; BBB+	1.8
Thames; 06/2020; BBB+	3
Thames; 11/2028; BBB+	1.4
Anglian; 10/2015; A-	1.6
United Utilities; 05/2018; A-	1.5
Anglian; 07/2030; A-	1.4
Severn Trent; 12/2014; A	1.3
Dwr Cymru; 03/2021; A	1.8
Severn Trent; 06/2029; A	1
Range for BBB+ rated bonds	**1.4 – 3**
Range for A- rated bonds	**1.4 – 1.6**
Range for A rated bonds	**1 – 1.8**

6.15 Figure 6.2 shows spread data for the same selection of bonds going further back in time. The chart illustrates that prior to the onset of the financial crisis there was an extended period from mid-2003 to mid-2007 when bond spreads were at historically low levels (in the region 50 to 100 basis points).

Figure 6.2: Spreads on selected water company bonds since mid-2001



Note: Ratings quoted are those given by Standard and Poor's

Source: Europe Economics calculations using Bloomberg data

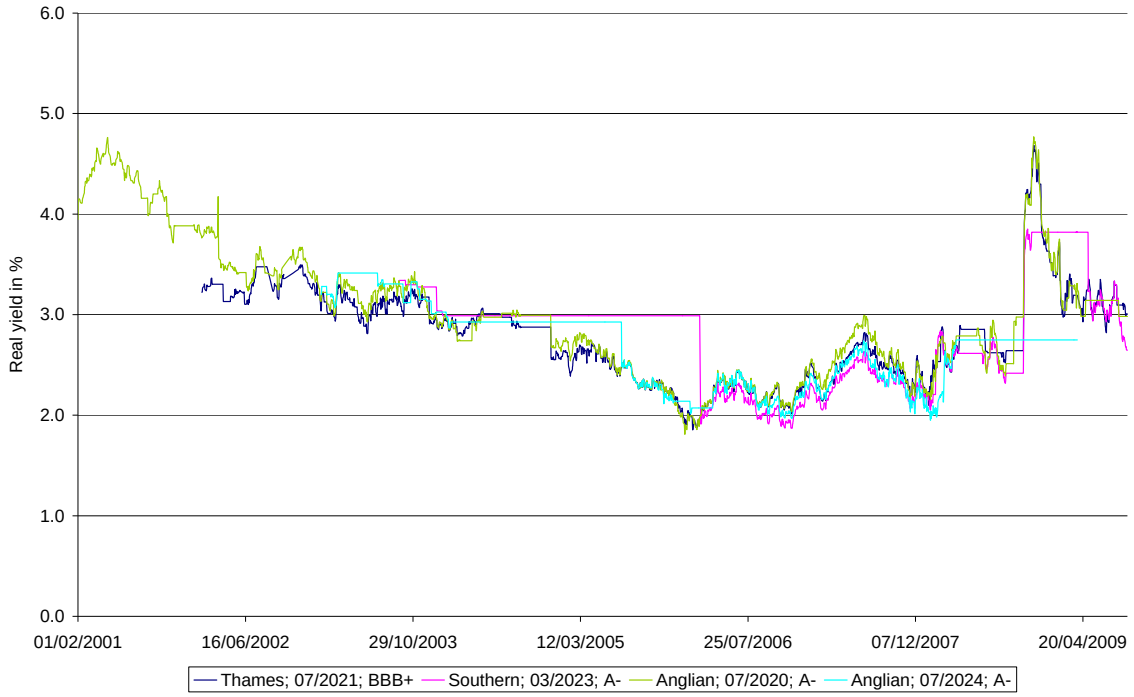
Yields and spreads on selected IL bonds

6.16 Data on water companies' index linked (IL) bonds can be used in two ways. First, the spreads on these bonds (against UK ILGs with comparable maturity dates) provide further evidence to inform our debt premium assumption. Second, as mentioned earlier the yields on these bonds can be used as a cross-check for the total cost of debt. Yield data will reflect both movements in gilt yields and movements in bond spreads.

6.17 Typically, IL bonds issued by water companies have very long terms to maturity and hence we were not able to build up a sample containing bonds with terms to maturity of around 5, 10 and 20 years for each of the credit ratings of interest, as we did for nominal bonds. Instead, we have selected a number of IL bonds with terms to maturity of less than 20 years and with credit ratings of A, A- and BBB+.

6.18 Yield data for these IL bonds since February 2001 are shown below in Figure 6.3. There are a number of periods in which the data show no re-pricing for particular bonds, which we assume is due to an absence of trading.

Figure 6.3: Yields on IL water company bonds since February 2001

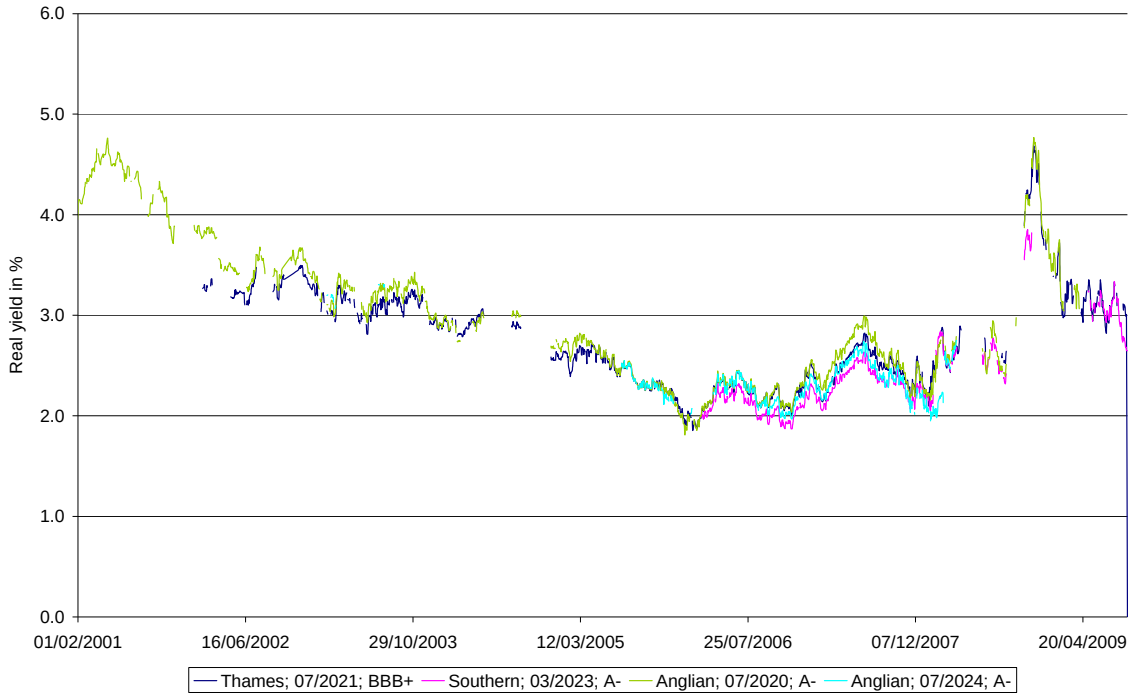


Note: Ratings quoted are those given by Standard and Poor's

Source: Bloomberg

6.19 Figure 6.4 shows the same data with periods in which there is no re-pricing for a particular bond removed from the dataset. The data suggest that the overall cost of debt steadily declined from a peak of over 4.5 per cent in early 2001 to around 2 per cent by early 2006. The data suggest it then fluctuated between 2 and 3 per cent for the next two years (with an overall upward trend), and that towards the end of 2008 the cost of debt rose to a peak of over 4.5 per cent, subsequently falling back to just above 3 per cent.

Figure 6.4: Yields on IL water company bonds (excluding periods with no re-pricing)

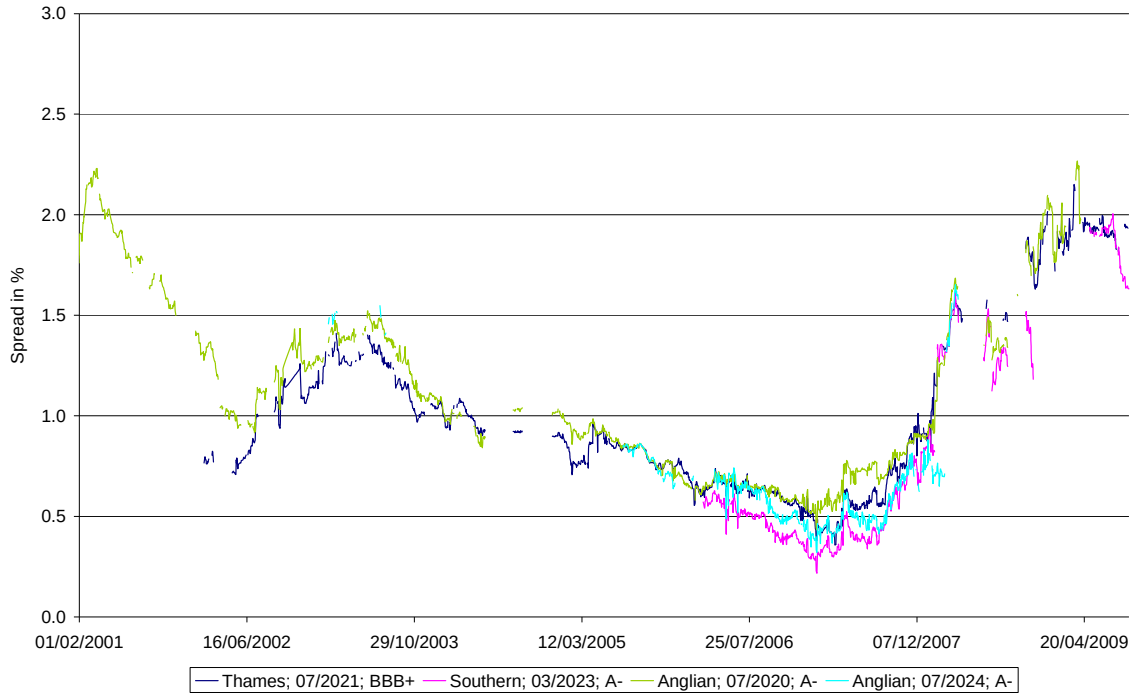


Note: Ratings quoted are those given by Standard and Poor's

Source: Bloomberg

6.20 Figure 6.5 below shows spreads on these IL bonds, calculated against a UK ILG with a comparable maturity date. A comparison of Figures 6.4 and 6.5 shows that trends are quite different when spreads rather than yields are examined. Figure 6.5 shows that spreads on these IL bonds were at low levels (mostly in the range 0.25 to 0.75 per cent) prior to the commencement of the "credit crunch". In line with the data for nominal bonds, spreads have since risen substantially and are now below 2 per cent.

Figure 6.5: Spreads on IL water company bonds (excluding periods with no repricing)



Note: Ratings quoted are those given by Standard and Poor's

Source: Europe Economics calculations using Bloomberg data

6.21 Table 6.2 shows the IL bond yield, benchmark ILG yield and spread for the two bonds for which data is available towards the end of August 2009. It can be observed that the benchmark ILG yield against which we have measured the spread is in both cases significantly below the risk-free rate of 1.75 which we recommend in section 2. This illustrates the importance of building up the cost of debt from the risk-free rate and a debt premium, so that any uplift applied to market data on ILG yields in setting the risk-free rate applies equally to both the cost of debt and the cost of equity.

Table 6.2: Data towards end March for selected IL bonds

Description of IL bond	Latest date in August 2009 for which data exists [1]	IL bond yield	Benchmark ILG yield	Spread
Thames; 07/2021; BBB+	28/08/09	3.06	1.07	1.93
Anglian; 07/2020; A-	5/08/2009	2.98	1.28	1.69

Note: [1]This is after periods in which there has been no repricing for the bond have been removed.

Recent new issues by water companies and other utility companies

6.22 The crisis in financial markets has affected the availability of debt finance as well as its pricing, and there have been periods in which debt markets have been temporarily closed to new issuance. Nonetheless, there have been a number of bond issues by utility companies during 2008 and in the first six months of 2009.

6.23 Tables 6.3 and 6.4 give a non-exhaustive list of the details of utility bond issues in sterling and euros respectively. .

6.24 Of those bonds for which spread data are presented in these tables:

(a) The most recent issuance with an A rating had a spread of 130 basis points (Verbund on 8th July, euro issue);

(b) The most recent issuance with a rating of A- had a spread of 200 basis points (Yorkshire Water on 14th July, sterling issue); and

(c) The most recent issuance with a rating of BBB+ had a spread of 145 basis points (Edison on 16th July, euro issue).

Table 6.3: Utility bond issuances (sterling)

Issue Date	Issuer	Sector	Ratings	Size (GBPm)	Coupon	Tenor	Spread vs UKT	
2008								
18-Dec-08	United Utilities Water	Utility	A3/A-	250	6.125%	7y	295	
15-Dec-08	TMS Water Utilities Cayman Finance Ltd	Utility	A3/BBB+	50	3.853%	32y	Index Linked	
09-Dec-08	ENI	Utility	Aa2/AA-	150	6.125%	10y	250	
02-Dec-08	EDF	Utility	Aa1/AA-	400	6.625%	14y	295	
07-Nov-08	SSE	Utility	A2/A-	500	8.375%	20y	350	
28-Oct-08	EDP Finance	Utility	A2/A-	325	8.625%	16y	370	
22-Oct-08	GDF Suez	Utility	Aa3/A	500	7.000%	20y	220	
09-Sep-08	Centrica	Utility	A3/A	300	7.000%	25y	253	
10-Sep-08	Centrica	Utility	A3/A	450	7.000%	10y	250	
08-Aug-08	SSE	Utility	A2/A-	350	6.250%	30y	170	
12-Jun-08	SPI	Utility	A1/A-	250	7.125%	10y	195	
23-May-08	EDF	Utility	Aa1/AA-	500	6.250%	20y	127	
06-May-08	Nat Grid Gas	Utility	A3/A-	300	6.000%	30y	153	
01-May-08	SGN	Utility	Baa1/BBB	225	6.375%	32y	177	
27-Mar-08	Thames Water	Utility	A3/BBB+	400	7.241%	50y	260	
18-Feb-08	Nat Grid Gas	Utility	A3/A-	300	6.375%	12y	170	
2009								
06-Jan-09	National Grid	Utility	A3/A-	379	7.500%	22y	320	
13-Jan-09	Severn Trent Utilities Finance	Utility	A2/A	400	6.000%	9y	285	
13-Jan-09	E.ON Int Finance	Utility	A2/A/A+	700	6.750%	30y	280	Tranche 1
14-Jan-09	E.ON Int Finance	Utility	A2/A/A+	350	5.125%	5y	245	Tranche 2
20-Jan-09	Iberdrola	Utility	A3/A-	500	5.000%	15y	290	
23-Jan-09	SSE	Utility	A2/A	700	8.625%	5y	290	
28-Jan-09	National Grid Plc	Utility	Baa1/BBB+	400	6.125%	5y	335	
03-Feb-09	GDF Suez	Utility	Aa3/A	700	5.431%	12y	210	
23-Feb-09	Southern Water Services Finance	Utility	A3/A-	300	6.125%	10y	265	
27-Feb-09	Centrica	Utility	A3/A/A	250	5.125%	5y	260	Tranche 1
27-Feb-09	Centrica	Utility	A3/A/A	400	6.375%	13y	270	Tranche 2
25-Mar-09	United Utilities Water	Utility	A3/A-	200	5.750%	13y	240	
01-Apr-09	Vattenfall	Utility	A2/A-	350	6.125%	10y	295	Tranche 1
01-Apr-09	Vattenfall	Utility	A2/A-	1000	6.875%	30y	275	Tranche 2
23-Apr-09	E.On Intl	Utility	A2/A/A+	250	6.000%	10y	215	
21-May-09	EDF	Utility	Aa3/A+	1500	6.125%	25y	187.5	
21-May-09	BG Energy	Utility	A2/A/A+	500	5.125%	8yr	205	
28-May-09	Anglian Water	Utility	Baa3/BBB	100	6.750%	15yr	425	
24-Jun-09	Northern Gas Networks	Utility	Baa1/BBB+	200	5.875%	10	220	
25-Jun-09	RWE AG	Utility	A1/A	500	5.500%	13yr	185	Tranche 1
25-Jun-09	RWE AG	Utility	A1/A	1000	6.125%	30yr	165	Tranche 2
03-Jul-09	Wales & West Utilities	Utility	Baa1/NR	250	6.250%	12yr	245	
10-Jul-09	ENW	Utility	NR/BBB	300	6.750%	6yr	375	
10-Jul-09	ENW	Utility	NR/NR	200	6.125%	12yr	240	
14-Jul-09	Yorkshire Water	Utility	A-/A3	275	6.000%	10yr	230	Tranche 1
14-Jul-09	Yorkshire Water	Utility	A-/A3	200	6.375%	30yr	200	Tranche 2
14-Jul-09	Yorkshire Water	Utility	A-/A3	175	2.718%	30yr	ILG + 200	Tranche 3
21-Jul-09	United Utilities Water Plc	Utility	A-/A3	70	2.400%	30yr	Index Linked	
03-Sep-09	Wessex Water	Utility	BBB+/A3	50	2.186%	30yr	Index Linked	

Source: Collated by Ofwat

Table 6.4: Utility bond issuances (euro)

Issue Date	Issuer	Sector	Ratings	Size (EURm)	Orderbook Size (EURm)	Tenor	Spread vs ms
2008							
03-Dec-08	REN	Utility	A3/A-	500	na	5y	325
01-Dec-08	Nat Grid Electricity	Utility	A3/A-	600	1,500	5y	330
27-Nov-08	Centrica	Utility	A3 / A	750	1,800	5y	380
25-Nov-08	Vattenfall	Utility	A2/A-	850/650	3,179 / 2,572	5y / 10y	230 / 280
18-Nov-08	EDF	Utility	Aa1/AA-	2000	5,500	4y	210
17-Nov-08	E.ON	Utility	A2/A	1000	NA	2y	150
13-Nov-08	EnBW	Utility	A2/A-	750/750	NA	5y / 10y	230 / 270
13-Nov-08	Iberdrola	Utility	A3/A-	1,000/600	NA	3y / 7y	290 / 365
12-Nov-08	RWE	Utility	A1/A	1,000/1,000	4,000/3,500	5y	215/255
23-Oct-08	Gasunie	Utility	Aa2/AA-	1,000	1,850	5y	195
17-Oct-08	GDF-Suez	Utility	Aa3/A+	1,000/900	1,600/1,700	5y / 10y	200/240
28-Aug-08	RTE	Utility	AA-	1,000	NA	10y	52
26-Aug-08	E.ON	Utility	A2 / A	750 / 1,000	3,500	3y / 7y	45 / 72
10-Jul-08	SSE	Utility	A2/A	600	1,250	5y	123
09-Jul-08	CEZ	Utility	A2/A-	600	1,250	6y	120
16-Jun-08	Anglian Water	Utility	A3/A-	500	1,000	8y	120
27-May-08	E.ON	Utility	A2/A	1000	2,500	6y	75
23-May-08	EDF	Utility	Aa1/AA-	600/ 1250	5,200	6,12y	47/ 67
07-May-08	National Grid Gas	Utility	A3/A-	750	3,200	5y	77
30-Apr-08	Iberdrola	Utility	A3/A-	1000/ 750	7,700	5/ 10y	83/ 110
23-Apr-08	E.ON	Utility	A2/A	1500/ 1000	11,000	5/ 12y	73/ 110
22-Apr-08	RTE	Utility	NR/AA-	1,250	2,100	7y	48
04-Mar-08	Severn Trent	Utility	A2/A	700	1,400	8y	115
18-Jan-08	EDF	Utility	Aa1/AA-	1,500	6,000	10y	70
2009							
13-Jan-09	National Grid Plc	Utility	Baa1/A-/BBB	500	2000	5y	365
16-Jan-09	EDF	Utility	Aa3	2000	7000	6y	205
	EDF	Utility	Aa3	2000	6000	12y	255
27-Jan-09	TMS Water Cayman Finance	Utility	A3/BBB+	500	1300	4y	330
03-Feb-09	RWE	Utility	A1/A	2000	9500	6y	190
	RWE	Utility	A1/A	1000	4300	12y	255
20-Mar-09	E.On	Utility	A2/A/A	750	3700	13y	155
15-Apr-09	Veolia Environnement	Utility	A3/BBB+	750		10y	330
	Veolia Environnement	Utility	A3/BBB+	1250		5y	250
06-May-09	Vattenfall	Utility	A2/A-	1350		5y	165
18-May-09	E.On	Utility	A2/A	750		2.5y	85
23-Jun-09	BEWAG	Utility	NR/NR	200		5yr	190
24-Jun-09	Gas Natural	Utility	Baa2/BBB+	2000	6000	5yr	235
24-Jun-09	Gas Natural	Utility	Baa2/BBB+	500	3000	10yr	275
01-Jul-09	ENBW	Utility	A2/A-	600	3400	30yr	215
01-Jul-09	ENBW	Utility	A2/A-	750	4500	6yr	105
07-Jul-09	EWE	Utility	A2/A-	500	5750	12yr	160
08-Jul-09	Verbund	Utility	A1/A	840	5750	10yr	130
16-Jul-09	Edison	Utility	Baa2//BBB+	700	7000	5yr	145

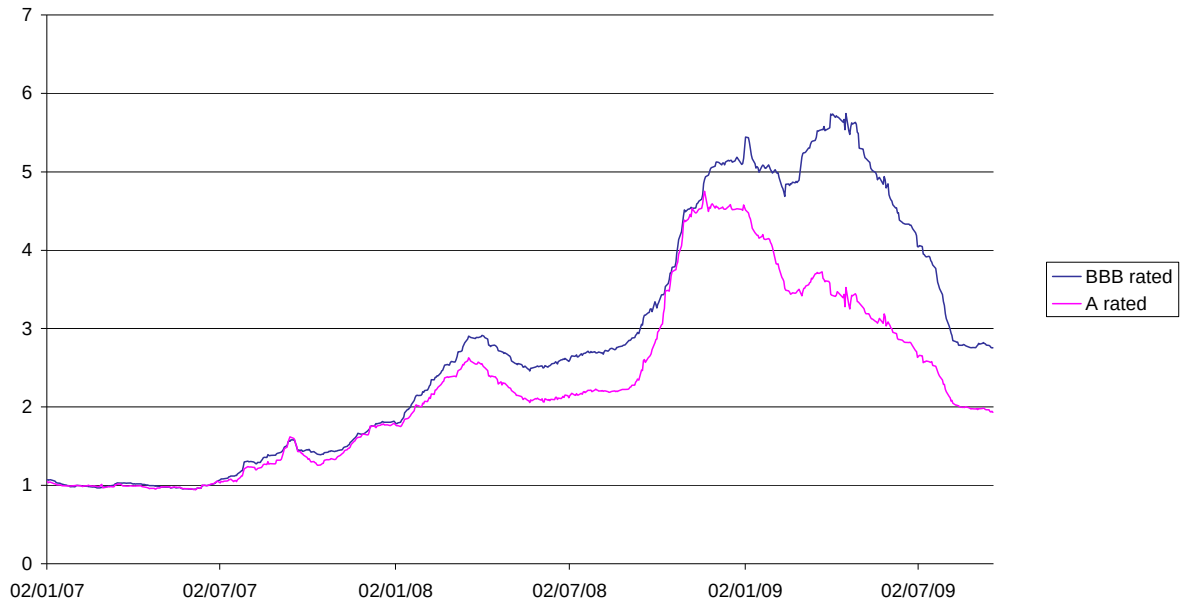
Source: Collated by Ofwat

Evidence from Wider Market Indices

6.25 As a cross-check on data for water company bonds, we have also examined yields on broader market bond indices.

6.26 Figure 6.6 shows spreads on A and BBB rated corporate bonds since January 2007. (Note that this data does not differentiate between ratings within each category i.e. the A rated bonds will include bonds rated A+, A and A-.) Spreads were around 1 per cent prior to the onset of the financial crisis, but then rose very substantially with spreads on BBB rated bonds peaking at 5.7 per cent in April 2009. Since then, spreads have fallen substantially with spreads on A rated bonds now being in the region of 2 per cent and spreads on BBB rated bonds being in the region of 2.8 per cent.

Figure 6.6: Spread data for A and BBB rated corporate bonds (non-financials) since January 2007

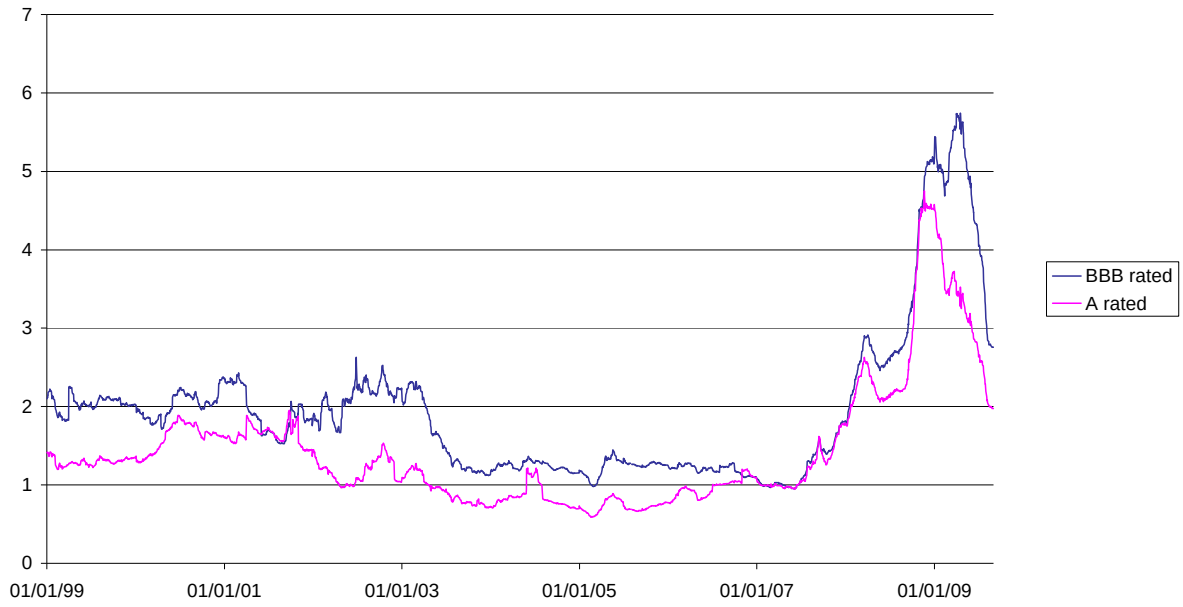


Note: data is for bonds with 7-10 year maturity issued by non-financials.

Source: Europe Economics calculations using data from iBoxx and Bloomberg

6.27 Figure 6.7 shows spread data for the same indices over a longer time period (from 1999 onwards). Broadly speaking, there appear to be three periods in the data. From 1999 to 2002, spreads on BBB rated bonds fluctuated around 2 per cent while spreads on A rated bonds averaged around 1.3 per cent. During 2003 bond spreads fell and remained at low levels from mid-2003 to mid-2007, averaging around 1.2 per cent for BBB rated bonds and 0.9 per cent for A rated bonds. However, as discussed above, from mid-2007 spreads have risen very substantially due to the financial crisis, before declining sharply in recent months.

Figure 6.7: Spread data for A and BBB rated corporate bonds since 1999



Note: data is for bonds with 7-10 year maturity issued by non-financials.

Source: Europe Economics calculations using data from iBoxx and Bloomberg

Analysis of the Impact of the Credit Crunch

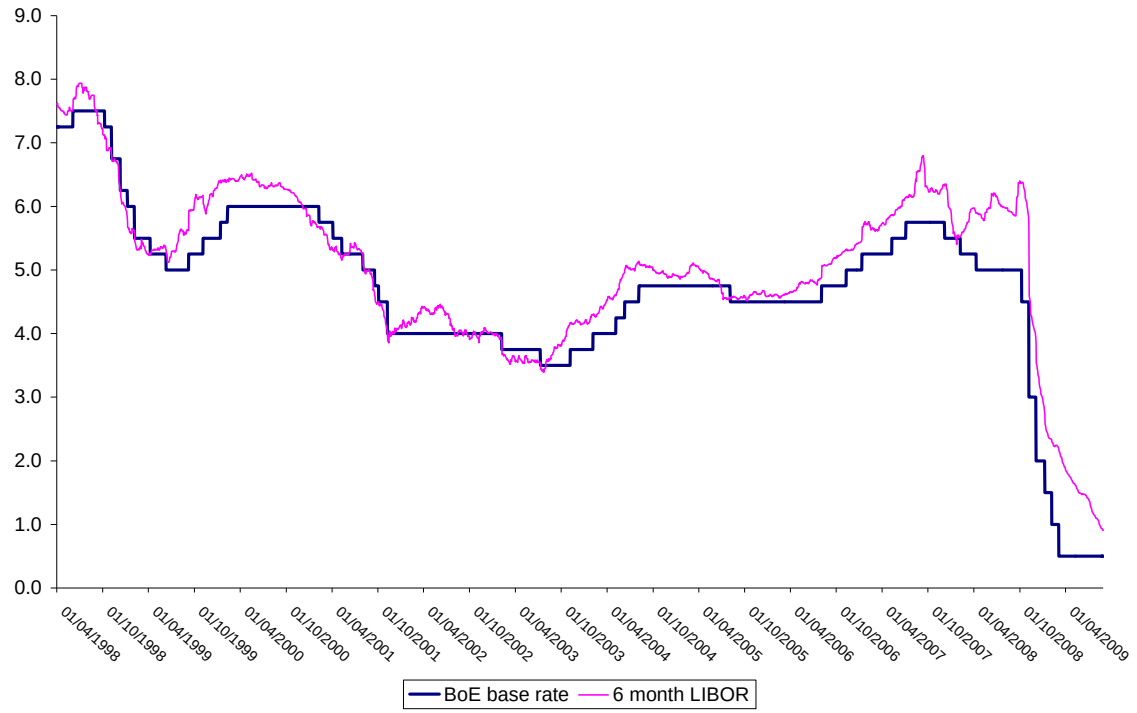
6.28 Given that current bond spreads are at historically high levels due to the "credit crunch", this sub-section addresses the questions:

(a) How long might we expect the credit crunch to last?

(b) What changes in longer term equilibria in financial markets may have been brought about by the credit crunch?

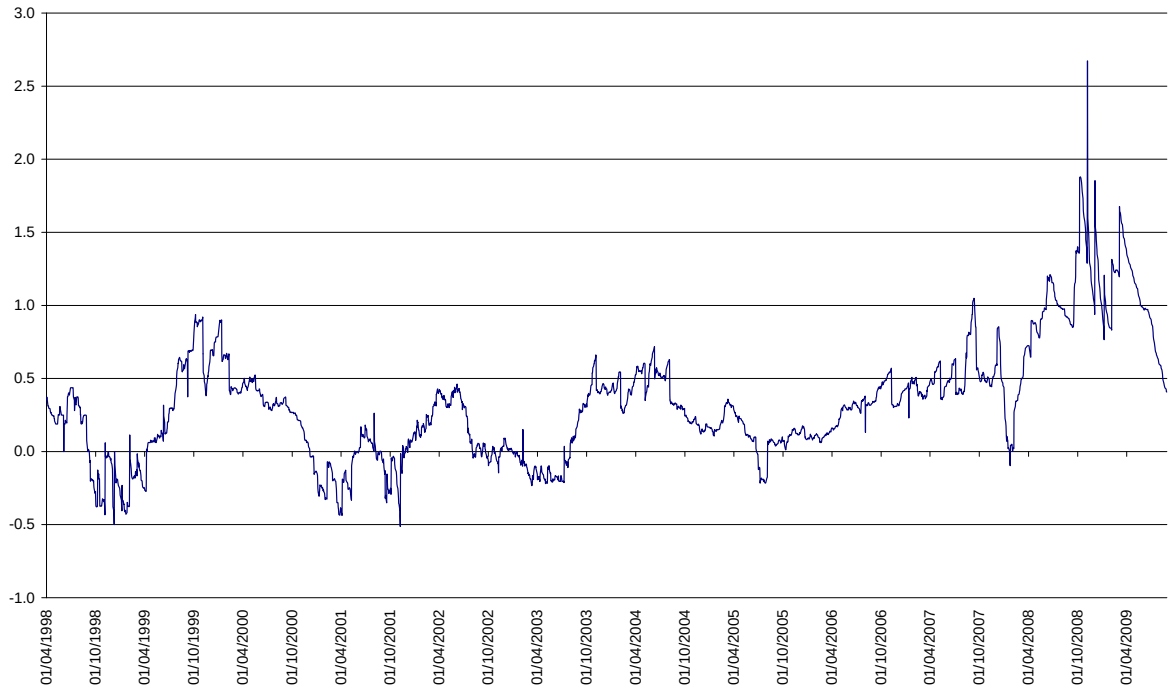
6.29 One standard way to exhibit the presence of the credit crunch is shown in the following figures:

Figure 6.8: 6 month LIBOR and the BOE base rate, 1998-2009



Source: Europe Economics elaborations on Bank of England data

Figure 6.9 LIBOR wedge, 1998-2009



Source: Europe Economics elaborations on Bank of England data.

6.30 The first graph exhibits, since 1998, the Bank of England interest rate (Bank Rate) and the rate at which banks lend to each other over six months (which in turn is the key determinant of mortgage rates). The second graph shows the evolution of the wedge between the two rates over the same time span.

6.31 It is interesting to note that the wedge sharply increased in December 2008 (reaching 2.6 per cent) and then returned to 0.5 per cent in August 2009, showing a significant easing of credit market conditions.

Implications of the credit crunch

6.32 Our view is that a significant contributor to the credit crunch was over-estimation of the degree to which risk could now be diversified away by new financial instruments (which would appear in CAPM as a lower Market Risk Premium). A number of things appear to follow:

(a) The Market Risk Premium from mid-2003 to mid 2007, and hence both the cost of equity and the cost of debt, was lower than that for earlier periods, and lower than that likely to prevail in the future.

(b) It is likely that there will be less capital available in the near future to be employed in financial market innovations. Debt funding for acquisitions is likely to become much harder to obtain.

(c) It seems likely that, by fairly early in the period 2010-2015, market conditions will have stabilised compared with their "credit crunch" level, but they are unlikely to return to their 2006 or early 2007 levels at any time during this price control period.

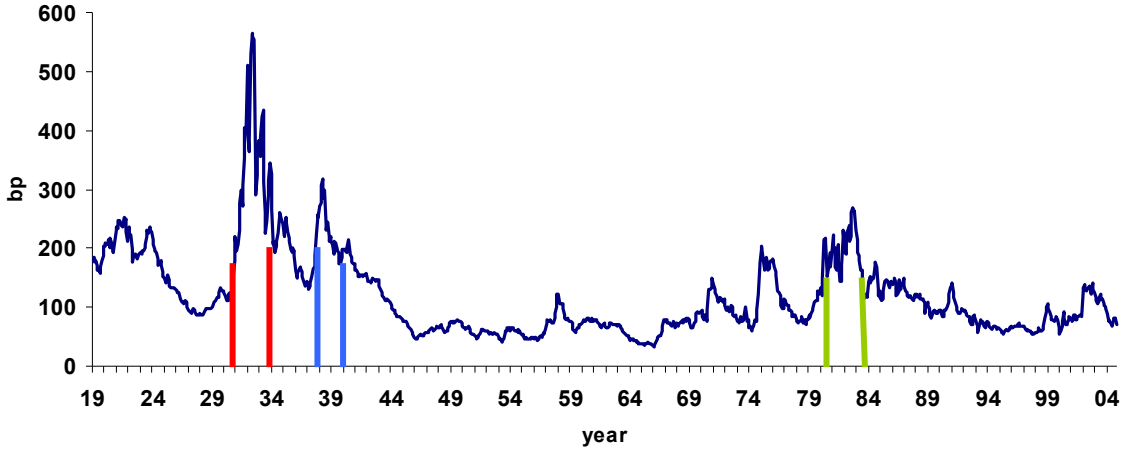
(d) Data for the entire period 2006-early 2008 should be carefully interpreted, in the light of the possible evolution of the financial crisis.

Evolution of past financial crises

6.33 To inform our analysis on the possible evolution of the current financial crisis we analyzed the path followed by corporate yields and spreads during previous episodes of financial turmoil.

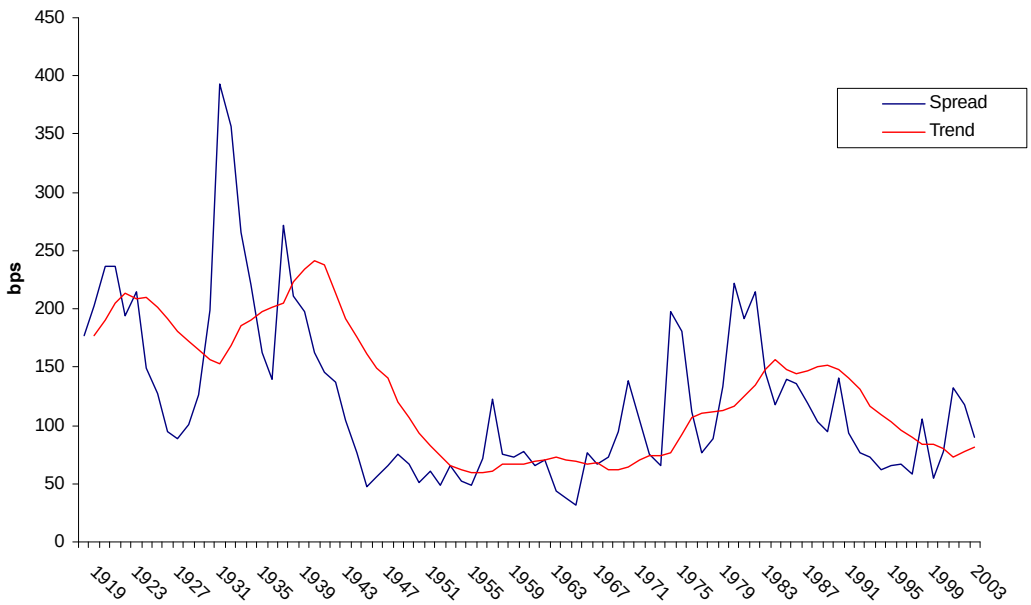
6.34 Figure 6.10 shows the historical path of the spread between US corporate Baa and Aaa bonds from 1919 to 2004 (material hikes in the spread are marked with coloured bars):

Figure 6.10: Baa-Aaa US corporate bonds spread, 1919-2004



6.35 To identify analytically periods in which the spread deviated materially from its "long-term norm" we de-trended the series using a moving average filter. The result of this exercise is reported in Figure 6.11:

Figure 6.11: De-trended series



6.36 Defining a financial turmoil as a deviation of 20 per cent or more of the spread from its trend, we find that:

(a) The longest "crisis" period lasted four years, after the 29 crash;

(b) The average duration of crisis is around two years;

(c) The average time for the spread to go back to its trend is around three years after the beginning of the crisis

(d) The average deviation after the end of the crisis, before the spread comes back to its long-term trend, is around 9 per cent.

6.37 Of course, each crisis has its own distinctive features, and it is impossible to predict robustly when the credit crunch will finish and the credit market conditions will come back to normality (whatever "normality" might constitute in this case). However if we assume the current turmoil will follow a path similar to past crisis episodes we can draw some conclusions from our historical analysis.

6.38 Considering that credit market conditions started materially tightening since June 2007, and given that this crisis has been the largest and most global for many decades, we believe it is appropriate to assumes its length at the top end — i.e. four year. So our view is that the correct assumption is that fully normal market conditions will not be re-established until 2010-2011. Hence, the tail end of the financial crisis may overlap with the early part of the forthcoming price control period.

6.39 Recent signs of easing in credit markets may suggest that this has actually been more typical in length (if not depth) to previous crises, at around two years. However, we note that the four-year crisis of the 1930s had a number of additional spikes of crisis after periods of apparent easing, and believe that it would be prudent to base the regulatory judgement this time on the assumption of a four-year crisis (i.e. that recent events are better characterised as a lull than as the end). Nonetheless, in Section 8 we also model the impact on the cost of capital of an approach that assumes the end of the crisis is now visible.

Embedded Debt Adjustments

6.40 In previous price reviews, discussion of embedded debt adjustments has related to whether there should be adjustments to the cost of capital to reflect higher-rate debt which water companies have taken out in the past. In PR99 an additional amount was allowed to companies, whereas in PR04 Ofwat reached the conclusion that this was not necessary given its assumption on the cost of debt.

6.41 In PR09 Ofwat is facing the situation that some water companies have taken out significant volumes of debt in the period up to mid-2007 at low rates. If Ofwat were to take account of this embedded debt, in line with its approach at PR 99, this may reduce price limits below what they would otherwise be. However, this is not altogether clear; it is by no means obvious that interest rates in the period 2010-2015 will be higher than those prevailing in 2006-7 when movements in gilt rates are taken into account as well as movements in corporate bonds risk premia.

6.42 In principle, a number of different approaches could be taken to the issue of embedded debt. For the purpose of analysis, three stylised approaches would be as follows:

(a) Making full allowance for embedded debt on a company-by-company basis;

(b) Applying an embedded debt adjustment based on average embedded debt costs across the industry;

(c) Making no allowance for embedded debt.

6.43 These three approaches have different properties with regard to the incentives on companies to finance themselves efficiently. The first approach can be rejected on the grounds that it would give companies little incentive to raise finance efficiently since poor financing decisions would ultimately be borne by consumers. The second of these approaches would have better incentive properties, since the adjustment would be based on the industry as a whole rather than each company's individual position. The third approach would provide the strongest incentives, since companies would bear the full costs of any inefficient financing decision which they take.

6.44 A key difference between the second and third approaches relates to who bears the risk of movements in the cost of debt for the water sector that result in embedded debt across the industry as a whole having higher or lower financing costs than current market rates. Such movements could be driven by economy-wide movements in interest rates, in which case the risk would be systematic in nature, or by industry-wide but specific risk factors (e.g. changes in the regulatory framework). In the second approach, investors are protected from such risk (across the industry as a whole) through embedded debt adjustments, meaning that the risk falls on customers. By contrast, in the third approach this risk would be borne by investors. Assuming that this risk is at least partly driven by economy-wide movements in interest rates, this implies that the water industry asset beta will tend to be higher under the third approach.

6.45 Under any of these approaches, it can be argued that Ofwat's policy on embedded debt should be symmetric in nature. In other words, if investors are compensated for high embedded debt costs when market rates fall, then customers should benefit from low embedded debt costs when market rates rise.

6.46 The key question is whether Ofwat should make any adjustment for embedded debt at PR09. As discussed above, it is possible that it would be in consumers' short term interests to reduce the estimate of the cost of debt that enters into the WACC for PR09 in recognition that some companies were able to issue bonds at what now appear to be low interest rates. But even if this is so, the proper consideration for cost of capital estimation is what rate provides proper investment incentives — if the rate is set too low, then consumers lose out in the long term. In the light of this consideration, and for the incentive reasons discussed above, we recommend that Ofwat makes no adjustment for embedded debt either at PR09 on in future price reviews.

6.47 Given Ofwat's past approach it could be argued that estimated betas for water companies are likely to be based on an investor expectation that Ofwat will continue to consider adjusting for embedded debt at PR09 and in future reviews. As mentioned earlier, a regime in which no adjustments are made for embedded debt would imply a higher asset beta for water companies, since investors would bear additional systematic risks associated with economy-wide movements in interest rates. Hence, it could in theory be argued that abandoning embedded debt adjustments may require Ofwat to use a beta above estimates based on historical data. However, it is unclear how material this effect is likely to be in practice, and given that abandoning embedded debt adjustments at PR09 may work in favour of water sector investors we have not sought to adjust our beta estimates on these grounds.

6.48 In its cost of capital report on behalf of the water sector, NERA take a weighted average of longer-term and current debt costs to inform their cost of debt assumption, with the weights determined by the industry's existing debt relative to its financing and re-financing needs over AMP5. NERA explain that this takes account of the debt that companies have raised in the past — in other words, their approach involves an adjustment for embedded debt.

6.49 We note that both our approach to cost of capital estimation and the approach put forward by NERA on behalf of the water industry involve weighting current and historic debt costs. However, whereas NERA justify placing some weight on historic data due to embedded debt, our approach to WACC estimation is justified on a forward-looking basis. That is to say, the reason we place some weight on longer-term historic averages is to inform our forward-looking estimate of what the "post crisis" cost of debt may be once the credit crunch comes to an end (which we anticipate will happen partway through AMP5). We consider that our approach represents the more satisfactory way to set the cost of capital, as it seeks to ensure the WACC gives appropriate investment incentives at the margin as well as providing the strongest possible incentives on water companies to raise finance efficiently.

Other Issues

6.50 In its report for the water industry, NERA includes an allowance of 60 basis points within its cost of debt assumption to cover pre-funding and transactions costs. This comprised 6.8 basis points for transactions costs and 53 basis points for pre-funding costs. We briefly discuss these two issues below.

Pre-funding costs

6.51 Water companies incur pre-funding costs associated with the maintenance of liquidity. It would not always be prudent for companies to wait until they actually need to spend cash (e.g. on CAPEX projects) before going to the market to raise funds, and hence companies will tend to pre-fund their requirements by raising capital in advance. This gives rise to an associated cost since companies will incur the cost of capital in raising funds, but the cash

they have raised may only be earning interest income in the time period prior to being spent.

6.52 However, we do not agree with NERA that this cost should be incorporated into the cost of debt assumption within the WACC. It is not a cost which affects the cost of raising new debt finance itself, and a crude adjustment to the cost of debt assumption may not capture very well the variation in pre-financing requirements across companies given their different cashflow situations.

6.53 Instead, we advise Ofwat that pre-funding costs should be taken into account by incorporating cash balances into its financial modelling on the basis of a reasonable liquidity policy. By taking account of the cost of raising the cash and the interest income which accrues prior to the cash being spent, the financial modelling will be able to assess more accurately the pre-financing cost allowance which is appropriate for each company.

Transactions costs

6.54 In addition to paying the coupon rate to bondholders, companies must also pay debt arrangement fees when issuing new bonds or when raising debt finance in other ways. These costs would not be captured in a debt premium based on data on bond spreads.

6.55 However, NERA's own analysis of transactions costs suggests that they are relatively modest. NERA estimate that these costs amount to 6.8 basis points, which their report notes is less than the allowance that has been given by the CC in some recent cases.

6.56 Given that we aim towards the top of the range justified by market data in arriving at our WACC estimates, we consider that this adequately allows for additional cost items such as transactions costs. Hence, we do not consider it necessary to add a separate allowance for transactions costs to our cost of debt assumption.

Conclusions on the Cost of Debt

6.57 We have reviewed a range of market data on the bond spreads, including data on nominal and real water company bonds and data relating to broader market bond indices.

6.58 Based on this evidence, our recommended cost of debt assumptions for different credit ratings are set out below in Table 6.5. The table include figures for both a "crisis cost of debt" relevant to debt finance raised during the ongoing financial crisis, and a "post-crisis cost of debt" representing our view of where the market may settle once the current constraints in credit markets ease. In both cases, the real cost of debt is calculated by adding our debt premium assumptions to our recommended risk-free rate of 1.75 (see section 2).

Table 6.5: Recommended cost of debt assumptions

Bond rating	Crisis cost of debt		Post-crisis cost of debt	
	Debt premium	Real cost of debt	Debt premium	Real cost of debt
A	2.0	3.85	1.2	2.95
A –	2.2	3.95	1.5	3.25
BBB +	2.8	4.55	2.0	3.75

6.59 The debt premia for the "crisis cost of debt" are based on current market data, drawing on evidence from spreads on water company bonds traded in the secondary market, new bond issues by utility companies in recent months, and broader market indices.

6.60 The debt premia for our post-crisis cost of debt figures contain a greater element of judgement. We have focused to a greater extent on spreads for wider bond indices to inform these assumptions. We assume that as the crisis eases, spreads will decline further from their current levels but will not return to the very low levels seen in the period between mid-2003 and mid-2007. Hence, we have assumed that historic data on spreads prior to mid-2003 provide an indication of where the market may settle.

6.61 As discussed earlier, subject to the results of Ofwat's financeability analysis, our recommended notional gearing assumption of 55 per cent appears with all water companies (WaSCs and WoCs) achieving a credit rating of A- or above. Hence, this implies that the real "crisis cost of debt" for the water industry is 3.95 per cent, and that the real "post-crisis cost of debt" is 3.25.

6.62 As shown in Figure 6.3, the current yield on selected water company index-linked bonds is around 3 per cent, although yields on these bonds have been very volatile in recent months. This is comfortably below the above assumption of 3.95 per cent for the "crisis cost of debt" — the difference being largely accounted for by the fact that our risk-free rate assumption is above market data on ILG yields. This confirms that our recommended "crisis cost of debt" should allow WaSCs to raise finance in current market conditions, even after allowing for the volatility observed in corporate bond spreads.

6.63 The relative weight which Ofwat should place on the crisis number relative to the post-crisis number in setting the overall WACC is discussed in section 7.

6.64 In relation to other issues discussed in this section:

(a) We recommend that Ofwat should not make any adjustment for embedded debt, either at PR09 or in any future price review.

(b) We advise Ofwat to take account of pre-funding costs by considering cash balances in its financial modelling.

(c) We consider that the transactions costs associated with debt finance are adequately covered by the fact that our WACC estimates aim up to the top of the range supported by market data. Hence, we do not consider it to be necessary to include a separate allowance for these costs.

7 COST OF CAPITAL FOR WOCS VS WASCS

Position on the "Small Companies Premium"

7.1 Previous price reviews have made allowance for a "small companies' premium" that in practice was to the benefit of water only companies. This was despite the fact that at PR04 Ofwat had stated that there was "very little evidence that investors differentiate between the water and sewerage companies in terms of required returns" and that even in the case of the cost of debt there was "little evidence for any premium on interest rates for the largest water only companies".

7.2 There has long been a claim that a weakness of CAPM is its not recognizing higher financing costs for smaller firms. Indeed, this "weakness" goes much further than merely CAPM. Modern corporate finance theory as a whole treats firms as bundles of projects, where each project has its own cost of capital. The firm's "cost of capital" is a mere averaging of the costs of capital of the projects of which it comprises. This cost of capital, as explained earlier in the description of CAPM, reflects the degree to which volatility in real cash flows associated with individual investment projects cannot be diversified away. Diversification is done by investors, not by firms. An implication is, for example, that pure "conglomerate mergers", in which firms of different sorts merge without thereby achieving cost efficiencies at the operational level, cannot increase the value of firms but might decrease that value. Consequently, the size of firms, per se, is totally irrelevant to their cost of capital (though it might, of course, be relevant to overall firm value if there are business synergies, economies of scale, or competition effects).

7.3 This is an important point — the absence of a small companies' premium is not simply a feature of the CAPM model. It is a reflection of modern corporate finance theory as a whole and the acceptance of a small companies' premium is, in that theoretical sense, virtually indefensible.

The rise and fall of the "small firm effect"

7.4 Nonetheless, the idea that there is a cost premium for small companies had a period of rise and fall in popularity amongst academics and practitioners. This was largely due to the statistical results, in a famous study by Rolf Banz in 1981 and early versions of the Fama-French model, that there was a "small firm effect" — i.e. that small companies delivered higher returns, on average, than did larger companies.

7.5 From 1926-2008, 1926 the (arithmetic) average annual difference between returns on the shares with the smallest market capitalisations and those with the largest such capitalisations was 3.54 per cent (the geometric average difference was 2.6 per cent). The "small-to-big" factor appeared in the Fama-French three-factor model (along with the Fama-French version of beta and a book-value-to-market-value factor). The popularity of the Fama-French model and the apparent significance of this small company premium led to a wide-spread sense that this was an important anomaly in respect of CAPM that might

necessitate some adjustment in a number of settings — perhaps even in regulatory determinations.

7.6 For the period 1981-2008, however, there appears to be no small companies premium — it seems to have disappeared as soon as it was discovered (for the period 1981-2007, the geometric average annual small company effect was 0.08 per cent); indeed during the 1990s there was a "small companies discount" (geometric average: -2.1 per cent).[59] The current state of play is that there is very widespread doubt as to whether such an effect exists at all.[60]

Explanations of a Small Firm Effect

7.7 If there is indeed a small companies effect, there are several candidate explanations, including:

(a) That this is a deviation from the CAPM model — that small firms are in some way more risky than large firms in a way not captured within CAPM.

(b) That the effect is driven by a greater survivorship bias for small firms.

(c) That this is an instance of collective data mining — that, having noticed a purely statistical anomaly in one dataset, researchers keen to achieve publication then sought to find similar relationships in other datasets.

(d) That this was a temporary deviation from the Efficient Markets Hypothesis, in that there was a tendency for small firms to be under-priced, but that once the deviation was pointed out through publication, it corrected itself as expected, as agents tried to make use of it. This would then be an instance of the principle that no known deviation from the efficient markets hypothesis could be used to make money. (The clear consequence would be that no such anomaly should ever be used in regulatory determination.)

(e) That this was a permanent deviation from the assumptions of the Efficient Markets Hypothesis in that there are non-trivial transactions costs in financial markets — e.g. fixed costs of flotation — that fall more heavily upon small firms than large.

(f) Investors require a premium for holding shares in companies whose shares have a low trading frequency, to compensate them for the fact that they can less easily sell the shares when they wish to do so. In other words, there may be a liquidity premium for equity in small companies.

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59 Source: Europe Economics calculcations on Kenneth French's dataset http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

60 See for example Fama and French, 2004, "The Value Premium and the CAPM", Chicago Graduate Business School.

If it existed, why has it disappeared?

7.8 If one of these explanations were accepted, there would then be a number of candidate explanations for why it has now disappeared:

(a) Small companies are indeed inherently more risky in some way not reflected in CAPM — so necessitating the small company premium — but the 1990s on has been one of those periods of relatively worse returns for smaller companies. This is supported by empirical evidence on UK, where the dividend performance of small companies was superior to that of larger companies until the end of 1980s and inferior thereafter.

(b) Small companies are subject to greater governance risks. The idea here is that governance differences between small and large companies may have become more marked during the 1990s than in previous decades. This meant that small company returns suffered in this period.

(c) The expansion in the number of available assets has created a number of alternative "competitors" (such as derivatives) to small companies as a means to achieve portfolio diversification.

(d) The huge adjustments in large listed firms during 2001 and 2002 (e.g. Enron) make updating the increased risk of larger firms necessary. Hence the small company premium would be re-confirmed by an analysis based on a larger horizon.

(e) Considering that small companies have limited access to bond markets, directly comparative analysis with larger quoted firms may be flawed.

(f) A small number of out-performers significantly biased the small company premium. Separating in the sample the rapidly rising firm the other more static small firms might confirm CAPM predictions.

Practical issues in the water sector

7.9 It is difficult to see how the impact of illiquidity in the trading of equity in smaller companies can continue to be relevant for most of the WoCs. Dee Valley is still listed, and evidence presented by NERA evidence suggests that Bournemouth and West Hampshire Water forms a significant proportion of Cascal (listed on the New York Stock Exchange) and that South East Water forms a significant proportion of the listed equity value of Hastings. However, all of the other WoCs are either unlisted or listed as part of much larger groups.

7.10 It could be argued that price controls should be set so as to allow water undertakers to be listed as independent companies so that there are no restrictions on the ownership arrangements which can be put in place in the future. On the other hand, it is not obvious why price limits should be set so as to facilitate independently-listed WoCs if this is not the most efficient ownership arrangement.

7.11 Another relevant issue in this context is the use made by WoCs (in particular by small to medium players) of Artesian debt, as a significant (in some cases the only) source of debt, which now looks relatively expensive compared to debt refinanced by other larger companies.

7.12 Bristol Water stated[61] that: "In May 2003 we finalised new financing arrangements. Prior to the refinancing, we had a relatively short debt maturity profile and the new structure provides a better mix and a considerably longer maturity profile appropriate to the long-term nature of the assets being financed. The new facilities provided for the repayment of £20m of existing bank debt and the financing of the ongoing capital expenditure programme. £15m of index-linked debt was drawn through the existing Artesian Finance plc monoline wrapped bond programme arranged by the Royal Bank of Scotland, previously used by three other water companies. An equivalent £30m financing was also drawn on a fixed interest basis through a new bond programme issued by Artesian Finance ll plc. The facilities extend to 2032 and 2033 respectively."

7.13 The issue can be seen as a problem of embedded debt (see Section 6 for a discussion of embedded debt allowance) or as a factor impacting on the systematic risk for small WoCs. If Ofwat did not allow for this kind of debt as embedded on the grounds that WoCs should seek more diversified sources of finance, it might seem necessary to allow a premium based on higher transaction costs.

7.14 Tendring Hundred Water (THD)[62] adds: ""THD would be deeply concerned if the small company premium was dropped. We believe that the special factors existing at AMP4 such as higher interest costs on new debt finance and higher insurance costs on new debt and equity are unchanged and still exist today. The cheap finance bond market is now closed and finance such as the RBS Artesian Finance bond is now unavailable"

Our view

7.15 Few, if any, of these explanations seems particularly compelling. As matters stand, there is scant evidence that there is any small companies premium to explain. The most theoretically defensible position is that relating to semi-fixed flotation and bond-issuance costs, and the deviation from the efficient markets hypothesis that this implies. But this raises the question as to how small companies have to be for such semi-fixed costs to become significant. Companies of tens or hundreds of millions of pounds in value are not obviously small for the purposes of flotation and bonds issuance costs, and we have not been convinced by the evidence WoCs have offered on this issue.

7.16 Otherwise, to defend the use small companies effects for firms on this scale, one must appeal to results such as that of Fama and French or to the use of a liquidity premium.[63]

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61 "Overview of the June Return 2004", Bristol Water.
62 "Response to Ofwat Consultation. Setting the Price Limits for 2010-2015:Framework and Approach", Tendring Hundred Water, p.7.
63 In the Fama-French dataset for 2007, the smallest five per cent of "small" firms have market capitalisation below $184m.

However, the principal approach taken in this review is CAPM and in any event, as noted, the Fama-French small companies' effect is now nugatory and perhaps even negative.

7.17 To summarize, our view is that the use of a small companies premium is incompatible with the broad thrust of modern corporate finance theory (going much broader than simply the CAPM model), and doubly so in the context of a review based on CAPM (in which issues such as liquidity premia do not arise), and does not have any good statistical support either. Thus we would strongly recommend against the use of a small companies premium.

Differences in Systematic Risk Exposure

7.18 A firm is a bundle of projects. Thus, even the use of a regulatory cost of capital at an individual firm level represents a compromise between precision in incentives and the feasibility and cost of accurate regulatory determination of the cost of capital. As explained in previous sections, measurement and other uncertainties mean that in the water sector it is useful to set a common cost of capital across a number of companies — the gains in accuracy of estimation through aggregation tend to outweigh the losses in terms of reflecting small differences in individual company circumstances.

7.19 Nonetheless, recent regulatory determinations across a number of sectors have come to recognise that there may be natural points of cleavage, either between businesses or within business entities, whereby there is sufficient and sufficiently clear difference in the nature of businesses and in their exposure to systematic risk that it is appropriate to set different costs of capital. Examples of this include the different costs of capital for the copper business of BT and the rest, and the different cost of capital assessed for Heathrow from that for other London Airports.

7.20 In the current regulatory review, the most natural candidate for such a cleavage is water only versus water and sewerage businesses. NERA, for example, in its report for the water only companies[64], asserts that water and sewerage companies have approximately a 60/40 split between sewerage and water businesses.

7.21 If it could be shown either (a) that there were strong a priori/analytical reasons to believe that sewerage businesses are different in nature in ways likely to make them subject to different systematic risks from water businesses; or (b) that there were robust statistical reasons to believe that water only companies differ from water and sewerage companies in their systematic risk exposure, that would be a good ground for allowing a different cost of capital for the two different kinds of business.

[64] NERA, March 2009

A priori/analytical reasons for viewing water and sewerage businesses as subject to differing systematic risks

7.22 We sought advice from Ofwat concerning the nature of exposure of the water business and the sewerage business to demand and cost risks.

Demand

7.23 Ofwat believes that for a given level of meter penetration, WaSC revenues may fluctuate less because there are more non-volume-related charges on the wastewater side. However, the revenue correction mechanism will protect companies in present value neutral terms from falls in revenue relative to PR09 assumptions.

7.24 WoCs have generally appeared to have less of a problem (when normalised by turnover or customer numbers) with bad debt. However, Ofwat's view is that this is not related to any differences in attitudes to water and sewerage — any difference in willingess to pay, for example.

7.25 It is possible that there is some difference between WoCs and WaSCs in terms of their exposure to large user demand. However, whereas overall exposure to industrial large user demand is linked to macroeconomic factors and hence gives rise to systematic risk, whether or not this exposure is "lumpy" (i.e. concentrated on a small number of customers) is a diversifiable risk from the perspective of investors. The greater exposure WaSCs have to industrial large user demand may be a relevant consideration, but is likely to be offset by differences between WoC and WaSC profit volatility in the face of shocks.

Cost

7.26 For capex, some companies suggested to Ofwat that capex input price volatility was an important beta risk. Ofwat's analysis of capex to turnover for the period 2003-04 to 2007-08 shows a difference between the WoCs and the WaSCs with the WoCs appearing to present lower exposure to risk (WoC average around 43 per cent, WaSC average around 50 per cent).

Conclusion

7.27 The a priori analysis suggests that there may be some limited reason to expect that water and sewerage companies are subject to higher systematic risk than water only companies. If borne out by statistical evidence, this might be sufficient to imply a lower cost of capital for water only companies. However, we do not regard the analytical basis for this as strong, and do not believe that it would be adequate to assign a lower cost of capital to water only companies in the absence of further statistical support.

Equity beta evidence

7.28 As noted in our equity beta analysis the only listed company WoC at the moment is Dee Valley (Bristol Water was de-listed in November 2003 and East Surrey on 15 October 2005).

7.29 We sourced beta estimates from Bloomberg (corrected with the Blume adjustment and based on monthly data[65]) to compare different companies' betas (the main measure of exposition to systematic risk) on the last point in time when all the WoCs were all listed. Results as of November 2003 (both raw and de-leveraged betas) are reported in the Table below:

Table 7.1: WoCs and WaSCs betas

	Beta	Gearing as of 2003	Asset beta, debt beta =0	Asset beta debt beta =0.1
United Utilities	0.45	0.53	0.21	0.26
Severn Trent	0.40	0.48	0.20	0.25
Pennon	0.19	0.54	0.08	0.14
Kelda	0.38	0.39	0.22	0.26
Dee Valley	0.21	0.50	0.10	0.15
East Surrey	0.48	0.51	0.23	0.28
Bristol Water	0.40	0.67	0.13	0.19

Source: Europe Economics elaborations on Bloomberg data

7.30 The average beta in 2003 was 0.49 for WaSCS and 0.56 for WoCs. *The hypothesis that the two coefficients are equal is accepted at the 95 per cent level of confidence*.

7.31 De-leveraging beta estimates to obtain asset betas does not seem the change the picture: the average de-leveraged beta for WoCs is 0.16 compared to an average value of 0.18 for WaSCs.

7.32 We report below the path over time of equity betas as sourced from LBS: the evidence for the only listed WoC (data are available from 2006 when Bristol Water and east Surrey were already delisted) does not support the idea of an material difference in equity beta between WaSCs and WoCs: indeed Dee Valley's equity beta estimate lies in the lower bound of our industry portfolio estimated beta.[66]

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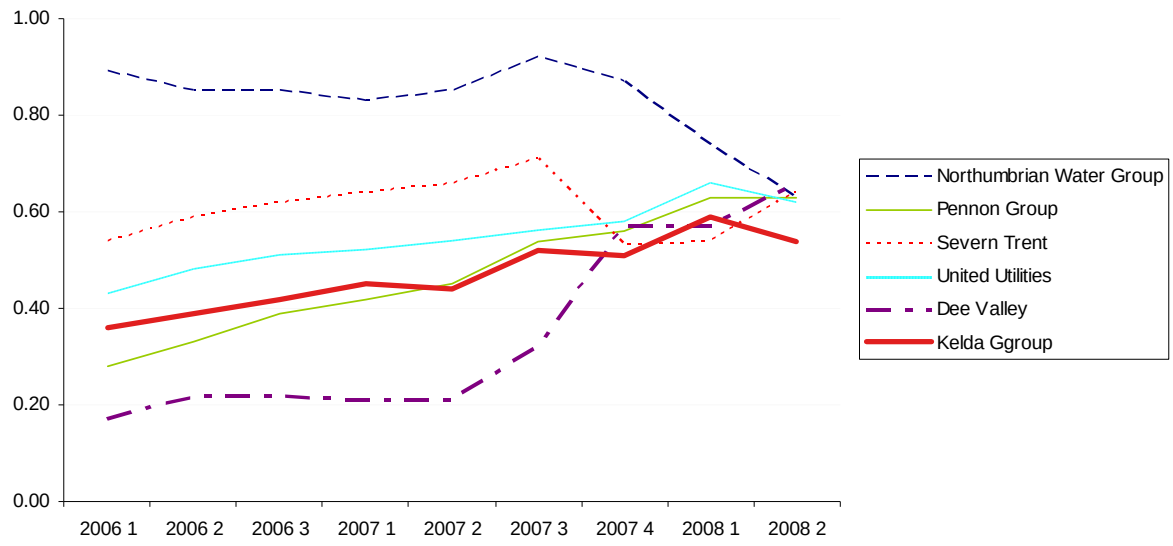
65 Estimates based on weekly or daily data were not statistically significant.

66 We note that the MARs evidence shows Dee Valley trading at a considerable premium relative to listed WaSCs. This is compatible with the idea that, as a recipient of a small companies premium to its cost of capital allowance, Dee Valley's position is privileged relative to WaSCs. However, though compatible with this result, such analysis is of course by no means conclusive — there could be many other reasons for Dee Valley's higher valuation (e.g. excellent management performance) and though we note this result for completeness, we place no material weight upon it in our analysis.

Figure 7.1: LBS betas over time



7.33 In conclusion, there does not appear to be statistical evidence, arising from beta analysis, of any significant difference between WoCs and WaSCs in their exposure to systematic risks.

7.34 However, if there were no difference on the cost of equity side, but there were material differences in the cost of debt, that might yet imply a difference in the overall cost of capital.

Cost of debt evidence

7.35 In its report for WoCs, NERA presents evidence suggesting that WoCs have a higher cost of debt than WaSCs. It states that this arises because WoCs do not have access to the same types of funding as WaSCs due to their smaller size.

7.36 In corporate finance theory, only systematic risks should affect the cost of capital. The question therefore arises, can NERA's evidence on the cost of debt for WoCs be reconciled to the above finding that there is no evidence of a difference in systematic risk between WoCs and WaSCs?

7.37 In interpreting NERA's evidence, it is important to distinguish between *promised* returns (e.g. the observed yield on bonds or the rate of interest charged by banks) and *expected* returns to providers of debt. If the risk of bankruptcy is higher for WoCs due to higher specific risks (which should not affect the cost of capital), then *expected* returns after adjusting for default risk may be identical for WoCs and WaSCs even though *promised* returns are different.

7.38 It is quite plausible that WoCs do in fact have a higher probability of default due to higher specific risks. Some of the risks that NERA mentions in its report — such as the fact that

WoCs have a smaller basket of investment projects and hence are more exposed if one of them goes wrong — relate to risks which are clearly diversifiable by investors.

7.39 Under CAPM, it is the expected return which needs to be equal to or greater than the cost of capital in order to persuade investors to finance a project. Hence, if Ofwat were to set the regulatory WACC at the true underlying cost of capital then it would set the cost of debt on the basis of evidence on expected returns to debt providers (i.e. adjusting promised returns downwards to take account of default risk). This would reduce the cost of debt assumption in the WACC calculation, as well as potentially removing the rationale for setting a different cost of debt for WoCs and WaSCs. (If data suggested that the cost of debt remained higher for WoCs even after removing the default risk premium and adjusting for any differences in gearing, then this would tend to indicate that WoCs have higher systematic risk exposure such that debt providers do actually require higher expected returns and not just higher promised returns.)

7.40 However, removing the default risk premium from observed yields on bonds would be controversial because regulators have not typically made such an adjustment in the past. There is an interesting and complex discussion to be had as to whether an adjustment of this nature is theoretically appropriate. But be that discussion concluded as it may, in the current climate in which financing costs are a key cause for concern among stakeholders, we consider it would be ill-advised for Ofwat to adopt such an adjustment given that it is not likely to be widely understood and it may undermine investor confidence in the sector.

7.41 In the light of this, it could be argued that WoCs require a higher cost of debt because, due to higher specific risks, a higher default premium is incorporated into their cost of debt. A practical way of incorporating this into the determination of the WACC would be through assuming a different bond rating for WoCs compared to WaSCs.

7.42 As discussed in Section 5, rating agencies appear to require better financial ratios (including lower gearing) from WoCs in order for them to achieve the same credit rating as WaSCs. In assessing credit-worthiness, credit rating agencies take account of all risks which may affect the probability of default (i.e. both specific and systematic), and hence this is in no way inconsistent with the above discussion which finds no evidence that WoCs have higher systematic risk exposure. As we explain in section 5, our recommended gearing level of 55 per cent (which we propose should apply to both WaSCs and WoCs) would allow WoCs to achieve a credit rating of A- and would potentially allow WaSCs to achieve an even stronger credit rating.

7.43 Given the above, one possible way of reflecting differences in specific risks affecting default premia would be to give WoCs a cost of debt consistent with a credit rating of A- but to use a cost of debt figure consistent with a stronger credit rating for WaSCs. However, this could be seen as unsatisfactory, as it would give a different regulatory WACC to WaSCs and WoCs based on specific risks despite the fact that in corporate finance theory only systematic risks should affect the cost of capital.

7.44 In the light of this, we propose to use a cost of debt assumption based on an A- rating for both WoCs and WaSCs. Given that at our recommended notional gearing level of 55 per cent all water companies should be able to maintain this credit rating (and some companies may be able to achieve a stronger rating), we consider that this should allow WoCs to raise the debt finance which they require.

Conclusion on cost of capital for WoCs vs WaSCs

7.45 Our recommendation is that Ofwat should apply the same cost of capital to WaSCs and WoCs during AMP5. This is based on a number of considerations:

(a) Corporate finance theory does not support a premium on the cost of capital for small companies *per se*;

(b) There is no convincing evidence that WoCs are exposed to greater systematic risk than WaSCs — the *a priori* evidence appears to point in the other direction and analysis of equity betas is inconclusive;

(c) Although an argument could be put forward for a higher cost of debt for WoCs based on higher specific risks being reflected in a higher default premia, this is unsatisfactory given that specific risks do not affect the underlying cost of capital. Instead, we have chosen a combination of gearing, target credit rating and cost of debt which we think will allow all water companies (WaSCs and WoCs) to raise debt finance, and which may allow those companies able to achieve a credit rating above A- to out-perform Ofwat's cost of debt assumption.

8 ESTIMATE OF THE OVERALL COST OF CAPITAL CALCULATED USING THE CAPM-WACC FRAMEWORK

8.1 This section pulls together the conclusions on individual WACC parameters set out in previous sections and presents our conclusions on the overall WACC which Ofwat should allow for PR09.

Weighting the Crisis and Post-Crisis Figures

8.2 As explained in the introduction, we have taken account of the financial crisis in our analysis by deriving two WACC figures: a "crisis WACC" based on current market data and a "post crisis WACC" representing our best view on where the market may settle once current constraints in capital markets ease.

8.3 In order to derive an overall WACC figure for AMP5, we need to weight the crisis and post crisis WACCs. In order to inform this weighting exercise, we have considered how long the financial crisis might be expected to last and the possible profile of the water industry's capital raising requirements over AMP5. Clearly, the duration of the financial crisis is a matter of great uncertainty, and hence we have adopted a conservative approach in carrying out this exercise (i.e. one which we consider errs on the side of over-weighting the "crisis WACC").

8.4 With regard to the duration of the crisis, we considered in section 6 how long crises have typically lasted in the past. Reviewing data over the period 1919-2004, we found that the longest crisis during this period (defined in terms of the deviation of bond spreads from their trend) lasted 4 years. Given that the current crisis began in summer 2007, we might conservatively allow for the crisis to last for four years until summer 2011 — which would be one and a quarter years into AMP5.

8.5 We note that corporate bond spreads have declined in recent months, suggesting that the crisis may already be easing. As discussed in Section 6, we have taken this into account by revising downwards our estimate of the "crisis" debt premium compared with the figure we provisionally recommended to Ofwat in our July 2009 report.[67] However, we think it is too early to conclude that the crisis is over, since it is possible that the current decline in bond spreads may simply represent a temporary lull. Hence, we have continued to make use of an estimated "crisis WACC" and "post-crisis WACC" in our final recommendations.

8.6 With regard to the profile of the industry's capital-raising requirements, we present below a simple calculation based on the assumption that the industry's cash requirements are spread evenly throughout AMP5. In calculating the weight to place on the crisis WACC, it is important to take account of the industry's pre-financing requirements — that is, the fact that companies will prudently seek to raise capital in advance of when they actually need

[67] Note that our July 2009 report was based on market data up to the end of March 2009.

to spend the cash. In this calculation, we allow for capital requirements to be pre-funded on a 12 months rolling basis, which we understand to be a generous allowance for a conventionally financed water company. Assuming the crisis has ended by summer 2011, this would mean that all of the capital required up to summer 2012 may have to be raised within the crisis period — equating to all of the capital required in 2010/11 and 2011/12 and a quarter of that required for 2012/13. As shown below, this yields a weight of 45 per cent for the crisis WACC.

Table 8.1: Simple calculation of weight on crisis WACC

	2010/11	2011/12	2012/13	2013/14	2014/15	Total
Assumed profile of capital requirements (on just in time basis)	20%	20%	20%	20%	20%	100%
Allocated to crisis (after taking account of pre-funding requirements)	20%	20%	5%	0%	0%	45%

8.7 Clearly, the above calculation is based on a very simplistic assumption about the profile of companies' capital requirements. We have cross-checked the answer using more detailed numbers sourced from companies' final business plan submissions and we find that that alternative suggests a slightly lower weight on the crisis WACC. While the profile of capital requirements associated with Ofwat's final determinations may be different, we consider that this provides some confirmation that a figure of 45 per cent places sufficient weight on the crisis WACC.

Asymmetry of Consequences

8.8 Reaching a judgement on the likely "true" value of the water industry's cost of capital over the period 2010-15 is inherently subject to uncertainty. In the light of this, it is important to consider how this uncertainty itself should be taken into account. In particular, what would be the consequences of either over-estimating or under-estimating the WACC?

8.9 The consequence of setting the regulatory WACC higher than the market cost of capital is that investors will receive a windfall gain at the expense of water customers, who will pay more than necessary for their water.[68] In the current economic circumstances, the impact of this on some water customers in both the domestic and non-domestic sectors may be particularly undesirable. Indeed, any perception that the cost of capital has been set too high is likely to be politically controversial in the current economic environment.

[68] This assumes that all other elements of the price control have been set at an appropriate level. In practice, it is of course possible that errors in setting one part of the price control may be offset by errors in the opposite direction made elsewhere in the regulatory settlement.

8.10 On the other hand, the consequence of setting the regulatory WACC lower than the market cost of capital may also be serious. In particular, at the margin the return that companies make on new investment projects may not be sufficient to cover the cost of raising finance, thus reducing incentives for water companies to invest. The impact of this on customers would be mitigated by the fact that companies might have to invest anyway in order to meet licence conditions. However, if under-estimation of the WACC was serious companies could face difficulties raising the finance which they need, both in debt and equity markets.

8.11 In addition, the setting of too low a WACC might have the result that any new innovations that required investment would be under-rewarded, thereby reducing the incentive to engage in such investments. That might imply customers foregoing the gains, in later years, of new cost-reducing technologies or new ways to pay bills (say). Work by J.A. Hausman and others suggests that the consumer welfare losses from innovation foregone as a result of regulation can be quite large.[69]

8.12 Furthermore, we understand that Ofwat is likely to rely on the assumption of new equity formation to deal with any financeability issues. If water companies were unable to raise new equity due to the WACC being set too low, this could leave some companies facing difficulties in maintaining appropriate financial ratios and credit ratings.

8.13 While customers might benefit from lower bills in the short run if the WACC is set too low, ultimately they would be expected to suffer in the long run if investment in the water sector does not go ahead. Such negative consequences could potentially last for years into the future.

8.14 Hence, while there are serious consequences from both over-estimation and under-estimation of the cost of capital, we consider that on balance the long-term consequences of under-estimation are more serious. This implies that, once one has formed a view about the "true" value of the WACC or its components, one should aim up to take account of the asymmetry of consequences from getting the decision wrong.

Aiming up on components versus aiming up on the overall result

8.15 The next question is whether the aiming up judgement to reflect asymmetry of error is best exercised on individual components of the WACC — the beta, the risk-free rate, the MRP, the debt premium, the gearing — or only on the overall answer.

8.16 The clear advantage of the latter approach is that it is to the final answer that the issue of asymmetry applies. If the beta is a bit low and the risk-free rate rather high and the ERP about right and so on, but the overall WACC is precisely correct, then it didn't matter that

[69] See, for example, Hausman, Jerry A., "Valuing the Effect of Regulation on New Services in Telecommunications," *Brookings Papers on Economic Activity*, Microeconomics 1997, pp. 1-54

the beta was low. The beta in and of itself is only a calculating device — it is the WACC that enters the price control.

8.17 Further, if we aim up on each of the individual components, we can only guarantee that the overall result on the WACC aims up enough-but-not-too-much by taking account of the degree to which the final answer is raised. But then we might as well have simply worked straight off the overall WACC.

8.18 On the other hand, there are some potential advantages in aiming up on individual components. First, it is possible that the degree of uncertainty differs considerably between components, and estimates of individual components take into account the conclusions of other regulators. Appropriate confidence in regulatory precedent (and hence reduced regulatory risk) might potentially be better served by adjustments to specific components. However, this argument presents a danger that one mixes up the issues of asymmetry in the probability distribution of ranges for components with the overall argument for aiming up. The deliberate aiming up we have in mind is not that intended to address asymmetry in probability distributions.

8.19 It is also possible that regulatory estimates of individual components of the cost of capital serve as market focal points or other mechanisms that guide expectations in respect of particular elements of the cost of capital. For example, the cost of equity, *per se*, does not enter the price control. But the regulator's estimate of the cost of equity might affect expectations for investors and firms when companies seek to raise equity capital or consider their dividend policies.

8.20 Our recommendation in previous reviews has been that the deliberate aiming up judgement should be exercised only on the overall WACC. However, on this occasion, given the significance of new equity issuance, we propose to present our judgement on aiming up in a number of stages:

(a) First, we calculate an overall WACC without aiming up.

(b) Second, we determine a degree of aiming up for the overall WACC.

(c) Third, we calculate the cost of equity that the overall figure plus aiming up might imply, assuming the estimatewhole of the aiming up is applied to the cost of equity (since it is equity holders who will gain from the aiming up if the true cost of debt is at the level we have assumed in the first step).

Factors affecting the degree of aiming up which is appropriate

8.21 This leads to the question of by how much one should aim up. This depends on at least two factors:

(a) First, the extent to which the consequences of setting the WACC too high or too low are asymmetric. As discussed above, we consider that there are serious

consequences from both over- and under-estimation, but on balance we consider the consequences of the latter to be more serious in the long run.

(b) Second, the degree of uncertainty which surrounds one's best view of the "true" value of the WACC. The more uncertainty which surrounds estimation, the more one should aim up by to avoid the potentially serious consequences of underestimation.

8.22 In the current financial turmoil, there is a very high degree of uncertainty about the true value of the WACC over the period 2010-2015. Both the cost of debt and (if one accepts certain arguments being made about the forward-looking ERP) the cost of equity are currently at historically high levels due to current constraints in capital markets. However, analysis of how long such periods of turmoil have lasted historically suggests that the current constraints are likely to to have eased by part-way through AMP5, if not before. Hence, there is a high degree of uncertainty about the financing costs which companies will face in AMP5, which is reflected in uncertainty about the relative weight which Ofwat should place on current spot market data relative to longer-term historical norms. This high degree of uncertainty implies that it may be appropriate to aim up by a fairly significant amount above one's best estimate of the "true" underlying WACC for water companies during AMP5.

Derivation of percentage mark-up

8.23 In the discussion which follows, we explain how we have derived a percentage figure which we use to aim up on our underlying cost of capital estimate.

8.24 Before beginning, note that the above discussion of asymmetric consequences does not mean that it is necessary to be *certain* that the estimate is not too low — given that estimates of each WACC parameter are subject to significant uncertainty this might require such a high mark-up that it would not be consumers' interests.

8.25 We begin by explaining the approach taken to the issue by the CC in the London airports price control review.

The CC's approach

8.26 In its advice on the London airports price control, the Competition Commission aims up a number of estimated parameters in the WACC calculation (such as the equity beta) basically by considering the 95 per cent confidence interval on the ground that if the true mean return is constant, then approximately a 95 per cent chance that the true mean lies between two standard deviations plus/minus the mean.[70]

[70] See for example: Competition Commision (2007), "BAA Ltd — A report on the economic regulation of the London airports companies (Heathrow Airport Ltd and Gatwick Airport Ltd)", Appendix paragraph 154,

8.27 The confidence interval tells that when repeating infinite times the true parameter's mean lies within two standard deviations of the mean with 95 per cent probability. When aiming up WACC estimates using such an approach the risk of aiming up too much, taking the upper end of the range, becomes a certainty (95 per cent probability). Or to matters another way, it becomes *statistically certain* that the WACC resulting from such an aiming up is not too low — which, as we have seen, is not the goal of aiming up.

8.28 Instead taking for example a narrower confidence interval (for example a 66 per cent level of confidence — one standard deviation) allows a more balanced trade-off between the risk of aiming up too much and the risk of picking up a too low value.

Our approach

8.29 There follows our estimates of the 66 per cent confidence interval for each of the key parameters, which we then draw together below.

Risk Free Rate[71]

	Estimate	**Estimated Standard error**	**[66% Conf. Interval]**	
RFR	1.75%	0.30	1.49%	2.01%

Equity beta[72]

	Estimate	**Estimated Standard error**	**[66% Conf. Interval]**	
Beta	0.65	0.05	0.61	0.69

[71] Steps: 1) subtract the trend from the raw time series in order to have a constant mean 2) take the 90 per cent confidence interval

[72] Portfolio as of 31/03/09, 2 years daily data, t used=1.60

Debt premium[73]

	Estimate	Estimated Standard error	[66% Conf. Interval]	
Debt premium	2.5%	0.40	2.2%	2.8%
	1.5%	0.40	1.12%	1.82%

Equity risk premium

	Estimate	Estimated Standard error	[66% Conf. Interval]	
Additional ERP crisis premium proportion[74]	20%	0.12	9%	31%
Implied ERP for base case of 5	6		5.45	6.55

Drawing together

8.30 Our view is that an appropriate degree of marking up would employ the upper 66 per cent confidence value for each of the individual parameters so as to provide one overall markup.

8.31 The individual parameter values that would enter for calculation purposes[75] are as follows:

(a) Risk-free rate: 2.01 per cent

(b) Equity beta: 0.69, relevered to 0.66

(c) Debt premium (crisis): 2.8 per cent

(d) Market risk premium (crisis): 6.55 per cent

8.32 For the crisis WACC, this produces an overall figure of 5.5 per cent versus the pre-aimed-up figure of 4.8 per cent — an overall markup of 14.4 per cent.

8.33 In the light of this analysis of uncertainty, we propose a substantial mark-up of 14.4 per cent on our underlying estimate of the WACC. We consider that this should ensure that, even if we have made errors in our estimate of the underlying cost of capital, companies

[73] Use the average spread on water companies' bonds (daily observations)
[74] So, if the ERP were 5, then in a crisis it might rise to 20 per cent more than this — i.e. to 5 x 1.2 = 6.
[75] Note that we are not hereby implying that the best estimates of the individual parameter values are these — the numbers quoted here are purely a calculation device for achieving the overall degree of markup.

should still be able to raise the finance that they need to fund their investment programmes.

WACC Estimate for PR09

Range estimates

8.34 The table below presents our range estimates for each WACC parameter and for the overall cost of capital. In line with our view (discussed earlier) that aiming up is best done at the level of the overall WACC, we present aimed-up figures only for the overall WACC and not for individual parameters.

8.35 **Our range estimate for the overall cost of capital is 2.9 to 5.4 per cent on a post-tax basis**. The width of this range reflects the uncertainty surrounding estimation of the cost of capital, particularly in the context of the current financial crisis. In the following section, we present our recommended point estimate within this range.

Table 8.2: Range estimates for the WACC

	Low	High
Cost of equity		
Risk-free rate	1.5	2.2
Equity risk premium	4.1	5.4
Equity beta (not relevered)	0.50	0.75
Asset beta (see note)	0.22	0.32
Re-levered equity beta	0.48	0.92
Post-tax cost of equity	3.46	7.18
Pre-tax cost of equity	4.80	9.97
Cost of debt		
Debt premium	1	2.5
Pre-tax cost of debt	2.5	4.7
Post-tax cost of debt	1.8	3.38
Overall WACC		
Notional gearing	55%	65%
Corporation tax rate	28%	28%
Pre-tax WACC	3.5	6.5
Post-tax WACC	2.5	4.7
"Vanilla" WACC	2.9	5.6
Marked-up figures to take account of asymmetric consequences		
Pre-tax WACC	4.0	7.5
Post-tax WACC	2.9	5.4
"Vanilla" WACC	3.4	6.4

Note: the asset beta is calculated assuming a debt beta of zero. Given that the asset beta is then relevered to a notional gearing level very close to the gearing of the industry portfolio which was used to estimate the equity beta, an alternative debt beta assumption is unlikely to have material impact on the final WACC estimate.

Recommended point estimate

8.36 Drawing on the analysis set out in previous chapters and on the considerations discussed above, our WACC estimate for PR09 is set out in Table 8.3 below. **Our recommended figure for the post-tax cost of capital is 4.3 per cent** (after weighting the crisis and post-crisis WACCs and then aiming up).

8.37 The derivation of this figure is as follows:

(a) Based on the WACC components discussed in previous sections, our crisis WACC is 4.1 per cent and our post-crisis is 3.5 per cent (both quoted on a post-tax basis);

(b) Placing a 45 per cent weight on the crisis WACC as discussed above gives a weighted post-tax WACC for AMP5 of 3.8 per cent.

(c) Applying the 14.4 per cent mark-up to this figure to take account of the potential asymmetry of consequences gives a final WACC recommendation of 4.3 per cent on a post-tax basis.

8.38 The point figures used for each WACC parameter in both the crisis and post-crisis WACC estimates are within the relevant range estimates in all cases except for the ERP figure in the crisis WACC. As discussed in section 4, in a period of economic and financial crisis the ERP can temporarily rise above the range that would apply in more normal times.

Table 8.3: Recommendations on the WACC

	Crisis	Post-crisis	Weighted WACC
Cost of equity			
Risk-free rate	1.75	1.75	
Equity risk premium	6	5	
Equity beta (not relevered)	0.65	0.65	
Asset beta	0.28	0.28	
Re-levered equity beta	0.62	0.62	
Post-tax cost of equity	5.48	4.86	
Pre-tax cost of equity	7.61	6.74	
Cost of debt			
Debt premium	2.2	1.5	
Pre-tax cost of debt	3.95	3.25	
Post-tax cost of debt	2.84	2.34	
Overall WACC			
Notional gearing	55%	55%	
Corporation tax rate	28%	28%	
Pre-tax WACC	5.6	4.8	5.2
Post-tax WACC	**4.0**	3.5	**3.7**
"Vanilla" WACC	4.6	4.0	4.3
Marked-up figures to take account of asymmetric consequences			
Pre-tax WACC	6.4	5.5	5.9
Post-tax WACC	**4.6**	**4.0**	**4.3**
"Vanilla" WACC	5.3	4.5	4.9
Implied marked up post-tax cost of equity			6.3

8.39 In order to show what the marking up implies for equity providers, we have calculated the cost of equity which would be consistent with a post-tax WACC of 4.3 per cent, assuming no marking up on the cost of debt. The results of this calculation are as follows:

(a) With no marking up on the cost of debt, the weighted average of the crisis and post-crisis estimates of the cost of debt is 3.6 per cent on a real pre-tax basis.

(b) Our overall WACC estimate of 4.3 per cent combined with this cost of debt would imply a cost of equity of 6.3 per cent on a real post-tax basis.

8.40 Given the possibility that the equity risk premium may be higher in periods of recession (as discussed in section 4), it is also instructive to consider the cost of equity implied by our marked-up estimate of the crisis WACC of 4.6 per cent (post tax). Keeping the crisis cost of debt figure at 3.95 per cent (on a real pre tax basis) and applying all of the marking

up to the cost of equity, we calculate that the marked-up crisis WACC implies a real post tax cost of equity of 6.8 per cent.

8.41 We consider that this cost of equity would provide ample incentive for investors to provide further equity to the sector, and is thus consistent with Ofwat assuming the formation of new equity (whether by changes in dividend policy or by new rights issues) in order to deal with any perceived financeability problems. We base our view that there should be ample incentive to add in equity on two key factors.

8.42 First, a real post-tax cost of equity of 6.8 per cent in the current crisis period is well above our best estimate of the market cost of equity in the crisis period — 5.48 per cent. There should thus be strong incentives for investors to purchase equity at this return.

8.43 Second, 2009 and 2010 (the key periods of ongoing crisis) are expected to be periods in which equity issuance (including through rights issues) is expected to be high. As can be seen from Table 8.4 there has been a large increase in the number and volume of rights issues this year when compared to previous years. We believe that this is indicative of a market appetite for (or at least tolerance of) new equity.

Table 8.4: Equity money raised (UK listed companies)

	Total		Of which					
			New issues		Rights issues		Other issues	
	No. issues	Money raised (£m)	No. companies	Money raised (£m)	No. issues	Money raised (£m)	No. issues	Money raised (£m)
August 2009	25	622	0	0	0	0	25	622
July 2009	37	2,044	0	0	6	1,233	31	811
June 2009	46	14,153	0	0	7	8,031	39	6,122
May 2009	32	2,887	0	0	6	2,993	26	842
April 2009	63	7,094	0	0	3	1,200	60	5,894
March 2009	41	20,181	1	3	7	19,543	33	636
February 2009	28	1,406	0	0	4	1,090	24	316
January 2009	14	5,677	0	0	0	0	14	5,677
2009 to date (August)	288	54,128	1	3	33	33,142	254	20,984
2008	427	54,761	23	3,110	15	27,174	389	24,476
2007	517	16,453	52	7,613	5	639	460	8,201
2006	710	21,280	55	8,415	12	5,974	643	6,890
2005	833	13,586	68	5,966	17	2,749	748	4,871

Note: There is a slight discrepancy in the table in that the monthly figures do not add up to the total "year to date" figures. The figures we have quoted for "year to date" are taken from stock exchange market statistics for the year to date to August, and the monthly figures are from individual monthly publications.

Source: London Stock Exchange market statistics

8.44 We understand that some investors have suggested a higher cost of equity figure to Ofwat. In principle, we consider that less weight should be placed on what investors say than on market data, since investors will tend to have a vested interest in talking up the WACC figure whereas market data (used to produce our WACC estimate) reflects the actual behaviour of investors. In other words, market data reflects what investors actually do rather than merely what they say.

8.45 Nonetheless, the cost of equity of 6.8 per cent implied by our marked up crisis WACC is not out of line with some of the estimates which have been put forward for the current cost of equity.

8.46 Water companies have largely based their WACC submissions on NERA's analysis. NERA's CAPM estimate of the cost of equity was 7.2 to 8.6 per cent at 60 per cent gearing, which we calculate translates to a range of 6.7 to 7.9 if gearing is instead assumed to be 55 per cent. Hence, a real crisis post-tax cost of equity of 6.8 per cent at 55 per cent gearing is within NERA's CAPM range.[76] This is despite the fact that we consider NERA's estimates of the risk-free rate and equity beta to be significantly above the level that can be supported by market data.

Impact of targeting BBB+ rating

8.47 The above calculations are based on a target credit rating for water companies of A-. The target rating affects the gearing level which can be sustained, which in turn affects both the relevered equity beta and the cost of debt.

8.48 As discussed in the section on financeability, recent narrowing of the gap in spreads between A- and BBB+ rated companies means that the argument for targeting a rating of A- is less clear cut. Hence, as a sensitivity check, we have also computed a cost of capital estimate based on a BBB+ rating.

8.49 The use of a target rating of BBB+ would be most compatible with the view that recent changes in bond markets (i.e. reductions in bond spreads and the narrowing of the gap in spreads between A- and BBB+ rated bonds) represent the end of the financial crisis. Hence, for this sensitivity we consider that it would be inappropriate to calculate the weighted average of a "crisis" and "post crisis" WACC. Instead, we calculate a single "post crisis" figure.

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[76] NERA's recommended range for the cost of equity is in fact driven by their DGM estimate of 7.4 to 8.2 per cent at 60 per cent gearing, rather than by their CAPM estimate. Within the CAPM framework, and given NERA's estimates of the risk-free rate and the equity risk premium, a range of 7.4 to 8.2 per cent for the cost of equity at 60 per cent gearing would be consistent with an asset beta of 0.36 to 0.42. Using this asset beta range and adjusting for a lower gearing level of 55 per cent would give a cost of equity range of 6.9 to 7.6 per cent. Hence, the cost of equity of 6.8 per cent implied by our crisis WACC is marginally outside NERA's final recommended range on the cost of equity, after adjusted for gearing. However, as noted above, we consider that NERA's estimates of some WACC parameters are significantly above the level which can be supported by market data.

8.50 This sensitivity calculation is shown in the table below. The post-tax WACC using this approach is again 4.3 per cent.

Table 8.3: Recommendations on the WACC

	Post-crisis
Cost of equity	
Risk-free rate	1.75
Equity risk premium	5
Equity beta (not relevered)	0.65
Asset beta	0.28
Re-levered equity beta	0.70
Post-tax cost of equity	5.24
Pre-tax cost of equity	7.28
Cost of debt	
Debt premium	2.0
Pre-tax cost of debt	3.75
Post-tax cost of debt	2.7
Overall WACC	
Notional gearing	60%
Corporation tax rate	28%
Pre-tax WACC	5.2
Post-tax WACC	3.7
"Vanilla" WACC	4.3
Marked-up figures to take account of asymmetric consequences	
Pre-tax WACC	5.9
Post-tax WACC	**4.3**
"Vanilla" WACC	5.0

Impact of assuming different gearing for WaSCs and WoCs

8.51 In the previous section we have recommended that Ofwat assign the same cost of capital and the same notional gearing assumption for WoCs and WaSCs. However, to demonstrate the regulatory options available, we now briefly consider what the effect would be on the overall WACC for WaSCs and WoCs if Ofwat were to assume a different level of gearing for these two groups.

8.52 The WACC recommendation presented above assumes the same gearing level (55 per cent) for both WaSCs and WoCs. As discussed in section 5, assuming other financial ratios were also adequate this level of gearing should allow WoCs to achieve a credit rating of A- and might allow WaSCs to achieve an even stronger credit rating. Our debt premium assumption is based on an A- credit rating, and hence should be sufficient for all water companies to raise debt finance.

8.53 However, given that WaSCs are arguably exposed to lower specific risks than WaSCs (e.g. because risks are diversified across more investment projects), it could be argued that a higher gearing level would be appropriate for WaSCs. This difference in risk profile is reflected in the approach taken by credit rating agencies, which typically tolerate a higher gearing level for WaSCs for any given credit rating. Note that this can be explained by differences in *specific* risks between WaSCs and WoCs, and hence is not inconsistent with our finding in section 7 that there is no evidence of any difference in *systematic* risk between WaSCs and WoCs.

8.54 To explore the possible effect of assuming different gearing levels, we have calculated the WACC which would apply to WaSCs if we assumed a gearing level of 60 per cent instead of 55 per cent. Sixty per cent is at the bottom of the range of 60 to 68 per cent which we understand would allow WaSCs to achieve an A- rating (assuming other financial ratios were also adequate).

8.55 Table 8.5 shows the results of our calculations, based firstly on a debt beta assumption of zero. The cost of debt is assumed to stay at the same level as in our recommended WACC, since the rationale for the calculation is that WaSCs would be able to sustain an A- credit rating (on which our debt premium is based) at higher levels of gearing. However, the increase in the notional gearing assumption changes the equity beta assumption and hence the cost of equity, since shareholders bear more risk at 60 per cent gearing than they do at 55 per cent gearing. After rounding, the weighted post-tax WACC remains at 4.3 (our recommended figure presented above), although both the pre-tax and vanilla WACC increase slightly. In other words, these calculations would if anything actually give a *higher* cost of capital for WaSCs than for WoCs.

Table 8.5: Impact of assuming higher gearing on WACC for WASCs

	Current	Post-crisis	Weighted WACC
Cost of equity			
Risk-free rate	1.75	1.75	
Equity risk premium	6	5	
Equity beta (not relevered)	0.65	0.65	
Asset beta	0.28	0.28	
Re-levered equity beta	0.70	0.70	
Post-tax cost of equity	5.94	5.24	
Pre-tax cost of equity	8.25	7.28	
Cost of debt			
Debt premium	2.2	1.5	
Pre-tax cost of debt	3.95	3.25	
Post-tax cost of debt	2.84	2.34	
Overall WACC			
Notional gearing	60%	60%	
Corporation tax rate	28%	28%	
Pre-tax WACC	5.7	4.9	5.2
Post-tax WACC	4.1	3.5	3.8
"Vanilla" WACC	4.7	4.0	4.4
Marked-up figures to take account of asymmetric consequences			
Pre-tax WACC	6.5	5.6	6.0
Post-tax WACC	4.7	4.0	4.3
"Vanilla" WACC	5.4	4.6	5.0

Note: the above calculations assume a debt beta of zero

8.56 An obvious question is why Modigliani-Miller (MM)'s first proposition does not appear to be reflected in the above result. As discussed in section 5, the MM theorem suggests that the (vanilla) WACC should be invariant to the chosen gearing level. Since the relevering of the equity beta was carried out using the equation derived from MM, one might have expected the vanilla WACC in tables 8.3 and 8.5 to be identical.

8.57 The answer to this question relates to the fact that the debt premium includes a default premium which reflects specific as well as systematic risks. Our calculations above assume a debt beta of zero, thus all of the debt premium is assumed to be company-specific (or industry-specific) diversifiable default risk. The Modigliani-Miller Theorem allows us to re-gear leaving the diversifiable risk unaltered. But the implication is that at a higher level of gearing the allowance for specific risk in the overall capital structure is increased — so the WACC rises. This effect is small,[77] but enough, through rounding, to

[77] For the post-tax WACC, the effect is below 0.1 per cent.

appear as a difference in the figures in the table for the vanilla WACC.[78] (We have tested the effect with a debt beta of 0.1 — a value that is plausible for the water sector — and found that the effect is still, after rounding, the same.)

8.58 In conclusion, these calculations show that assuming a higher gearing level for WaSCs has only a small effect of the WACC. Insofar as it does have an effect, the result is that it leads to a very marginally higher WACC for WaSCs — in contrast to the arguments put forward by WoCs that they should have a higher WACC than WaSCs. As in the previous section, we recommend that Ofwat assumes the same gearing for both WaSCs and WoCs and applies the recommended WACC presented earlier to all water companies. However, an alternative would be to assume a higher notional gearing for WaSCs (say, 60 per cent versus 55 per cent for WoCs) but to ignore the small impact on the WACC of different gearing levels generated by specific risk — which we consider can easily be justified on the basis that the cost of capital is intended to make allowance only for non-diversifiable systematic risks.

[78] If either the debt premium were zero or the debt beta were set such that the entire debt premium were encompassed by beta risk (i.e. if Debt Beta = Debt Premium ÷ MRP) then changes to gearing would leave the vanilla WACC precisely unaffected.

9 CROSS CHECKS TO THE CAPM

Introduction

9.1 In section 7 we present the results of our CAPM approach for the cost of capital. This section presents the results of a number of alternative estimation techniques we undertook in order to provide a cross-check to our primary WACC estimates derived from CAPM modelling. We have made use of the following alternative estimation techniques:

(a) Dividend Growth Model;

(b) Fama French Three Factor Model;

(c) Market to Asset Ratios; and

(d) Cross checks against city opinions and comparables.

Reasons for Using CAPM, and for Considering Alternatives

9.2 We have used CAPM as the main method for the cost of capital investigation for several reasons, including an intuitive theoretical base enabling discussion by stakeholders, its track record in regulatory determinations, and lack of viable alternatives.

9.3 CAPM is widely used in UK economic regulation, and has been endorsed in a number of recent reviews. It has a persuasive theoretical basis which points to calculations and estimates that can often be made. In the past Ofwat, and other economic regulators, have concluded that whilst the CAPM approach had drawbacks it is the most robust methodology currently available. [79]

9.4 However, the CAPM's empirical record as a predictor or model of firm performance is generally thought to be poor.[80] Shortfalls identified in the literature include:

(a) The standard CAPM fails to account for several empirical observations about average stock returns. These include:

- Small firm effect. Small firms sometimes have higher expected returns than predicted by CAPM.
- Value effect. Firms with low ratios of book value to market value sometimes have higher expected returns than those predicted by CAPM.

(b) CAPM does not explicitly take into account the skewness of returns.

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[79] A review by Smithers & Co. (2003) reached the same conclusion. (Smithers and Co., 2003, *A Study into Certain Aspects of the Cost of Capital for Regulated Utilities in the UK.)*

[80] See for example, Fama and French (2004) for many empirical examples illustrating its weakness.

(c) CAPM does not explicitly allow for the possibility that investors may diversify into a wider range of assets than those quoted on stock exchanges.

9.5 For these and other reasons, other models have been put forward as potential alternatives to the standard CAPM, some of which have been employed in our analysis below.

Dividend Growth Model

Introduction

9.6 The simplest version of the DGM (also known as the Gordon Growth Model, or constant growth Dividend Discount formula) expresses the current value of a stock as that stock's expected next-period dividend divided by the real required rate of return less the growth rate of the stock shares. Derived as an infinite summation of the valuation of a current stock price, this version of the DGM assumes constant growth. The formula is:

$$P_0=D_1/(r-g),$$

where P_0 is the current price of the stock, D_1 is the expected next period dividend, r is the required rate of return, and g is the expected constant long-term growth rate of earnings.

9.7 Solving for r gives an approximation of the cost of equity,

$$r=(D_1/P_0)+g.$$

In words, the cost of equity is the prospective dividend yield of a stock plus the constant long-term growth rate of dividends. Because the dividend yield is expressed through a one-period difference between price and expected dividend, it represents future rather than actual dividend yield for the stock.

9.8 A major caveat to be taken into account for this simple version of the DGM is its assumption of constant long-term growth. In practice it is often not possible to predict the next period dividend even for a relatively steady stock. Multi-stage variations of this model therefore allow for differentiation of growth between dividend periods (for example, short and long term). However, these often require further assumptions to be made about when and by how much a dividend will vary over time.[81]

9.9 Some serious restrictions apply to the denominator of the equation in paragraph 9.7: g may not equal the cost of equity (or prices would be infinite), nor can it exceed it (or current prices would be negative). Thus the model often fails when it is applied to high-

[81] McClure, Ben (2008) "Digging into the Dividend Discount Model" http://www.investopedia.com/articles/fundamental/04/041404.asp?viewed=1.

growth stocks, either because differences in valuation become disproportionately sensitive as *g* approaches *r*, because *g* cannot equal *r*, or the price value will be negative.

9.10 Therefore even when used as a method for cross-checking *r*, the DGM should be applied carefully.

Use of CAPM versus DGM

9.11 Before presenting our DGM estimates, the question arises as to exactly how they should be used to provide a cross-check on our CAPM estimates.

9.12 Analysis of NERA's cost of equity recommendations shows that they are actually driven by its DGM analysis rather than by the CAPM. NERA estimates a CAPM range of 7.2 to 8.6 per cent for the cost of equity, and then uses its narrower DGM range of 7.4 to 8.2 per cent to choose where in the CAPM range to locate its cost of equity recommendation. The effect of this is that its recommended range for the cost of equity (7.4 to 8.2 per cent) is determined by its DGM result. Rather than simply using the DGM as a cross-check, NERA effectively ends up using it as the main estimation tool for the cost of equity.

9.13 As far back as its March 2008 paper on the framework and approach for PR09, Ofwat made clear that it would use the CAPM as the main estimation tool for the cost of capital:

> "The 2003 joint regulators' study for PR04 concluded that whilst the CAPM approach had its drawbacks, it was the most robust methodology then available. Since PR04, other regulators, including Ofgem, the CAA and most recently the Competition Commission, continue to recommend and use the CAPM approach at least as a general framework.
>
> "We will continue to use the overall CAPM framework. We will as at previous reviews consider a wide range of market evidence and will cross-check against other models."[82]

9.14 In our view, CAPM remains appropriate as the main method for regulatory cost of capital determination for several reasons. The CAPM has a persuasive theoretical basis which points to calculations and estimates that can often be made, and its intuitive theoretical basis facilitates discussion by stakeholders. It also has a strong track record: it is widely used in UK economic regulation and, as Ofwat mentions above, it has been endorsed in a number of recent reviews.[83]

9.15 NERA's stated reason for placing greater weight on other approaches is that the CAPM allows a wide range of answers. However, given the very serious financial crisis and consequent uncertainty, it is far from obvious that employing a wide range is a flaw. Further, while it is indeed possible to produce a wide range using the CAPM (as illustrated by our own range estimate), it is a mistake to think that all figures within such a range are

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82 Ofwat, "Set ting price limits for 2010-15: Framework and approach", March 2008

83 See, for instance, Smithers and Co., 2003, *A Study into Certain Aspects of the Cost of Capital for Regulated Utilities in the UK.*

equally plausible. Analysis of market evidence allows a reasoned judgment to be reached of where within the range for each CAPM parameter the true figure is most likely to lie. For instance, while we produced a range for the equity beta based on statistical confidence intervals round our industry beta estimate, our point estimate for the industry beta gives the most plausible figure within this range.

9.16 We therefore remain of the view that other approaches to estimating the cost of capital, such as the DGM, should be used as cross-checks with the CAPM providing the main basis for the final answer. Consequently, we reject NERA's approach of using other approaches to select an answer from within the CAPM range: as discussed above, this means that these other approaches end up deciding the answer rather than merely cross-checking the CAPM result. Instead, we believe that the CAPM should be used to produce a best point estimate, and that this should be cross-checked with other approaches by checking that the CAPM point estimate is within the range of plausible values produced by other approaches such as the DGM.

Problems with the DGM

9.17 Further to the above, there are a number of problems with the DGM which mean that estimates derived from this approach need to be treated with caution, even as cross-checks.

9.18 The DGM is based on the fact that the price of a share should equal the stream of future dividends expected by investors discounted at the cost of equity, and in that sense it has a solid theoretical basis. The problems with the model do not derive so much from its theoretical foundations but from the speculative nature of any attempt to guess the future path of dividends expected by investors.

9.19 The problems with using the DGM have been summarised as follows:

> "the dividend discount model requires an enormous amount of speculation in trying to forecast future dividends. Even when you apply it to steady, reliable, dividend-paying companies, you still need to make plenty of assumptions about their future. The model is subject to the axiom 'garbage in, garbage out', meaning that a model is only as good as the assumptions it is based upon. Furthermore, the inputs that produce valuations are always changing and susceptible to error."[84]

9.20 While analysts' forecasts represent one possible source of information about the dividends which investors may be expecting in the short- to medium-term, the use of such data is not without problems. In particular, the literature suggests that analyst valuations tend to be upwardly biased,[85] which will tend to bias upwards DGM estimates of the cost

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[84] Ben McClure, "Digging into the Dividend Discount Model"

[85] One of the first studies to provide evidence of a positive bias in analyst estimates for the US market was W F M DeBondt and R H Thaler (1990), *Do Security Analysts Overreact?*, in American Economic Review 80, pp 52-57. This triggered subsequent research efforts in this area.

of equity which are based on these forecasts. The problem of a systematic upwards bias in analysts' forecasts was investigated, for instance, in a recent report on corporate earnings and share prices by the German Bundesbank:

> "The aggregate forecast error is calculated by comparing the actual earnings of the last 12 months with the 12 month-ahead earnings expected 12 months ago …. As an average for the almost 20 years under review, analysts expected annual earnings growth of 21%. In fact, however, the average increase was only 11%. Thus, the forecast error is significantly biased upwards, which indicates over-optimism on the analysts' part. Furthermore, in the period under review it is striking that, in phases of plummeting share prices, the average earnings expectation systematically deviates more strongly from the actual values than in comparable upwards stock market trends. During the three post-1990 economic downturns and the attendant severe declines in share prices, the cumulative forecast error in analyst estimates surpassed 50%. By contract, in phases of sharply rising share prices the forecast error was markedly lower and often even negative."[86]

9.21 The Bundesbank's findings suggest that analysts' forecasts of dividends are likely to be particularly biased upwards at times of economic and financial crisis when share prices are falling. This means that Ofwat should be particularly cautious about placing weight on DGM estimates produced during the recent period of turmoil.

9.22 Projections of dividend growth after the period covered by analysts' forecasts are even more speculative. Generally, DGM estimates rely on proxies for long-term dividend growth, such as the long-run sustainable rate of GDP or (in the context of regulated utilities) historic trend growth in RCV. However, there is no guarantee that such proxies accurately reflect investors' expectations of long run dividend growth for a particular company.

One-step DGM estimates

9.23 Below, we first present the DGM estimates from the Report by Europe Economics published in July 2009 which were calculated using a simple one-step DGM and using industry-wide ranges for the input variables. Later in this section, we present more recent analysis using a multi-period DGM and company-specific inputs.

Share price data and short term dividend forecasts

9.24 As the first step in estimating the cost of equity using the DGM, we obtained data on historic dividend yields (D_1/P_0).

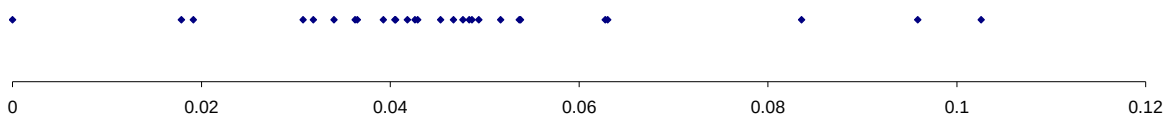
[86] Deutsche Bundesbank, "Corporate earnings and share prices", Monthly report, July 2009

9.25 For historic yields, we used data for six listed UK water companies available through the Bloomberg financial information network.[87] In order to place more weight on current data, we used only data from 2003 or later. To maintain the prospective nature of the yield estimates, we used price data that preceded dividend data by one period (e.g. for a dividend paid out on an ex-dividend date in 2004, the corresponding price value used to calculate dividend yield would have been from the 2003 ex-dividend date, usually exactly one calendar year before). For each period, interim and final dividend values were combined to obtain total values. Before calculating dividend yields, all dividends and prices were adjusted for inflation using the RPI.

9.26 With 28 estimates, our dividend yields ranged from 0.017 to 0. 107, with a mean value of 0.047, a 25th percentile of 0.036 and a 75th percentile of 0.052; we use those values to construct a range for the cost of equity based on DGM.

9.27 Figure 9.1 illustrates the distribution of the data on historical prospective dividend yields.

Figure 9.1: Range of Historical Prospective Dividend Yields (2003-08)



Source: Bloomberg, Europe Economics, 2008

Long term dividend growth forecasts

9.28 There are a number of different possibilities for estimating *g*. These include:

(a) Analyst projections of dividend growth into the next few years;

(b) Long-run trend growth in the UK economy; and

(c) Ofwat's projected real growth in water companies' regulatory capital values.

9.29 Given that RCV growth should be directly linked to companies' dividend growth, via the allowed rate of return, we use this as our preferred proxy for long term dividend growth.

[87] Listed firms included Kelda Water Services, Severn Trent, Dee Valley Group, East Surrey Holdings, Northumbrian Water, and Pennon Group.

9.30 For values of future regulatory capital values (RCV) set by Ofwat for WaSCs and WoCs, we refer to Ofwat's PR04 (covering 2005-10).[88] Data were adjusted to a 2002-03 year end price base.

9.31 Actual RCV data had a mean growth rate of 2.2 per cent.

9.32 Hence, we employ the mean RCV growth rate, 2.2 per cent, to produce our central point estimate and growth rate estimates of 2 per cent and 2.5 per cent to construct a range on it.

Cost of equity estimate

9.33 Summing the estimates for (D_1/P_0) and g, we obtain a range for the cost of equity (r):

	lower	point	upper
DGM based cost of equity	5.6%	6.9%	7.7%

9.34 Therefore using the DGM our central estimate of the cost of equity to be 6.90 per cent, and the range is 5.6 to 7.7 per cent.

9.35 The range for the cost of equity proposed by NERA is 7.40 to 8.20 per cent. We note that NERA adjusts its estimates to accommodate differences in gearing among companies, re-leveraging DGM estimates to a notional gearing of 60 per cent. In addition NERA's results are based on a multi-period extension of the DGM model, which relies more heavily on analysts' forecasts, which tend to be upward biased.[89]

9.36 We do not re-leverage our estimates (which are based on an observed average gearing of 54 per cent[90]) and we base our analysis on raw DGM estimates. We are of the opinion that the re-leveraging exercise is not appropriate in the DGM context, which lies outside the MM framework, on which this exercise is based. In addition given that the actual gearing level of 54 per cent associated with our DGM estimates is very close to our working point figure for notional gearing of 55 per cent, we do not consider that any re-leveraging of our DGM cost of equity estimates is necessary.

9.37 The cost of equity implied in our WACC recommendation is 6.3 per cent (calculated by applying all of the mark-up for asymmetry of consequences to the cost of equity). Likewise, when the uplift for asymmetry of consequences of 14.4 per cent is applied to crisis WACC, the implied cost of equity is 6.8 per cent (again, applying the uplift all to the cost of equity). Both of these figures are within the range which we have derived using the simple version of the DGM.

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88 Ofwat (2004) "Future water and sewerage charges 2005-10: final determinations" Periodic review 2004.
89 With regard to this point see McClure, Ben (2008) "Digging into the Dividend Discount Model"
90 The average gearing of 54 per cent refers to the companies used to construct dividend-price estimates.

Multi-period DGM

9.38 Our multi-period DGM estimates of the cost of equity are presented in Table 9.1 below. To produce these estimates, we used share prices at the end of August, recent (post Draft Determinations) analysts' forecasts of dividends in the next three years, and a long-run dividend growth assumption based on each company's average RCV growth over the period 2010-15 (taken from the Draft Determinations). Given the multi-period approach makes greater use of company specific data, we have estimated the cost of equity separately for each listed WaSC and used the results to identify an industry average and range.

Table 9.2: New estimates of the cost of equity using multi-period DGM

	Using average of analyst forecasts	Using lowest analyst forecast for UU (and average for other companies)
United Utilities	9.3	7.9
Pennon (South West)	5.2	5.2
Severn Trent	7.2	7.2
Northumbrian	7.2	7.2
Average	7.2	6.9
Range	**5.2–9.3**	**5.2–7.9**

9.39 The second column shows results obtained using an average of analyst forecasts. This produced a wide range of 5.2 to 9.3 per cent for the cost of equity.

9.40 Given that the estimate of 9.3 per cent for United Utilities appears out of line with other evidence on the cost of equity (e.g. from the CAPM), we investigated it further. Analyst commentary on the Draft Determinations suggests that United Utilities and Severn Trent may have to cut dividends substantially in order to maintain financial ratios – perhaps by 20 per cent. This suggests that there is likely to be substantial uncertainty surrounding dividend forecasts for these two companies, meaning that DGM estimates of the cost of equity for these two companies are particularly uncertain. When the calculation for United Utilities is redone using the lowest analyst forecast of dividends (which factors in a substantial dividend cut), the cost of equity estimate falls from 9.3 per cent to 7.9 per cent. Hence, a possible explanation for the outlier of 9.3 per cent is that investors are factoring in the possibility of larger dividend cuts for United Utilities than reflected in the average of analyst forecasts. Using the revised figure of 7.9 per cent for United Utilities gives a range for the industry cost of equity of 5.2 to 7.9 per cent, with an average of 6.9 per cent – broadly in line with the figures we obtained previously using a simpler version of the DGM.

9.41 Table 9.3 below shows the average annual percentage growth in RCV over 2010-15 taken from Ofwat's Draft Determinations, which we have used as a proxy for long-run dividend growth for each company. We note that NERA's report continues to quote the figure of 2.2 per cent for average real growth in water companies' RCV, based on the period 2005-10. In other words, NERA has failed to update its figure for RCV growth to

take account of the Draft Determinations, even though one would expect investors' forward-looking expectations of RCV growth to factor in Ofwat's draft proposals.

Table 9.4: Average annual percentage growth in RCV over 2010-15 (%)

United Utilities	2.1
Pennon (South West)	0.0
Severn Trent	0.3
Northumbrian	1.6

Source: Calculated from figures in Ofwat's Draft Determinations for PR09

9.42 An alternative proxy for long-run dividend growth is the long-run rate of sustainable growth for the UK economy. At the high end, HM Treasury used a long-run growth assumption of 2.75 per cent in its 2009 Budget,[91] although this was criticised by commentators as being too high. At the low end, the IMF has forecast that in the medium term economic growth in the UK will pick up to 1.75 to 2.25 per cent.[92] Using 1.75 to 2.75 as a range for long-run dividend growth, we obtained estimates of the cost of equity of 6.7 to 8.6 per cent using a multi-period DGM model, and a slightly wider range of 6.6 to 9.1 per cent using a one-step DGM model.[93] These ranges include NERA's estimated range of 7.4 to 8.2 per cent.[94]

9.43 However, while the long-run growth rate of the economy may be a suitable proxy for long run dividend growth when the DGM is being applied to the stock market as a whole (e.g. to produce an ERP estimate), we consider that it is not a good proxy for long run dividend growth for individual water companies. In the long run, water companies cannot increase their dividends in line with growth in the economy if the growth rate of their own business (reflected in the trend growth of their RCV) is lower. Hence, we believe that trend RCV growth is a much better proxy for long-run dividend growth — a conclusion which is confirmed by the fact that DGM estimates based on these figures are more in line with evidence from the CAPM.

9.44 In comparing the estimates in Table 9.5 with our CAPM results, the relevant comparison is with our "crisis" cost of equity. This is because the DGM analysis and our crisis CAPM estimate are both based on current market data, whereas our post-crisis and overall WACC figures assume financial markets will continue to ease in the future. Our CAPM analysis gave an estimated "crisis" cost of equity of 5.48 per cent (post tax), or 6.8 per cent once the mark-up to the overall WACC is taken into account. These figures are

91 HM Treasury, "Budget 2009; Building Britain's future"
92 IMF Country Report No. 09/212, July 2009
93 Note that in these calculations we estimated the DGM cost of equity for each company on the date one year before the next expected dividend.
94 NERA's figures are based on 60 per cent gearing and hence would be somewhat lower at the same level of gearing as our DGM estimates (54 per cent).

within the DGM ranges presented in Table 9.6, and hence the multi-period DGM cross-check does not contradict our CAPM estimate.

Fama French Three Factor Model

9.45 We also conducted Fama and French estimation on the returns of listed water companies as an additional cross-check on our CAPM calculations. The main purpose of running this model was to investigate potential "small firm" or "value effect", especially when studying possible differences between WaSCs and WoCs.

The Fama-French Model

9.46 The CAPM model estimates the cost of equity using only the Market Risk Premium (MRP) as an explanatory factor of equity returns. However, it has been argued that there could be additional factors that affect the cost of equity not taken into account in the CAPM. The Fama-French Three Factor Model incorporates two such factors in addition to MRP: the "size factor" and the "book-to-market factor."

9.47 The size factor is represented by "SMB", which stands for Small Minus Big and is defined as the return on small-firm stocks less return on large-firm stocks. Inclusion of this factor in the investigation reflects a tendency that Fama and French observed for owners of the smallest market capitalisation stocks to make a substantially higher return than owners of the largest market capitalisation stocks.[95]

9.48 The book-to-market factor is represented by "HML", standing for High Minus Low, which is calculated as the return on stocks with high ratios of book value to market value less return on low book-to-market ratio stocks. This factor controls for the historical tendency for "value stocks" (those with high book-to-market ratios) to provide a higher long-run return than so called "growth stocks" (those with low book-to-market ratios).[96]

9.49 Intuitively, a relatively high book-to-market ratio could indicate that the public value of a company has fallen because of hard times or doubt regarding future earnings. Given that these companies have probably experienced some sort of difficulty, it seems plausible that they would be exposed to greater risk of bankruptcy or other financial troubles than their more highly valued counterparts.[97] Hence investors would be expected to demand a higher return for bearing this additional risk.

9.50 The Fama-French Model is specified mathematically as:

$$r_E = r_f + \beta_A (r_M - r_f) + s_A SMB + h_A HML,$$

[95] Brealey, Myers and Alan (2006) *Corporate Finance*, New York: McGraw Hill.
[96] Brealey, Myers and Alan (2006) *Corporate Finance*, New York: McGraw Hill.
[97] Womack, Kent and Zhang, Ying (2003) "Understanding Risk and Return, the CAPM, and the Fama-French Three-Factor Model" Tuck School of Business, Dartmouth University.

where the $(r_M - r_f)$ term is the MRP.

9.51 By rearranging and adding a constant term, we obtain a form of the equation where we can regress actual excess fund returns linearly against historical market data:

$$r_E - r_f = \alpha + \beta_A (r_M - r_f) + s_A SMB + h_A HML \,.$$

9.52 The Fama-French model has been subject to considerable criticism. There is no clear theory as to why the factors included should deliver positive premia. Even if the assumed effects did once exist, given that they are now identified, they should disappear.

9.53 While it might seem that the Fama-French Model with its increased explanatory power in cross section analysis of portfolio returns would inevitably have greater explanatory power than CAPM (in the sense that the total amount of variation explained by the model will be higher), this is not necessarily so. The model gives rise to the questions such as whether to use historical or cross-sectional data to measure the risk factors, how to select the period under consideration, and how to measure the risk-free rate. Although some of these issues are also present in the CAPM, adding two additional explanatory factors subject to different interpretations on how they should be calculated makes matters more problematic.

9.54 The most important empirical objection to the Fama French model is that the increased number of variables does not necessarily improve the accuracy of the estimates.

9.55 Another reason to question the Fama-French Model relates to the present context. According to a report written for Ofgem by Smithers & Co. on the cost of capital (2006), the book-to-market factor may in fact not be at all relevant to regulated companies, since they are not in a state of permanent financial distress — the economic rationale of the "value effect" is not certain.

9.56 Finally, Petkova (2006) postulated that the SMB and HML variables may be a proxy for "news" other than size risk or book-to-market risk, i.e. interest rates, term spreads, or dividend yields; picking up on an idea first put forward by Fama and French (1993) suggesting that the risk factors may be a proxy for state variables which describe intertemporal variation in the investment opportunity set.

9.57 Similarly, it has been argued that the Fama French additional factors are a simple proxy for the value placed on higher moments of the returns distribution (noting that CAPM considers only the first two moments — mean and variance).

9.58 Thus, it is necessary to be cautious when interpreting Fama-French estimates.

Risk-Style Database

9.59 Europe Economics has used the Fama-French variables estimates provided in the Exeter Enterprises Risk-Style database, TM Risk-Style. It is the only database known to us with

UK estimates of the Fama French factors, and has also been used by other recent OXERA and Smither's & Co investigations. The database gives monthly estimates for the three factors, MRP, SMB, and HML, from July 1975 through December 2005.

9.60 The SMB and HML factors have been constructed following the approach to factor construction adopted for the US by Fama and French.[98] The "big versus small" cut off point has been set at the point where firms comprise a cumulative 80 per cent of market capitalisation. The book-to-market cut offs were set such that the top 30 per cent of firms were "high value", 40 per cent of firms were in a middle category, and the bottom 30 per cent of firms were "growth". This produces six value-weighted portfolios on the risk factors (s/h, s/m, s/l; b/h, b/m, b/l). The HML and SMB factors include the universe of UK stocks for which market capitalisation, returns and book-to-market ratios can be constructed from any source.

9.61 The estimates of the SMB and HML factors are presented in Table 9.7, based on the averages of annualised monthly data provided in the dataset.

Table 9.7: Fama French factors in the Risk-Style database

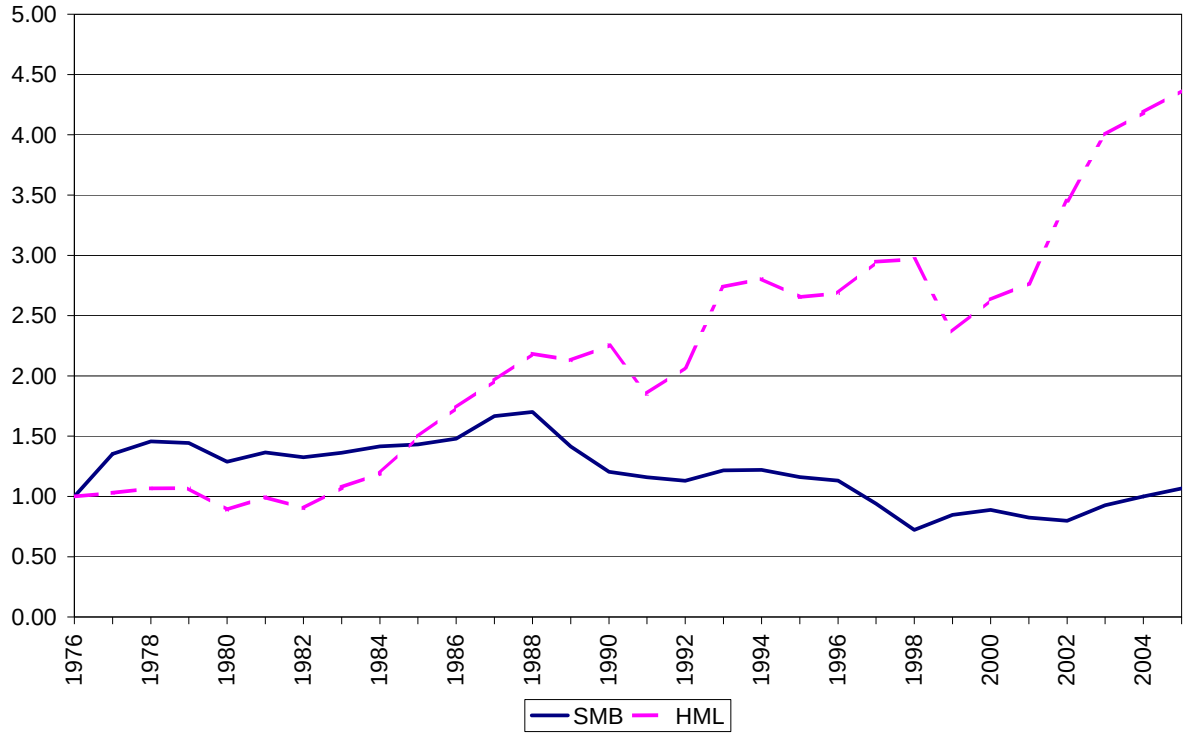
Period	SMB	HML
1975-80	5.5%	-0.4%
1981-85	2.2%	11.6%
1986-90	-2.7%	8.7%
1991-95	-0.6%	4.7%
1996-2000	-4.1%	0.5%
2001-05	4.0%	10.9%
1975-2005	0.7%	6.0%

Source: Based on annualised averages in TM RISK-STYLE database

9.62 It is evident that both of the factors vary substantially through time. The premium on small companies seems particularly dependent on the period under consideration. Also, while the HML is positive in most periods, and namely from 2001 to 2005, it too shows considerable variation with the range of these annualised averages reaching zero in the period 1996-2000. The same can be seen in the figure below, which shows the cumulative increase in SMB and HML factors over the sample period (with 1976 as the base year of 1). The SMB performance is around one, implying that even over the longer term small companies have not outperformed larger companies. The HML line is increasing as expected, though there is some irregularity in the annualised series.

[98] Details of this can be found on: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/

Figure 9.2: Cumulative behaviour of the SMB and HML measures



Source: Europe Economics

9.63 Considering the variation evident in the data, it becomes relevant to test how statistically reliable the measured SMB and HML factors been through the period.[99] The thought behind the use of the factors is that they should always be positive, whereas, as evident from Table 9.7 and Table 9.2, they have not been so in every year. The way of investigation is to calculate the average of the monthly observations, including the confidence interval at the conventional levels of significance. Table 9.8 below shows the results for the different time periods, where we report p-values in parentheses. A "p-value" of 0.05 or less is usually taken as a reliable indication of significant difference from zero.

[99] As highlighted in Smither's & Co (2003) this sort of investigation is often omitted in application of Fama French. This includes their 2006 paper for Ofgem and the OXERA paper on behalf of BAA.

Table 9.8: The average monthly Fama French factors

Period	SMB	HML
1975-80	0.40% (0.25)	0.07% (0.78)
1981-85	0.19% (0.42)	0.91% (0.01)
1986-90	-0.26% (0.39)	0.70% (0.00)
1991-95	-0.02% (0.95)	0.30% (0.30)
1996-2000	-0.39% (0.38)	0.07% (0.90)
2001-05	0.41% (0.50)	0.97% (0.14)
1975-2005	0.06% (0.70)	0.50% (0.00)

Source: Europe Economics

9.64 In contrast to the reasoning behind the use of Fama French, based on the monthly observations, the SMB factor is not significantly different from zero in any of the periods analysed. In addition, the HML factor is not significantly different from zero in many of the sub periods. This means that the variation in the monthly observations for both variables SMB and HML is large enough that the average cannot be reliably said to be different from zero. This is consistent with the averages in the U.S. data, reported in Smither's & Co (2003), where the HML measure was found to be significant from 1964 to 2002, but more so in the beginning of the period, whereas the SMB was not found significant.[100]

9.65 The above analysis suggests that the underlying factors which are meant to explain meant to explain an additional risk factor on top of CAPM beta do not seem to be themselves reliably different from zero.

Estimation and Results

9.66 In addition to the data from the RISK-STYLE database, the estimation of the Fama-French model for the water sector requires data on the monthly total return on listed water companies' equity during the period and the FTSE All Share total returns index for the same period which we obtained from Bloomberg. Combining these with the available data on the Fama French factors, we are able to estimate the Fama French three-factor model for most listed water companies from August 1990 to December 2005.

9.67 The monthly nature of the data requires certain choices to be made – namely; the day of the month to be used as the basis for calculating the monthly return and the number of observations to use for the estimation. Following a widespread convention we used the last trading day of the month to obtain monthly returns for both water companies' shares and the FTSE All Share index. With regard to the optimal estimation window we chose to use the largest available number of available observations for the different companies in order to make our inference more robust.

[100] Smither's & Co (2003), page 73, Table 3.2.

9.68 Smithers & Co also expressed concern that monthly data is less reliable than daily data, and that the two can give different Beta estimates.[101]

9.69 Finally, there is a choice to be made of how to measure to risk free rate used in the calculation of the excess returns. Smithers & Co (2003) suggest using daily LIBOR data as a proxy for the safe rate. However, the use of LIBOR is problematic at the moment, given the significant increase in the wedge between LIBOR and the Bank Rate which has occurred due to the credit crunch. We hence decided to carry out the estimation without netting off the risk-free rate from individual share and market index returns.

9.70 To summarise, the model we estimated, using the same Newey-West estimation as in our beta estimation is:

$$r_E = \alpha + \beta_A r_M + s_A SMB + h_A HML + \varepsilon$$

Results

9.71 The results over the whole sample of available water companies' total returns data, from 1990 to 2005[102] are reported in Table 9.9, which presents the coefficients of the market return term, the size factor and the book-to-market factor as well as the number of observations for each company. The coefficients of the market risk premium (β_A) can be interpreted in the same manner as the CAPM beta.

[101] Wright, Stephen, et al "Report on the cost of capital provided to Ofgem" Smithers & Co. Ltd.: London.
[102] The actual dimension of the sample varies among different companies according to data availability.

Table 9.9: Fama and French estimated coefficients

Company	β_A	s_A	h_A	Number of observations
United Utilities	0.54**	-0.1	0.22	185
Severn Trent	0.38*	0.003	0.30	173
Pennon	0.37*	0.001	0.34	185
Kelda	0.42*	-0.04	0.33	173
Northumbrian	0.73	-0.34	-0.17	31
Dee Valley	-0.05	0.19	0.17	132
East Surrey	0.22*	-0.17	0.09	163
Bristol Water	0.20**	0.15	0.18	144

*Source: Europe Economics estimations from Bloomberg data and Risky Style database. ** significantly different from zero at 99 per cent level of confidence, * significantly different from zero at 95 per cent level of confidence.*

9.72 We note that the coefficient on the market return (β_A) tends to be lower as compared with the CAPM beta estimates based on daily data. This is likely to be due to the monthly nature of the data used, and the introduction of additional variables which "eat up" some explanatory power even though they are not significant. The confidence intervals around these monthly estimates are much wider, and indeed include our CAPM beta estimates.

9.73 Importantly, our results show that that over the sample period the Fama French factors are never significantly different from zero — they do not hold significant explanatory power over the water companies' equity returns. The coefficients also do not support the idea of any asymmetry between WaSCs and WoCs.

Conclusions

9.74 The purpose of this exercise was to investigate the evidence on Fama-French models as an alternative model for cost of equity estimation for water companies.

9.75 Our results show that Fama-French model estimation over the sample of the listed UK water does not refute our CAPM beta estimates, in the sense that our CAPM beta estimates lie within the confidence interval of betas estimated from the Fama-French model.

9.76 In addition, there is no evidence of any significant explanatory power of Fama and French factors on the returns of water companies.

9.77 Finally the econometric evidence produces does not support the idea of measurable differences with respect to these factors between WaSCs and WoCs.

Market to Asset Ratios

Introduction

9.78 This section presents our analysis of Market to Asset Ratios (MARs), also known as Tobin's q, for the four listed water and sewerage companies — Severn Trent, United Utilities, Pennon and Northumbrian — and the sole listed water only company — Dee Valley.

Theory

9.79 The Market to Asset Ratio (MAR) refers to the market value of a company's assets divided by their replacement value. In our context MAR would be defined as the market value of a company's regulated assets (*i.e.* those regulated by Ofwat) over the regulatory asset base.[103]

$$\text{MAR} = \frac{\text{Market value of regulated assets (debt and equity)}}{\text{RCV}} \qquad [1]$$

9.80 The contention of the theory is that this should be equal to one, since if the value of shares was not equal to the current or replacement cost of the assets represented by those shares it would pay to invest in those assets or shares until that equilibrium was reached.

9.81 If one abstracts from matters such as the potential for out-performing regulatory cost assumptions, the cost of capital set by the regulator can be viewed as an estimate of the rate of return the market would require to purchase the regulated assets at the RCV. Therefore it follows that if the regulator has set the allowed rate of return equal to the market cost of capital, the MAR should equal one, ceteris paribus.

9.82 To illustrate the concepts further: suppose that the RAB were £100, and the regulator allows a 5.1 per cent return as part of the price setting. If the market cost of capital for assets with the risk characteristics of the RAB were in fact only half the 5.1, i.e. 2.55 per cent, then the shares representing ownership of the RAB should trade for £200 less net debt.

[103] Regulatory capital value (RCV) is an accounting representation of the regulatory asset base (RAB).

Calculating MARs

9.83 There are two main ways to calculate MARs.

(a) MAR based on *equity value* of the company:

$$\text{MAR} = \frac{\text{Market value of equity}}{\text{RCV - debt}} \qquad [2]$$

(b) MAR based on *enterprise value* of a company:

$$\text{MAR} = \frac{\text{Market capitalisation plus net debt minus value of non - regulated assets}}{\text{RCV}} \qquad [3]$$

9.84 The former approach gives rise to a MAR which is dependent on the level of gearing. This can be seen through the example set out in the table below. Although the underlying value of assets for both companies is the same, the company with the higher gearing level has the lower equity MAR ratio.

	Company 1	Company 2
Market capitalisation	100	400
Debt	800	500
Implied enterprise value	900	900
RCV	1000	1000
MAR (Asset)	0.9	0.9
RCV less debt	200	500
MAR (equity)	0.5	0.8

9.85 Our calculations are therefore based on the latter approach using enterprise value of the regulated company.

Sources of data

9.86 We have used daily market capitalisation values from Bloomberg between 1 December 2003 and 31 August 2009 inclusive.

9.87 The net debt figures for the financial years from 2003 to 2007 are taken from Ofwat's latest financial performance and expenditure report.[104] This report did not contain equivalent figures for the years beginning 1st April 2008 and 1st April 2009, and thus we relied on an equity market analyst report for this figure. The RCV figures are also sourced

[104] Ofwat (2008) "); Financial performance and expenditure of the water companies in England and Wales 2007-08"

from Ofwat's financial performance report. The figures for 2008-09 and 2009-10 have been taken from projections of RCV in PR04 final determinations.[105]

9.88 For the value of non-regulated assets, we have relied on analyst valuations during this time period as reported by NERA, supplemented with more recent analyst reports we obtained.[106]

9.89 All figures were adjusted and expressed in cash terms *i.e.* in the prices of the year to which they refer using RPI data from the Office for National Statistics and the Treasury.

9.90 While market capitalisation will typically change day on day (excluding non-trading days), values for net debt and regulatory capital value are only available on an annual basis. The value of non-regulated assets will adjust periodically as a new valuation becomes available, although the date of release of a new valuation may not correspond with the date on which any change in the value of non-regulated assets actually occurred.

Historical MARs

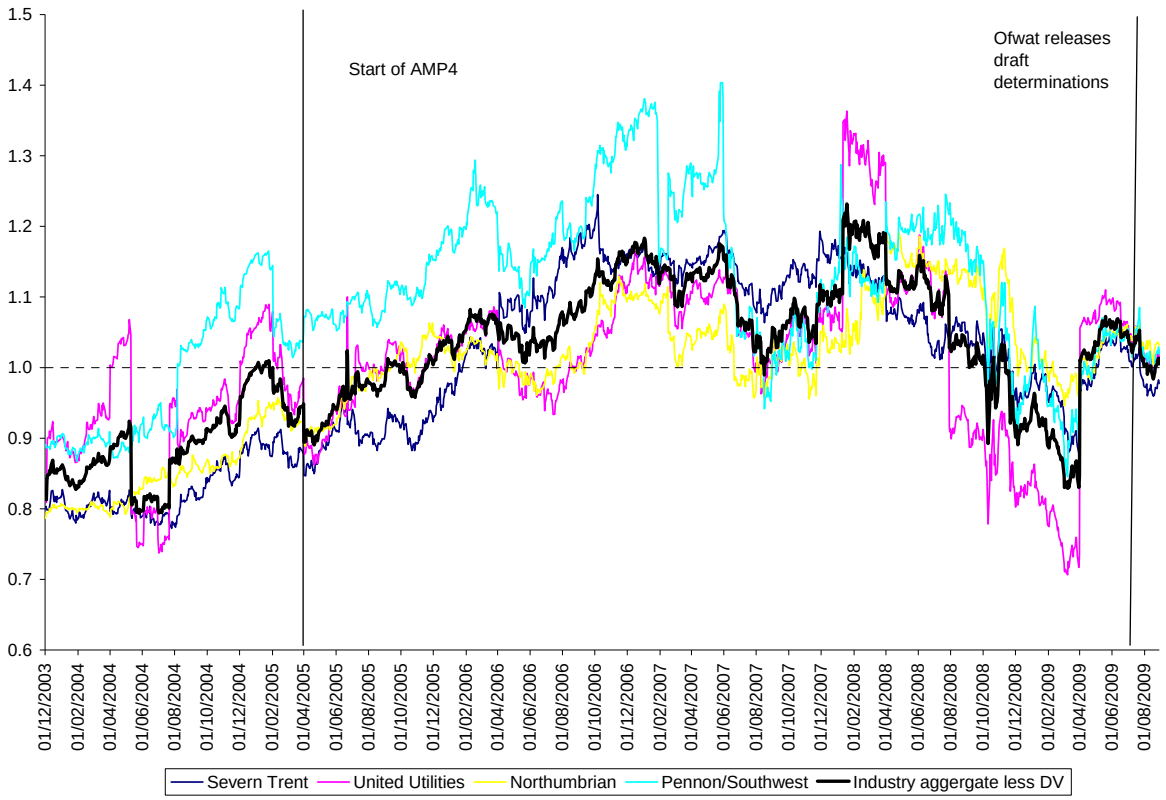
9.91 We present below the historical trend in MARs between December 2003 and August 2009 for the four listed WaSCs, as well as an industry aggregate. We also present the results after incorporating Dee Valley.[107]

[105] A downward adjustment of 1.3% was applied to the figure from the PR04 final determinations based on the observation that the figures from the financial performance report were consistently 1.3% lower than that projected during PR04.

[106] Cost of capital for PR09: final report for Water UK, NERA, June 2008, Appendix J

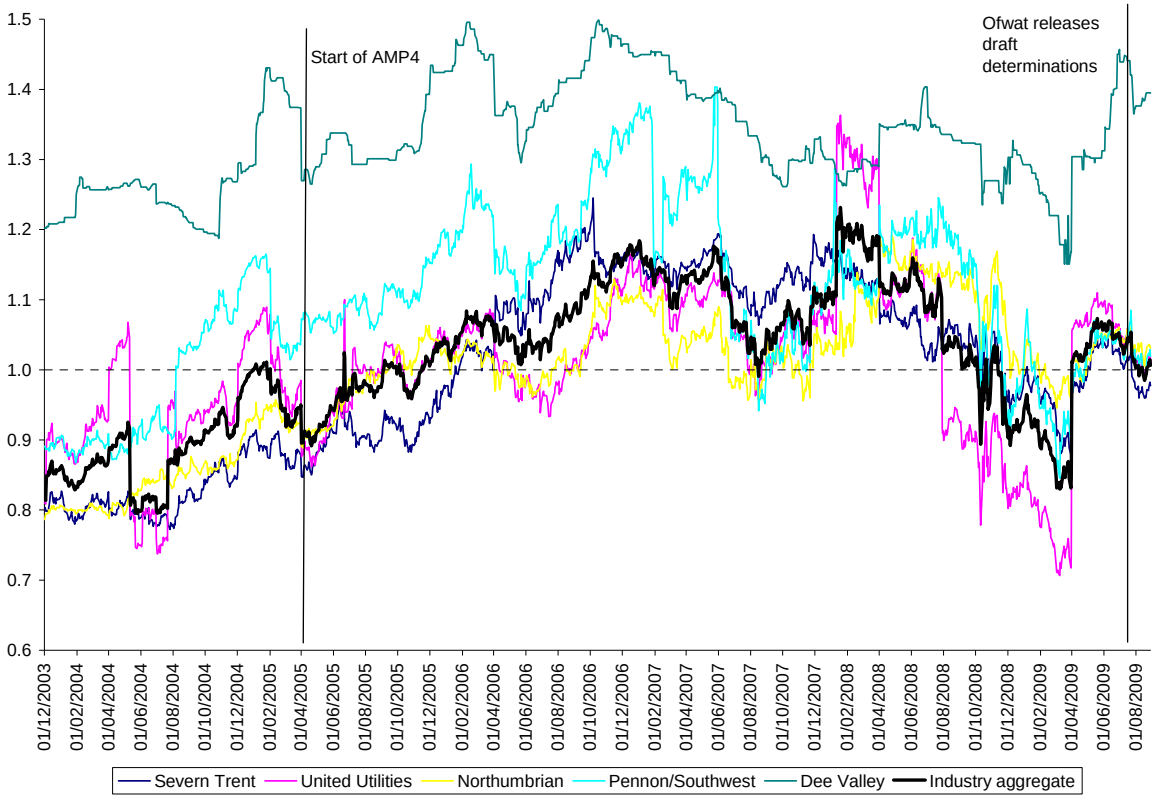
[107] As agreed with Ofwat, it is reasonable to assume that the non-regulated assets of Dee Valley have a value fo zero from 2004 onwards. There does not appear to be any analyst reports which would provide a valuation of their non-regulated assets.

Figure 9.3: Market to Asset Ratios for listed WaSCs



Source: Europe Economics analysis of data obtained from Bloomberg, Ofwat and analyst reports

Figure 9.4: Market to Asset Ratios for listed WaSCs and WoCs



Source: Europe Economics analysis of data obtained from Bloomberg, Ofwat and analyst reports

9.92 The following trends can be observed:

(a) The industry MAR tended to remain below 1 prior to 2005. Examination of even earlier MARs between 1998 and 2005 shows that the industry aggregate MAR fell sharply in 1999 and largely remained below 1 until late 2005.

(b) Another conspicuous feature is that during AMP4, the industry MAR has tended to remain above 1. We discuss some of the reasons for this trend below.

(c) The industry MAR dropped sharply in June 2007 but subsequently recovered by January 2008.

(d) However, since March 2008 the industry MAR has seen another downward trend and has been fluctuating below 1 between September 2008 and April 2009.

(e) The sharp recovery in the industry MAR in April of this year is driven mainly by United Utilities' net debt increasing sharply for the financial year.

(f) Ofwat published its draft determinations on the cost of capital on 23 July 2009. The industry MAR (and of the WaSCs' MARs) did decline slightly on this day, losing some of the earlier gains experienced in May and June; however, it remains above 1..

(g) The MAR for Pennon appears to be above the industry aggregate for much of the period while that for Dee Valley is considerably above the industry aggregate throughout the entire period.

Table 9.10: Historical range and average for Market to Asset Ratios

	Range between 01/12/03 and 31/08/09	Average between 01/12/03 and 31/08/09	Range over AMP4	Average over AMP4
Severn Trent	0.77 – 1.25	1.00	0.85 – 1.25	1.05
United Utilities	0.7171 – 1.36	1.00	0.7171 – 1.36	1.02
Northumbrian	0.79 – 1.19	0.99	0.89 – 1.19	1.04
Pennon (Southwest)	0.8585 – 1.40	1.10	0.8585 – 1.40	1.13
Dee Valley	1.1515 – 1.50	1.33	1.1515 – 1.50	1.35
Industry aggregate (excluding Dee Valley)	0.79 – 1.23	1.01	0.8383 – 1.23	1.05
Industry aggregate (including Dee Valley)	0.80 – 1.23	1.01	0.8383 – 1.23	1.05

Source: Europe Economics analysis of data obtained from Bloomberg, Ofwat and analyst reports

9.93 The table above displays the historical ranges and averages for the MAR of individual companies and the industry aggregate, yielding the following observations:

(a) Despite individual company volatility the MAR has averaged out to be 1 or very close to 1 throughout the entire period for Severn Trent, United Utilities and Northumbrian.

(b) The average MAR is slightly higher for Pennon at 1.10 and even higher for Dee Valley at 1.33.

(c) If we look instead to the industry aggregate MAR, much of the volatility is reduced with a range between 0.79 and 1.23 and an average MAR of 1.01. Even after incorporating Dee Valley, the average industry MAR comes to around 1.

(d) Over AMP4, the data to date shows the average MAR for each company has been higher during this particular period relative to the entire period, with an industry aggregate MAR of 1.05.

Discussion of trends

9.94 In theory, and abstracting from errors in stock valuations and data inaccuracy, any deviation of MARs away from 1 would be down to one, or both, of the following factors:

(a) A wedge between current and future beliefs about the market cost of capital and the allowed rate of return.

(b) A wedge between expectations of current and future cash flows and those cash flows which are reflected in current and future price limits.

9.95 If one were to interpret the divergence of MARs away from 1 purely as a wedge between the allowed rate of return and the market cost of capital it would imply the regulator had been 'too generous' over AMP4 in that the companies have been trading at a MAR above 1 for most of the period since the latter part of 2005. This is not too say the regulator did not make the best decision possible ex ante given the information available at the time as conditions can change ex post. The market cost of capital could also vary during the five year period for which the regulatory cost of capital has been fixed, but the regulator usually picks a point estimate applicable to the entire period.

9.96 We should note however that as time passes, the period during which the regulatory cost of capital set in 2005 for PR04 will apply reduces, and the relative importance of the regulatory decision to be taken in 2010 increases. Thus the declining trend in MAR towards the end of PR04 may be because the market judges that, having been rather too generous in 2005, Ofwat is less likely to make the same mistake for PR05.

9.97 The fact that the industry MAR has been close to 1 since Ofwat's Draft Determinations suggests that investors view the proposed regulatory package as neither significantly too harsh nor significantly too generous (despite some of the market commentary suggesting that the Draft Determinations are tough). It must be borne in mind, as discussed below, that the MAR reflects the entire package contained in the draft determination and not just the decision on the WACC.

9.98 The period prior to 2000 was widely regarded as a period of a harsh regulatory decision following PR99, and this could explain the observation of a MAR below 1 for much of this period.

9.99 However, MARs need to be interpreted with caution as there are a range of other factors apart from the cost of capital which may affect the MARs of water companies, such as the extent to which companies are expected to do better or worse than the regulators' cost assumptions on OPEX and CAPEX. The effect of these factors changes during the course of a price control period. At the outset of a price review period, MARs will be affected by whether or not the market believes that the parameters of the current price control are harsh or generous. As the price control period continues, exogenous shocks affecting how companies are performing relative to cost allowances will affect MARs. As a price control period draws towards its end, MARs will be increasingly affected by investors' expectations concerning the potential outcome from the next price review.

9.100 Examples of factors in which under- or over-performance may be expected include:

(a) *Outperformance of regulatory assumptions*: Evidence suggests that over AMP4, companies had achieved some regulatory outperformance in relation to both Capex

and Opex. The full range for Opex outperformance was between 1.0 per cent and 3.0 per cent per annum, and that for Capex outperformance was between 1.5 per cent and 5.0 per cent per annum.[108]

(b) *Tax outperformance*: There may also be some scope for tax relief if the companies are able to realise tax savings above and beyond Ofwat's assumptions in setting its price limits. It is a possibility that increasing gearing over AMP4 in order to take advantage of debt tax shields might have allowed additional cash flows to the companies.

(c) *Overall Performance Assessment (OPA)*: A company's Overall Performance Assessment (OPA) may also allow it to reap some benefits of high quality service as a one-off adjustment can be made which allows companies that score well to charge slightly higher customer prices in the first year's price limits as well a slightly lower prices for those companies that score poorly. In the last price review this adjustment was in the range of -1.0 per cent to +0.5 per cent of first year revenues, and investors may be expecting a similar range for PR09.

(d) *Financeability adjustments*: At PR04, Ofwat made allowances within regulated revenues for financeability related uplifts which amounted to a total of £430 million over the review period. We have argued elsewhere in the report that there should no financeability adjustments in the next price review.

Other factors

9.101 Some of the observed volatility in MARs may be driven by underlying data uncertainty especially with regards to the value of non-regulated assets. We have used analyst valuations of this value updating whenever we could find a new valuation.

9.102 In some instances two analyst reports released within a short space of time give quite different valuations of the same company. For example, a report released on the 31st March 2004 put the value of United Utilities' non-regulated assets at £1,839 million, while a second report released on the following day put this value at £1,648 million. We did not find any evidence of a major change in United Utilities assets during this period such as disposal or sale of assets, and therefore presume the difference is due to different valuation techniques and data.

9.103 In other cases a company may have sold off some of its non-regulated assets but because of a delay between a company's actions and the new valuation, the MAR may be unnecessarily distorted if our data on the value on non-regulated assets did not adjust at the same time as actual company action. We tried to correct for this distortion where

[108] See for example the NERA report.

possible by investigating sudden large movement in the value of a company's MAR to check when their asset base had changed.

9.104 Investor expectations relating to other aspects of a company might also drive MARs, for example, different expectations about metered customer demand as compared to that embodied in the price control.

9.105 Unexpected market conditions such as the general decline in share prices, as witnessed by falls in major equity indices since summer 2007 (but showing a slight recovery since March 2009), could also be behind some of the observed trends. More generally the MAR may be responding to a change in investors' appetite for water stocks relative to other stocks. For example, depressed values of the MAR around the year 2000 may have been partly driven by a 'negative safe haven effect' prior to 2001 which made water stocks relatively unattractive, as investors preferred higher yielding stocks.

9.106 It is sometimes argued that takeover speculation may also lead to inflated MARs. Following declines in MARs since the onset of the financial crisis in June 2007, the MAR of Pennon and Northumbrian has tended to remain above that of Severn Trent and United Utilities since April 2008 which might have been down to some takeover speculation as smaller companies make easier targets in current market conditions.

9.107 The introduction of future competition may also affect MARs, and judging from our interview programme, most investors believe there is (from their perspective) a *risk* that competition will be introduced to the sector — an outcome which may lead any gains above and beyond Ofwat's assumptions to be stripped away, suppressing the MAR.

9.108 Furthermore, market share price premiums over AMP4 may have been driven partly by changes in overseas pensions requirements, leading to higher demand for infrastructure assets. This is a factor that if true may have reduced the market cost of capital.

Conclusions

9.109 An analyst report released December 2008 supports the view that recent falls in the MAR are reflective of the greater uncertainties surrounding the sector.[109] This uncertainty has been caused not only by the general economic downturn and volatile funding costs but also, in their view, Ofwat's stance that returns may be lowered in the next review period. It also came across during one of our interviews that Ofwat's city briefing in November 2008 did not reassure investors that the RAV would be a floor below which the companies would not be allowed to trade — which of course it should not be, if the correct policy objective is a MAR of about one.

[109] UK Water: Uncertain times; Cazenove, December 2008

9.110 A MAR of 1.05 is generally considered a reasonable premium by city commentators (consumer representatives do not generally offer informed comment on such matters). Since the start of the year, the industry MAR has been fluctuating and the latest picture shows it has continued its decline since the start of 2009, showing some recovery since March. The analyst report referred to here deemed it unlikely that the sector would be able to trade at a substantial premium over RAV until the publication of Ofwat's draft determinations in July 2009.

9.111 Although MARs generally started rose back above 1 in March this year, the weeks prior to the publication of the Draft Determinations saw them declining slightly and the MAR declined on the day of publication (23 July 2009). The MAR has remained close to 1 during this period following publication of the Draft Determinations (1.02 on the last day for which we have data).

9.112 Current MARs represent some interaction between expectations of operational efficiency/outperformance of water companies, expectations about future reviews, and the implications of the current review. Mechanical derivation of the market cost of capital from MAR data rests on very strong assumptions about market expectations of the future WACC as well as a host of other factors discussed earlier and any results of such an attempted exercise is unlikely to be reliable.

Other Cross-Checks

9.113 As a final "sanity check" to our results we outline below some decisions on cost of capital parameters in the current economic climate for broadly comparable companies, as well as estimates of the appropriate cost of capital for the water industry from industry analysts. We also draw on city opinion that we have been able to gauge from our interviews, bearing in mind the limited scale of our interview programme.

9.114 A full Appendix reviewing regulatory precedents on the parameters of cost of capital estimation covering some five regulators has also been included.

9.115 Table 9.7 summarises the various ranges for the WACC, the sources of which are detailed subsequently.

Table 9.11: Summary of WACC estimates obtained from other sources

Source	Range for WACC estimate (%)	Date of estimate	Notes
Ofwat draft determinations for AMP5	4.50	July 2009	
Analyst report	4.00 – 5.30	May 2009	The point estimate within the range is dependent on the economic scenario which is realised.
Bloomberg	3.34 – 6.24	3 September 2009	This range is for individual company WACC.
Water UK Investor Survey	4.50 – 4.70	March 2008	
NERA estimate for Water UK	4.60 – 5.10	January 2009	
Office for Rail Regulation	4.50 – 4.90	October 2008	
Competition Commission on Stansted	5.20 – 7.54	October 2008	Airports are considered more risky than water therefore not much weight should be placed on the numbers here
Ofgem (views of advisers in context of initial proposals for DPCR5)	3.50 – 5.60	August 2009	
Analyst report	3.80	January 2009	Estimated long-term forecast

Source: Europe Economics

Analyst Findings

9.116 An analyst report originally dated 12 December 2008 and updated in May 2009, modelled the cost of capital outcome under four different scenarios relating to the recovery of the market. The outcome of the modelling undertaken in May this year is reported below.

Table 9.12: Analyst projections of the WACC for the UK water sector

	Current state	Recovered market	Further falls
Inflation assumption	Base Case	Pick-up	Extended deflation
Real Vanilla WACC	4.6%	4.0%	5.3%

Source: Analyst report, May 2009

9.117 According to these projections, the cost of capital would be above the 5.1 per cent of the previous price review only if there are further deteriorations in the market scenario.

9.118 Another report estimated the long-term cost of capital as 3.8 per cent believing that Ofwat was going to lower the gap between the allowed rate of return and cost of capital in this price review. .

9.119 Finally, we report below estimates of the individual company WACC obtained from Bloomberg.

Table 9.13: Current Bloomberg estimates of individual company WACC

	WACC (%)
United Utilities	5.20
Severn Trent	6.24
Northumbrian	4.05
Pennon	5.09
Dee Valley	3.34

Source: Bloomberg (as at 3 September 2009)

City opinion

9.120 The March 2008 Water UK survey of investors also attempted to capture city opinion on the WACC required for the water industry. Although many respondents either did not wish to divulge their thoughts or felt it too difficult a question to answer, out of those that replied, views on the cost of capital that Ofwat needed to set to meet their required returns ranged from **4.8 per cent to 5.5 per cent**.

9.121 We treat these estimates with caution as they are now 6 months old and some industry experts may have a vested interest in the outcome.

NERA analysis for Water UK

9.122 Before we summarise recent regulatory precedents on cost of capital estimation by other UK regulators we summarise NERA's findings in the table below.[110] At the time of publication in January 2009 NERA advised on a real post tax (net of debt tax shield) cost of capital for the UK water sector of lying between **4.6 per cent and 5.1 per cent**.

Table 9.14: NERA estimates of cost of capital for Water UK

Component	NERA's estimate
Gearing	60
Real cost of debt	3.8 – 4.3
Real post tax cost of equity	7.4 – 8.2
Post tax WACC (net of tax shield)	**4.6 – 5.1**
Vanilla WACC (gross of tax shield)	5.3 – 5.8

Source: NERA

[110] We understand that NERA is to submit a revised report in September 2009, but this is not available at the time of writing.

Regulatory precedents

Competition Commission on Stansted

9.123 The Competition Commission presented its recommendations on the maximum level of airport charges that Stansted Airport would be able to levy during the five year period beginning on April 1st 2009 (Q5) on 23 October 2008 (well into the current financial crisis).

9.124 The CC believed **7.1 per cent** to be the appropriate cost of capital for Stansted. We do not place emphasis on the final conclusion on WACC, since airports are considered a more risky business than water, but we take into account the CC's findings on economy wide parameters such as the risk free rate and the equity risk premium in cross-checking our analysis.

Table 9.15: Competition Commission's estimates of cost of capital for Stansted

Component	CC estimate	
	Low	**High**
Gearing (%)	50	50
Pre-tax cost of debt (%)	3.40	3.70
Risk free rate (%)	2.0	2.0
Return on market (%)	5.0	7.0
Equity risk premium (%)	3.0	5.0
Equity beta	1.00	1.24
Post-tax cost of equity (%)	5.00	8.20
Taxation	28.0	28
Pre-tax cost of equity (%)	6.94	11.39
Pre-tax real WACC (%)	5.20	7.54
Point estimate of WACC (%)	**7.10**	

Source: Competition Commission

Office of Rail Regulation

9.125 Rail may be considered to be broadly in the same risk class as the water sector.

9.126 On 30 October 2008, the ORR released a report which formed the culmination of the periodic review it conducted during the year to set Network Rail's outputs, revenue requirement and access charges for the five years from 1 April 2009 to 31 March 2014.

9.127 The final decision taken by the ORR in October 2008 was to pick a point estimate of **4.75 per cent** for the WACC from a range of 4.5 per cent to 4.9 per cent.

Table 9.16: ORR estimates of the range for WACC

Component	Lower estimate	Upper estimate
Post-tax cost of equity (%)	6.50	7.00
Pre-tax cost of debt (%)	3.25	3.50
Gearing (%)	62.50	60.00
Post-tax vanilla WACC (%)	**4.50**	**4.90**

Source: CEPA

Ofgem

9.128 We also note the recent initial proposals published by Ofgem on the Distribution Price Control Review 5 (DPCR5). An initial range for the vanilla WACC of between 3.5 per cent and 5.6 per cent has been estimated by Ofgem's advisers.

10 FINANCEABILITY

10.1 This section sets out our advice concerning financeability. It is structured as follows:

(a) The concept of financeability

(b) The credit rating we suggest Ofwat targets

(c) Suggested financial ratios and threshold levels required for target ratings

(d) Historical ratio levels

(e) Implications of target rating

(f) Conclusion.

The Concept of Financeability

10.2 Ofwat has a duty to ensure that companies are able to finance the proper carrying out of their activities as licensed undertakers. This objective can be seen as having two strands, first, to see that if a company is efficiently managed and financed it can earn a return at least equal to its cost of capital and second, if reasonably efficient, that a company's revenues, profits and cash flows must be such as to allow it to raise finance on reasonable terms in the capital markets. Ofwat refers to this second strand as financeability.

10.3 In theory, a company offering expected returns equal to its cost of capital can have no difficulty in financing its activities; this is true as a matter of definition. In practice, however, regulators have given separate consideration to financeability which has typically meant ensuring that projected financial ratios (calculated using a notional gearing assumption) are such as to allow companies to maintain an appropriate credit rating.

10.4 Perceived financeability problems can arise as a result of the timing of cash flows. Currently UK regulatory price caps are intended to deliver stable real revenues based on a combination of a real allowed rate of return and an inflation linked asset base. In this context, the use of nominal debt may make it difficult for companies to finance large investment programmes. This is because in the early years of an asset's life the (real) return and depreciation allowed on the asset may be lower than the nominal costs of financing it, which can lead to financial ratios becoming strained. This effect may be reversed in the later years of the asset's life.

10.5 It is our view that if financeability problems are driven by the use of large amounts of nominal debt, then the appropriate solution is for companies to use less nominal debt (instead using other financing arrangements such as equity or index-linked debt). Hence, we believe that Ofwat should address financeability issues through the choice of the notional gearing level and (if necessary) through the assumption of new equity formation

part-way through AMP5. This is in line with Ofwat's preference for market-led solutions to any perceived financeability problems.

Credit ratings

10.6 There are three main credit rating agencies: Standard & Poor's, Moody's, and Fitch. The table below sets out the rating structures of these agencies.

Table 10.1: Long-term credit rating scales used by different agencies

Grade	S&P**	Moody's*	Fitch**	Description
Investment grade	AAA	Aaa	AAA	Highest quality
	AA	Aa	AA	High quality
	A	A	A	Upper medium grade
	BBB	Baa	BBB	Medium grade
Speculative or non-investment grade	BB	Ba	BB	Lower medium grade
	B	B	B	Low grade
	CCC	Caa	CCC	Poor quality
	CC	Ca	CC	Most speculative
	C	C	C	No interest being paid or in bankruptcy
	D	C	D	In default

Source: The Bond Market Association

** The Moody's ratings from Aa to Ca may be further differentiated by adding 1,2 or 3 as a suffix to indicate the relative position within the category.*

***The S&P and Fitch ratings from AA to CC may further be differentiated by adding a plus or minus sign as a suffix to indicate the relative position within the category.*

10.7 Although the rating scales of the three agencies are broadly comparable, they are not exactly comparable (for example, the same company may be rated differently by different agencies).

10.8 It is not possible in this analysis of financeability to take into account the finer points of each agency's methodology and rating scale. Therefore in our discussion of the thresholds necessary for particular financial ratios for the achievement of particular ratings, we have tended to include the thresholds required according to the more stringent of the rating agencies' criteria.

Target Credit Rating

10.9 The first step in our analysis involves identifying the appropriate credit rating that should be targeted. It is important that this is done with regard not just to current market conditions, but with a view to how the situation is expected to evolve by 2010-2015.

Investment grade rating

10.10 In setting price limits, regulators typically aim to allow companies to remain comfortably within investment grade. In previous reviews, some regulators have explicitly stated that they consider a rating of BBB+/Baa1 or above as being comfortably within investment grade,[111] while others do not specify a particular rating.

10.11 In the analysis which follows we seek to determine whether a BBB+ rating is likely to be sufficient for companies to raise finance under current market conditions, or whether a higher target rating is more appropriate.

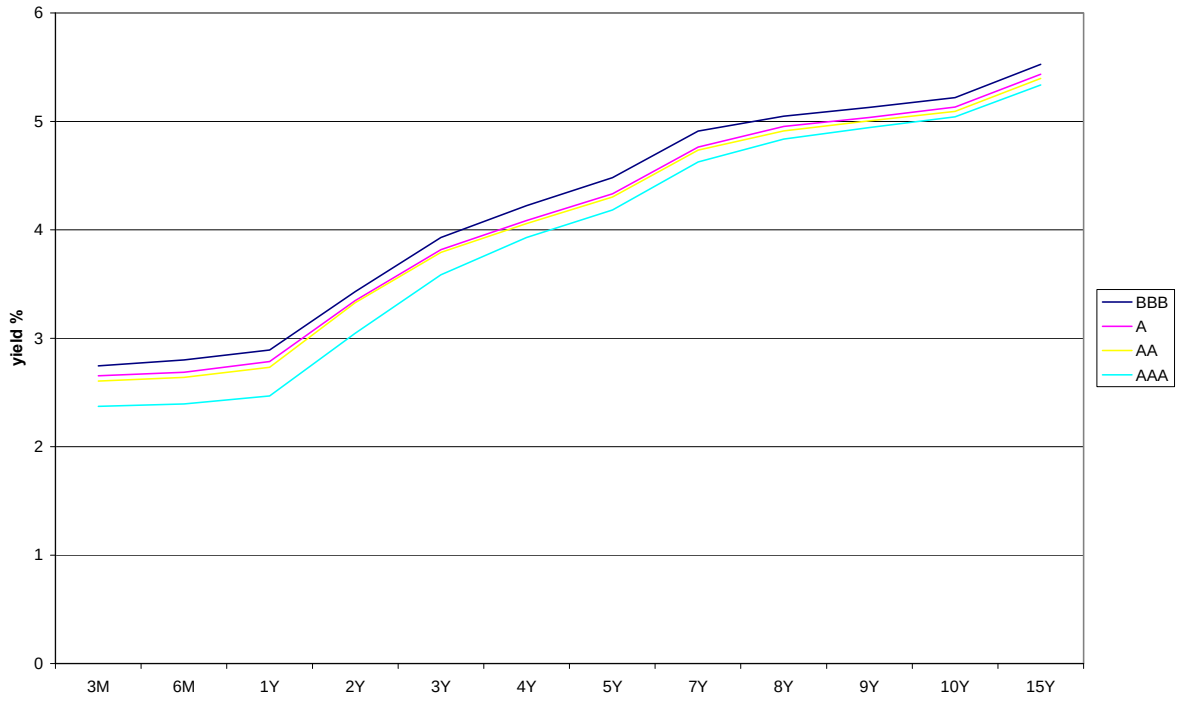
Yield analysis

10.12 In order to inform our decision on the credit rating which seems most likely to allow companies to access debt finance on reasonable terms, we first examine how the yields on bonds vary between different credit ratings within investment grade

10.13 Figure 10.1 shows current differences in yield between bonds of different credit ratings. The indices comprise fixed-rate Euro-denominated debt of UK issuers. Note that the BBB index includes bonds with ratings of BBB, BBB- and BBB+ and the A index includes bonds with ratings of A, A- and A+ and similarly for the AA index.

[111] For example, recent determinations by CAA on Heathrow and Gatwick, and the ORR. Please refer to Appendix 2 for further details.

Figure 10.1: Yield curve for EUR UK bond indices of different ratings on 31st August 2009

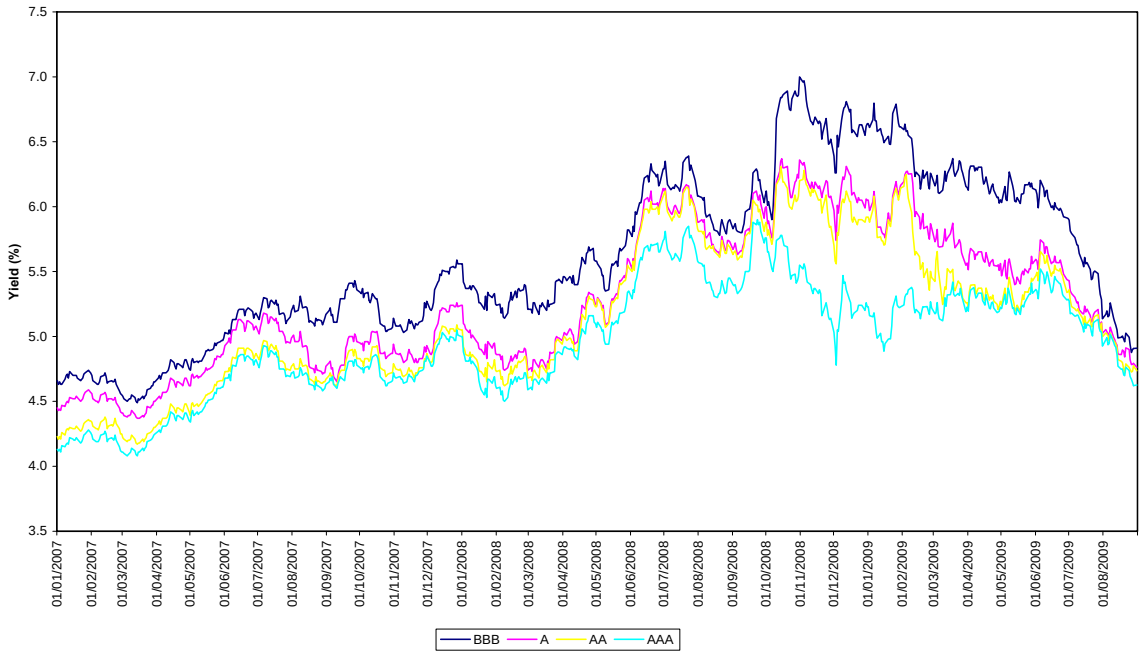


Source: Bloomberg

10.14 The yield curve is currently upward sloping, which is the standard expected shape (although it had been appearing inverted or flat at times during 2007 and 2008). The upward slope is widely believed to be explained by the presence of a risk or liquidity premium which investors demand for holding bonds of a longer maturity.

10.15 The typical yield on bonds with a BBB rating is higher than bonds of an equivalent maturity with an A, AA or AAA rating. At present there seems to be virtually no distinction between yields on bonds with an A or AA rating. Whilst this tells us that companies issuing bonds with a BBB rating will typically have to pay a higher yield to attract investors, for the purpose of our analysis it is more informative to look at the historical relationship between credit ratings and yield. This is shown in the figure below.

Figure 10.2: Credit ratings and yield since 1st January 2007 for bonds with a 7 year maturity



Source: Bloomberg

10.16 A number of points can be drawn from this:

(a) Yields on bonds have seen an upward trend across all credit ratings since January 2007.

(b) The period between September 2007 and May 2008 saw a widening of the wedge between yields on BBB rated bonds and the bonds with superior ratings. This differential then narrowed considerably in the second and third quarters of 2008.

(c) This differential reappeared in October 2008. Further, yields on AAA rated bonds started falling around the same time such that a differential between yields on index of BBB bonds and AAA bonds was around 1.45 basis points on the 2nd January 2009.

(d) During 2009 the wedge between yields on BBB rated bonds and bonds with superior ratings has steadily narrowed again. The wedge between yields on BBB and AAA bonds was around 28 basis points on 31st August 2009.

10.17 Observation of even earlier trends shows that such a large wedge between BBB and AAA bonds as occurred in late 2008/ early 2009 had not been seen since at least December

2003. The large wedge observed in late 2008/ early 2009 was likely to be a reflection of the following factors:

(a) Reduced appetite for risk (so that demand for AAA's is emphasised);

(b) Some pension funds will not buy bonds below an A rating; and

(c) There has been a re-pricing of risk (resulting in an increased wedge between AAA and BBB).

10.18 One inference we can draw from this is that, while firms with BBB ratings need to provide a higher return to investors than firms with single A ratings, the premium can vary considerably.

10.19 Given current constraints in debt markets, concerns have also been expressed about the *availability* of debt finance for utility companies with a rating of BBB+. We discussed this issue with contacts in the City during our interview programme in late 2008 / early 2009, and views were divided. Some people we spoke to thought that water companies needed a rating of at least A- in order to access sufficient debt finance, whereas others thought that debt finance would be available at a rating of BBB+, albeit at a higher cost. We note that most recent bond issues by utility companies in the sterling and euro markets have been at ratings of A- or higher, although there have been a few counterexamples in which utilities have issued bonds at lower credit ratings.

Our suggested target rating

10.20 Whilst in the past regulators may have regarded a BBB+ rating as being sufficient for companies to finance the proper carrying out of their activities, recent evidence suggests that in certain market conditions this may be more difficult.

10.21 In our previous paper (based on market data up to 31 March 2009) we recommended that Ofwat should carry out its market analysis for both a target rating of A- and of BBB+. However, we determined our notional gearing assumption on the cautious basis so as to allow companies to maintain a rating of at least A-.

10.22 At the time of our previous paper we saw three broad possibilities for the evolution of bond yields over the coming period. These were:

(a) The wedge between yields on bonds of credit rating BBB+ and those rated A- would remain large

(b) The wedge would narrow with the premium on A- bonds rising to that on BBB+ bonds

(c) The wedge would narrow with the premium on BBB+ bonds falling to that on A- bonds

10.23 The latest market data suggests that the third of these possibilities has materialised. One might therefore consider that the BBB+ bond yields were previously "more distorted" than

the A- bond yields. It could be argued that in late 2008 / early 2009 the yields on bonds with an A- rating were more representative of the long run BBB+ bond yields than the actual yields on BBB+ bonds at that time.

10.24 In section 6 tables 6.3 and 6.4 we detail recent utility bond issues. The majority of these have been at ratings of A- and higher. However there have been instances of utilities issuing bonds with a rating of BBB+ (for example National Grid in January 2009.

10.25 The latest market data supports the view that it would be acceptable for Ofwat to target a BBB+ rating at the current time. However, in order to allow for the possibility that the financial crisis is not yet over, and that there may be future volatility in bond yields as seen in late 2008/ early 2009, we recommend that Ofwat continues to target an A- rating.

Financial Ratios Needed to Achieve Target Rating

10.26 We carried out interviews with representatives from each of the three main credit rating agencies: Standard & Poor's, Moody's, and Fitch. In the interviews agencies stressed that their ratings were based on a broader assessment of the companies and not just on quantitative ratios. Moreover, different agencies put different weight on different ratios and so there is no single set of ratios which captures the approach of all the rating agencies.

10.27 Table 10.4 was compiled drawing on discussions with rating agencies and inferences from published material. It contains our recommendations on the package of financial ratios which Ofwat should use in its financeability analysis in order to allow WaSCs and WoCs to achieve particular issuer ratings. In some cases, judgements were required in deciding on the appropriate levels to recommend for a particular financial ratio (e.g. when drawing inferences from published material), and hence the recommendations should be treated with caution).

Table 10.2: Recommended package of financial ratios

Ratio	Minimum level if targeting BBB+		Minimum level if targeting A-	
	WaSC	WoC	WaSC	WoC
Cash interest cover (FFO/interest) [112]	Greater than 2.5 times	?	Greater than 3 times	?
Adjusted cash interest cover (FFO – IRC & CCD/ net interest) [113]	Greater than 1.4 times	Greater than 1.6 times	Greater than 1.6 times	Greater than 1.8 times
Post-maintenance interest cover ratio (PMICR) [114]	Greater than 1.5 times	?	Greater than 1.8 times	?
Expected cash flow coverage (FFO/Debt)	Greater than 10%	Greater than 13%	Greater than 13%	?
Retained Cash Flow (RCF) / net adjusted debt [115]	Greater than 6%	Greater than 8%	Greater than 8%	Greater than 10%
Net debt to RCV[116]	Below 70%	Below 65%	Below 65%	Below 60%

Notes: The thresholds in the table are those for traditionally financed non securitised companies. Agencies said that they generally gave a higher rating (perhaps one notch higher) to companies with a securitised structure.

Different ratios have different weightings for different agencies, and not every ratio is used by each agency.

Where different agencies indicated different thresholds for a particular rating we have included the more stringent threshold.

The PMICR ratios are those we believe are required for issuers to obtain the target credit ratings. However, achieving these credit ratings on senior unsecured debt, for a traditionally financed water company, might be possible at lower levels of PMICR, since issuer and debt ratings may not always be the same

Source: compiled by Europe Economics from interviews and material published by rating agencies

10.28 WoCs are generally required to have higher levels for the ratios than WaSCs as they are deemed by rating agencies to be higher risk with less ability to absorb shocks. WoCs therefore have different thresholds in the table. The gaps in the table indicate where we have not been able to obtain an estimated threshold.

10.29 Other ratios mentioned by the agencies as being of important which are not included in Table 10.4 included: net cash flow: capex; and dividend cover ratios.

112 FFO, plus interest paid, minus operating lease adjustment to depreciation/ interest

113 IRC equals infrastructure renewals charge, CCD equals current cost depreciation. CCD and IRC are broadly equal to depreciation of the RCV

114 (FFO + interest – nominal RCV depreciation) / interest

115 Retained cash flow equals operating cashflow minus tax paid minus interest paid, minus dividends paid.

116 (debt – cash & cash equivalents)/ RCV

Impact of the credit crunch/ recession on credit ratings

10.30 How likely companies are to be affected by market conditions depends on how much the sector is cyclical or non-cyclical. The water sector is not very cyclical and therefore does not tend to be heavily affected by market conditions. Business risk in the sector is also generally regarded as being low.

10.31 In general the agencies do not tend to downgrade companies as a result of conditions which are viewed as cyclical. They tend to instead take a longer term view and consider the reasons for weakened ratios and whether ratio levels are likely to recover.

Other factors affecting credit ratings

10.32 Factors mentioned by rating agencies as influencing water sector ratings in the medium term were the Cave review and opening of the market to competition. However, anticipated changes were unlikely to be reflected in ratings until they were finalised. PR09 issues likely to influence ratings included the WACC, the size of the capex programme; decisions about capex scheduling; opex and capex efficiency targets; and the treatment of bad debts and pensions.

Calculating interest payments in the financeability testing

10.33 A crucial issue which arises for Ofwat in carrying out its financeability testing is how interest payments on existing debt should be calculated. The approach adopted on this matter is likely to have a significant effect on whether the industry's interest cover ratios allow it to maintain the target credit rating of A-.

10.34 For the purpose of discussion, consider the following two approaches:

(a) Applying our forward-looking cost of debt estimate to all of the industry's debt;

(b) Applying the industry's average embedded cost of debt to existing debt, and our forward-looking cost of debt to new capital raised over AMP5 (i.e. our proposed crisis cost of debt to debt taken out up to summer 2011 and our proposed post-crisis cost of debt to debt taken out thereafter)

10.35 In our view, which approach is appropriate depends on the purpose of financeability testing:

(a) If the purpose is to test whether the WACC calculation is internally consistent, such that a new entrant raising all of the notionally assumed level of debt at current market rates would be able to maintain the assumed credit rating, then the first approach would be appropriate.

(b) On the other hand, if the purpose is to act as a "reality check" on whether the industry would actually be able to finance its functions given its actual debt structure, then the second approach would be appropriate.

10.36 To consider the second of the above points further, consider a company (not necessarily a water company) that had £2bn of assets, including £1bn of historic debt at 1 per cent. Then suppose the cost of debt rises to 100 per cent. And suppose that this company wished to borrow £1,000. Would ratings agencies, assessing the appropriate rating on this company for the purposes of this £1,000 bonds issuance (its financial robustness as a borrower), apply the 100 per cent interest rate to the whole £1,000,001,000 of debt, or just to the £1,000 with the rest at 1 per cent? It seems clear that the latter would be the approach adopted.

10.37 Hence, we recommend that Ofwat adopt the second approach in testing whether the industry can finance its functions — applying the actual historic costs of debt to historic debt and the WACC to new capital. It can be argued that this is more appropriate conceptually given that the forwards-looking cost of debt estimate only applies to new debt. It is also more realistic, in that it more closely reflects the industry's actual position. In the current context, it may also assist Ofwat in demonstrating that its proposals will allow companies to finance their functions, since we understand that embedded interest costs are lower than our forward-looking cost of debt (although we recognise that this would not always be the case).

10.38 Note that this is not at tension with the rejection of embedded debt adjustments in assessing the WACC, for the WACC calculation and the financeability analysis have different purposes — the former aims to identify the correct forwards-looking cost of capital adequate for the company to engage in new investment; the latter aims to test whether the WACC determination leaves the company able to finance its actual functions.

Historical Levels of Financial Ratios

10.39 We now examine the levels of financial ratios obtained by companies in recent years. Table 10.3 presents the six core financial indicators used at PR04 to assess financeability, together with their corresponding threshold levels.

Table 10.3: Ranges for financial indicators used by Ofwat at PR04

Ratio	Value
Cash interest cover (FFO/gross interest)	Around 3 times
Adjusted cash interest cover i (FFO less capital charges/gross interest)	Around 1.6 times
Adjusted cash interest cover ii (FFO less capital maintenance expenditure/gross interest)	Around 2 times
FFO/debt	Greater than 13%
Retained cash flow (RCF)/debt	Greater than 7%
Gearing (net debt/regulatory capital value)	Below 65%

Source: Ofwat, Future water and sewerage charges 2005-10: Final determinations, p233

10.40 (We note that the package of financial ratios Ofwat used at PR04 is similar to the ratios we recommend in Table 10.4 for achieving A- for WaSCs.)

10.41 Table 10.6 shows some key financial indicators for the water and sewerage sectors as a whole over the five years between 2003 and 2008.

Table 10.4: Key financial indicators for the sector as a whole

	2003-04	2004-05	2005-06	2006-07	2007-08
Cash-based indicators					
Cash interest cover (net)[117]	3.8	3.5	3.6	4.5	3.8
Cash interest cover (gross)[118]	3.5	3.2	3.2	3.7	3.3
Adjusted cash interest cover i[119]	1.7	1.5	1.5	1.7	1.6
Adjusted cash interest cover ii[120]	2.1	2.1	2.0	1.9	1.8
Debt payback period (years)	5.1	5.2	4.9	5.3	5.5
Cash flow: capital expenditure	50.4%	60.8%	67.0%	28.7%	67.2%
Funds from operations: debt	14.0%	13.4%	14.3%	13.2%	12.5%
Retained cash flow: debt[121]	8.1%	8.7%	8.0%	2.6%	8.2%
Accounting-based indicators					
Historic cost dividend cover[122]	1.1	1.1	1.0	1.5	1.3
Current cost dividend cover	1.1	1.2	1.0	1.7	1.3
Interest cover	2.0	1.9	2.5	2.3	2.1
Gearing[123]					
Gearing – net debt/RCV	59.3%	61.2%	58.5%	62.2%	66.0%

Source: Ofwat: Financial performance and expenditure of the water companies in England and Wales 2007-08

10.42 As can be seen by comparing Table 10.3 and Table 10.4 above, overall the industry has stayed within the levels indicated at PR04 for the majority of indicators for most of the period 2003-2008, although in 2007-08 average levels of gearing rose above the 65 per cent level.

10.43 Table 1.5 shows gearing levels of water and sewerage and water only companies during the period 2003- 08.

117 Cash interest cover (net) is calculated as: net cash flow from operating activities/ net interest.
118 Cash interest cover (gross) is calculated as: funds from operations/ gross interest.
119 Adjusted cash interest cover i is calculated as (funds from operations less capital maintenance charges)/ gross interest
120 Adjusted cash interest cover ii is calculated as: (funds from operations less capital maintenance expenditure)/ gross interest.
121 Retained cash flow: debt is calculated as: (funds from operations less dividends paid)/ net debt.
122 Dividend covers exclude capital restructuring dividends. Dividend covers in the table additionally exclude all special dividends, thereby eliminating distortions to the industry trends.
123 Net debt and gearing excludes loans to group companies for the purposes of capital restructuring.

Table 10.5: Gearing of the water companies in England and Wales (%)

	2003-04	2004-05	2005-06	2006-07	2007-08
Water and sewerage companies					
Anglian	82.2	89.7	78.6	85.5	88.1
Dŵr Cymru	83.4	79.6	73.7	74.3	71.2
Northumbrian	59.5	61.5	58.0	57.1	57.5
Severn Trent	48.9	48.2	47.2	55.1	57.8
South West	54.6	55.2	61.2	59.6	58.4
Southern	85.5	85.6	95.8	94.4	92.8
Thames	47.9	46.6	44.4	49.8	67.9
United Utilities	52.9	58.7	51.3	48.8	52.9
Wessex	67.9	70.0	63.1	62.2	64.3
Yorkshire	39.7	39.8	42.2	60.6	60.4
Total WaSCs	60.2	61.6	58.4	62.3	66.3
Water only companies					
Bournemouth & W Hampshire	20.9	18.2	52.3	78.0	52.6
Bristol	67.4	58.1	75.6	71.9	70.2
Cambridge	13.0	57.5	51.9	50.1	50.7
Dee Valley	50.5	55.2	48.6	49.7	53.8
Folkestone & Dover	33.9	34.3	42.4	40.4	40.6
Mid Kent	81.1	78.1	77.4	75.8	80.3
Portsmouth	75.9	79.5	73.2	69.9	71.2
South East	34.3	78.8	82.2	84.0	87.0
South Staffordshire	65.2	66.8	80.5	69.9	71.7
Sutton & East Surrey	51.3	52.9	89.4	68.2	71.4
Tendring Hundred	18.2	14.3	15.6	17.4	19.6
Three Valleys	34.8	36.0	32.5	30.3	33.4
Total WoCs	45.6	55.7	60.2	60.3	61.2
Industry	59.3	61.2	58.5	62.2	66.0

Source: Ofwat "Financial performance and expenditure of the water companies in England and Wales 2007-08".

10.44 There is wide variation in gearing levels between companies with gearing in 2007/08 ranging from 19.6 for Tendring Hundred to 92.8 for Southern.

Implications of Targeting A-/BBB+

10.45 When Ofwat carries out the financial modelling to see whether a particular credit rating is achieved, it will need to make certain assumptions concerning the feasibility of the issuance of equity and index linked debt.

10.46 Since the decline of the monoline insurers it is unclear as to how feasible it is for companies to issue index linked debt in the forthcoming review period. There may be scope for the issuance of unwrapped index linked debt, but this is uncertain. Around 25 per cent of debt currently issued by companies is index linked so even without further issuance it will still feature prominently on balance sheets.

10.47 We consider that it is realistic to expect companies to engage in new equity formation in the forthcoming review period. In the first instance, this could be done by retaining profits by cutting dividends. We see no reason in principle why companies could not also engage in new rights issues.

Conclusion

10.48 Ofwat has a duty to ensure that companies are able to finance the proper carrying out of their activities as licensed undertakers. In previous regulatory price determinations a credit rating of BBB+ has been considered sufficient for companies to raise debt finance on reasonable terms.

10.49 In our March paper, in order to reflect the changes in the cost of raising debt finance in late 2008/ early 2009, we suggested that Ofwat's financeability analysis should be carried out using target ratings of both BBB+ and A-, although our notional gearing assumption was chosen with the aim of allowing all companies (WaSCs and WoCs) to maintain a rating of at least A-.

10.50 We note that in the latest market data, the wedge between the yields on bonds with a BBB+ rating and those with a A- rating has now narrowed significantly. It would therefore be possible to now argue for the targeting of a BBB+ rating. However, as it is unclear to what extent the financial crisis is over, and whether the market conditions experienced in late 2008 / early 2009 might reoccur, we continue to suggest that the financeability analysis should be carried out targeting both a BBB+ and A- rating. We also continue to suggest that notional gearing should be chosen with the aim of allowing all companies (WaSCs and WoCs) to maintain a rating of at least A-.

10.51 Based on our discussions with rating agencies, our recommended package of financial ratios is set out in Table 10.4 above. WoCs would generally be required to achieve higher financial ratios that WaSCs in order to achieve the same credit rating, and this is reflected in our recommendations. However, two points should be noted: whilst, in principle, this approach could yield different notional gearings we believe that different notional gearing levels should only be adopted if the differences between the gearings suggested by the financeability analysis were sufficiently large. For example, if the WaSC figure turned out to be 65 per cent and the WoC figure 62 per cent, we would probably recommend the use of a single figure — perhaps 65 per cent. Second, (and connected to the first point) one important lesson of the Modigliani-Miller theorem is that differences in gearing do not necessarily imply differences in the overall cost of capital — and this would be particularly true for small differences in gearing. Hence, although we recommend the use of different

financial ratios for WoCs and WaSCs, we by no means consider it likely that this will eventually imply different recommended costs of capital for WoCs and WaSCs.

10.52 Our view that if financeability problems are driven by the use of large amounts of nominal debt, then the appropriate solution is for companies to use less nominal debt (instead using other financing arrangements such as equity or index-linked debt). This implies that financeability issues should be addressed through the choice of the notional gearing level or through the assumptions made about the type of debt issued by companies. In addition, financeability problems arising in later years of AMP5 could also be addressed by assuming new equity formation, as discussed above. This suggested approach is in line with Ofwat's preference for market-led solutions to any perceived financeability problems.

11 SUMMARY OF RECOMMENDATIONS

11.1 In this report we have analysed the cost of capital and calculated the results using the CAPM-WACC framework. We have cross-checked our results against various alternative approaches. In particular:

(a) The Fama-French cross-check produced no statistically significant results for the SMB and HML factors, whilst the beta factor was broadly compatible with the CAPM findings.

(b) The DGM results have been used to produce an additional estimate for the post-tax cost of equity at 54 per cent level of gearing.[124]

11.2 Our estimate of the cost of capital for the UK water sector during AMP5 is presented in Table 11.1. **Our recommendation for the post-tax real cost of capital is 4.3 per cent** (after weighting the crisis and post-crisis WACCs and then aiming up).

11.3 The derivation of this figure is as follows:

(a) Based on the WACC components discussed in previous sections, our crisis WACC is 4.0 per cent and our post-crisis is 3.5 per cent (both quoted on a post-tax basis);

(b) Placing a 45 per cent weight on the crisis WACC as discussed above gives a weighted post-tax WACC for AMP5 of 3.7 per cent.

(c) Applying the 14.4 per cent mark-up to this figure to take account of the potential asymmetry of consequences gives a final WACC recommendation of 4.3 per cent on a post-tax basis.

[124] As discussed in Section 9 we think that the re-leveraging exercise is not appropriate in the DGM framework.

Table 11.1: Recommendations on the WACC

	Crisis	Post-crisis	Weighted WACC
Cost of equity			
Risk-free rate	1.75	1.75	
Equity risk premium	6	5	
Equity beta (not relevered)	0.65	0.65	
Asset beta	0.28	0.28	
Re-levered equity beta	0.62	0.62	
Post-tax cost of equity	5.48	4.86	
Pre-tax cost of equity	7.61	6.74	
Cost of debt			
Debt premium	2.2	1.5	
Pre-tax cost of debt	3.95	3.25	
Post-tax cost of debt	2.84	2.34	
Overall WACC			
Notional gearing	55%	55%	
Corporation tax rate	28%	28%	
Pre-tax WACC	5.6	4.8	5.2
Post-tax WACC	**4.0**	3.5	**3.7**
"Vanilla" WACC	4.6	4.0	4.3
Marked-up figures to take account of asymmetric consequences			
pre-tax WACC	6.4	5.5	5.9
post-tax WACC	**4.6**	**4.0**	**4.3**
"vanilla" WACC	5.3	4.5	4.9

11.4 Concerning potential differences in the costs of capital for WoCs and WaSCs we find at this stage no compelling reason to assign different costs of capital to these companies.

11.5 In order to show what the marking up implies for equity providers, we have calculated the cost of equity which would be consistent with a post-tax WACC of 4.3 per cent, assuming no marking up on the cost of debt. The results of this calculation are as follows:

(a) With no marking up on the cost of debt, the weighted average of the crisis and post-crisis estimates of the cost of debt is 3.6 per cent on a real pre-tax basis.

(b) Our overall WACC estimate of 4.3 per cent combined with this cost of debt would imply a cost of equity of 6.3 per cent on a real post-tax basis.

11.6 We consider that this cost of equity would provide ample incentive for investors to provide further equity to the sector, and is thus consistent with Ofwat assuming the formation of

new equity (whether by changes in dividend policy or by new rights issues) in order to deal with any perceived financeability problems.

11.7 Our recommendation is that Ofwat carry out its financeability analysis for credit ratings of both A- and BBB+ for bonds and that the financial ratios employed be as follows.

Table 11.2: Recommended package of financial ratios

Ratio	Minimum level if targeting BBB+		Minimum level if targeting A-	
	WaSC	**WoC**	**WaSC**	**WoC**
Cash interest cover (FFO/interest) [125]	Greater than 2.5 times	?	Greater than 3 times	?
Adjusted cash interest cover (FFO – IRC & CCD/ net interest) [126]	Greater than 1.4 times	Greater than 1.6 times	Greater than 1.6 times	Greater than 1.8 times
Post-maintenance interest cover ratio (PMICR) [127]	Greater than 1.5 times	?	Greater than 1.8 times	?
Expected cash flow coverage (FFO/Debt)	Greater than 10%	Greater than 15%	Greater than 14%	?
Retained Cash Flow (RCF) / net adjusted debt [128]	Greater than 6%	Greater than 8%	Greater than 8%	Greater than 10%
Net debt to RCV[129]	Below 70%	Below 65%	Below 65%	Below 60%

Notes: The thresholds in the table are those for traditionally financed non securitised companies. Agencies said that they generally gave a higher rating (perhaps one notch higher) to companies with a securitised structure.

Different ratios have different weightings for different agencies, and not every ratio is used by each agency.

Where different agencies indicated different thresholds for a particular rating we have included the more stringent threshold.

Source: complied by Europe Economics from interviews and material published by rating agencies

11.8 We continue to recommend that there be no embedded debt or financeability adjustments.

[125] FFO, plus interest paid, minus operating lease adjustment to depreciation/ interest

[126] IRC equals infrastructure renewals charge, CCD equals current cost depreciation. CCD and IRC are broadly equal to depreciation of the RCV

[127] (FFO + interest – nominal RCV depreciation) / interest

[128] Retained cash flow equals operating cashflow minus tax paid minus interest paid, minus dividends paid.

[129] (debt – cash & cash equivalents)/ RCV

APPENDIX 1: ASSESSING THE RISK-FREE RATE: ALTERNATIVES TO GOVERNMENT GILTS

Standard Regulatory Approaches

CAA's approach to the risk-free rate determination

A1.1 The most recent regulatory decision on the risk-free rate relevant to the UK water sector is the CAA's decision on BAA in March 2008.

A1.2 The CC's recommendation, adopted by CAA in setting BAA's price controls in 2008, was for a risk-free rate of 2.5 per cent, building on evidence on yields to maturity for five- and ten years UK index-linked gilts (ILGs) (including forwards), over different historic periods from 1-day to 10-year. The CC noted that relatively low yields on long dated ILG yields could be the result of distortions in the government bonds market.

A1.3 CAA had been cautious in trusting the (then recent) market evidence on the risk free rate, consistently using an estimate above the prevailing long-term government gilt yields. However, the observed gilt rate had been well below the values typical in previous regulatory determinations for many years, and Europe Economics had urged that it would be a mistake to feel overly bound by these past regulatory precedents. Europe Economics' interpretation of how previous regulatory judgements related to the very much lower data on gilts was approximately as follows:

- Older regulatory judgements reflected gilts data in the 2.5-3.0 per cent range;
- When the return on gilts fell initially in the late 1990s, there was uncertainty as to what extent this reflected temporary policy-driven distortions or other temporary features, and hence it may have been appropriate that judgements initially leant upon older historical data even though the risk-free rate is a forward-looking concept.
- Because a disconnect arose, through the mechanism in (b) between the observed data and regulatory practice, regulatory precedent started to gain a higher weight in regulatory judgements. This meant that regulatory judgements continued to come in at figures well above those indicated by the data, even long after the uncertainties appropriately reflected at step (b) had been resolved.[130]

A1.4 In essence, the Europe Economics' view was that the forward-looking data could not be ignored indefinitely, and that it was time for regulators to start adopting markedly lower risk-free rate judgements. Indeed, there was a concern that ignoring consistent market

[130] For example, for the sample of determinations chosen by NERA (NERA, 2008, *Cost of capital for PR09 Final Report for Water UK*) the average risk-free rate over the period from 2001 to 2007 is 2.6 per cent. Index-linked gilt returns were below 2 per cent for virtually the entire period from 2003.

evidence of a low risk free rate might be seen as a windfall gain to the regulated companies, and as contrary to the regulators' duties to protect consumers.

A1.5 (We note here that another possible interpretation of regulators' actions is that setting the risk free rate above market levels was a (perhaps unconscious) "fudge" to take account of the embedded debt taken out by regulated companies in the past when market rates were higher.)

The Smithers & Co approach

A1.6 The Joint Regulators Study[131] by Smithers & Co (2003), although it did not set out explicitly a way to estimate the risk-free rate for regulatory purposes, did investigate a number of related issues. Smithers & Co urged that the risk-free rate and the equity risk premium should be forward-looking and based on international data, not simply UK data. They also contended that estimates of the sum of the risk-free rate and the equity risk premium will be subject to markedly less volatility and uncertainty than estimates of the parameters separately.

A1.7 To determine the "safe rate" the authors propose different alternatives.

- Future prices;
- Non market forecasts;
- Government bond yields;

A1.8 For estimation purposes they offered the following solution:

- If the relevant time horizon for measuring returns is one day, the safe asset used is the overnight money market rate (e.g. LIBOR);
- With monthly data, both the monthly LIBOR and the return on one month treasury bills are used for robustness checks. The results do not change. Although the real return on such assets is not certain, because inflation is not entirely predictable, with very short time horizons of under a month the divergence between the degree of certainty of real and nominal returns is small; with daily data it would only be an issue in times of hyperinflation.

NERA Critiques

A1.9 In its report for Water UK, NERA criticizes the CC's judgement on the ground that it is essentially subjective, "since it only matched the average yields on short term (5 years) ILGs over an arbitrary historical period of 3 months". NERA contends that the CC's

[131] Note that Ofwat was one of these Joint Regulators.

judgement thus does not meet the requirement to be based on "objective and transparent methods".

A1.10 NERA's report claims that ILG yields do not provide a reliable basis for estimation of the risk-free rate, for two reasons:

- The impact of regulations and accounting requirements such as the Minimum Funding Requirement (MRF), FRS17 and IAS19, which had created high and inelastic demand for government gilts.
- A flight to safety effect, driving investors into safe assets following the bursting of the dotcom "bubble".

A1.11 NERA states that these factors "have caused yields to be distorted from the true risk-free rate…because they are not related to fundamental changes in investors' preference over risk". A Bank of England statement dated 1999[132] is offered as evidence to confirm this interpretation of the collapse in real yields.

A1.12 NERA presents an alternative method to estimate the "true" risk-free rate based on swap rates. The risk free rate is constructed by subtracting a measure of the interbank risk[133] (or AA credit risk) from the implicit swap rate. The real rate is obtained by stripping out expected inflation from the nominal rate.[134]

A1.13 The report states that the swap market does not suffer from the same distortions as the government gilts market — namely illiquidity, even on long-dated maturities, and supply constraints. Hence "the swap curve can be regarded as lying at fair value".[135]

Difficulties with the NERA view

A1.14 There are a number of issues relating to NERA's analysis. First of all, the correlation between the swap based real-free risk measure and the IL Gilt yield is very high and even higher if one excludes the period 1999-2001. The two series responded almost in the same way to different shocks, as shown by NERA's graph which is copied below. Since the motivation for using the swap-based approach was purportedly to correct for distortions created by pension funding rules and the collapse of the dotcom "bubble", it is problematic that the swap-based approach estimate shows downward dips at precisely those points the ILG series is alleged by NERA to be downward-distorted. The natural conclusion is that either the swap markets share the same distortion as ILG markets (in which case is there really any advantage to using them?) or the alleged distortion does not exist.

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[132] Bank of England, 1999, Quarterly Bulletin, May.
[133] Measures of the interbank risk can be extracted from market data on Credit Default Swap (CDS) contracts or market indices thereof.
[134] This is done using the Fisher equation, which specifies the relationship between the real interest rate, the nominal interest rate and the rate of inflation.
[135] NERA, 2008, *Cost of capital for PR09 Final Report for Water UK*, p.20.

A1.15 Next, NERA acknowledges that the swap-rate based series appears to decline over the past ten years.[136] Despite this they employ an average over the period — thereby materially increasing their estimate. A key driver for this is the brief period from 1999-2001 in which the average gap between the ILG yields and the swap base risk-free rate was considerably elevated. It seems very odd to argue for the use of a swaps-based approach on the basis of avoiding distortions, then choose an implementation of the approach that makes the final answer highly dependent on a rather old apparent distortion from 1999-2001. Indeed, if the swap rate point estimate from the end of the data series were used, reflecting the forwards-looking nature of the risk-free rate, a figure below 2 per cent would be recommended.

A1.16 Also, NERA report does not prove that the decrease in real ILG yields is due to regulatory changes, but only brings anecdotic evidence. The statement of the Bank of England cited above is dated 1999, only at the beginning of a period of declining interest rates, increased global liquidity and adverse economic cycle. It might have been more convincing to bring a more recent statement — it is perfectly plausible that the Bank of England's 1999 statement represented a speculation about a temporary distortion, and that the sustained nature of the effect would lead it to have revised its interpretation over time. The CC, considering the evidence presented by NERA, was not persuaded that the swap rates provided a stronger basis for determining the risk-free rate than ILGs. In addition NERA proffer the phenomenon of yield curve inversion (described as "contrary to economic theory"[137]) as a proof that risk-free rate estimates based on ILGs are unreliable. However, this type of yield curve is not contrary to economic theory. Yield curves are usually considered to be upwards-sloping reflecting the risk of inflation being higher out into the future, and have only been "normal" since the Second World War. In the late nineteenth century, for example, in an era of ongoing deflation, yield curves were consistently downwards-sloping. An inverted yield curve merely implies a different expected path for future interest rates from a downwards-sloping curve, and even in inflationary times an inverted yield curve has been considered a good predictor of economic downturn (and hence interest rate cuts). A recent example is when the U.S. Treasury yield curve inverted in 2000 just before U.S. equity markets collapsed. An inverse yield curve predicts lower interest rates in the future as longer-term bonds are in demand, driving yields down.

A1.17 As pointed out by the Financial Times[138] pension funds in the UK (and in other European countries as well) have increasingly engaged in derivatives operations. The development of derivatives markets has gone hand in hand with these trends. In the UK, for example, a strong two-way market in inflation-linked swaps has become established since the late 1990s, driven by the complementary demands of both pension funds and corporates. The use of inflation-linked swaps can supposedly significantly increase the efficiency of

[136] NERA, 2008, *Cost of capital for PR09 Final Report for Water UK*, p.24.
[137] NERA, 2008, *Cost of capital for PR09 Final Report for Water UK*, p.19.
[138] FT Mandate, 2005, March

institutional portfolios. This is because government bonds cannot perfectly match liabilities and expose a fund to significant reinvestment risks. For example, inflation-linked gilts are available in the UK up to 2035 maturities, while pension fund liabilities can extend up to 80 years into the future. Swaps, by contrast, can be constructed to match an arbitrarily long maturity profile. On top of all this, index-linked gilts do not grant asset managers the potential to "add alpha" — positive company-specific return — by active management.

A1.18 In addition the acknowledged inelasticity of government gilts demand from institutional investors is likely to prevent ILGs with shorter maturity from being affected from the distortions alleged by NERA.

A1.19 We agree that it would be useful to have some more explicit basis for deciding how much to "aim up" from the ILG data if that is indeed necessary. However our current view is that it would be more productive first to explore the use of non-index-linked gilts, though the differing tax treatments of index-linked and non-index-linked gilts, movements in the inflation risk premium, and the length of the available time series could make it appropriate to apply adjustments to the results of non-index-linked gilts analysis.

Appendix: Further Details on the MFR and FRS17

Background

A1.20 The Minimum Funding Requirement (MFR) was introduced in the Pensions Act 1995 in response to the Maxwell fraud scandal, and came into effect in April 1997. It was abolished in the Pensions Act 2004 and replaced by "scheme specific" funding requirements. The MFR was not a solvency standard and in fact was little more than a "minimal" funding standard.

A1.21 Financial Reporting Standard 17 (FRS17) was issued by the Accounting Standards Board in November 2001 and replaced the previous UK accounting standard for pension costs, SSAP24.

A1.22 For accountancy periods beginning on or after 1st January 2005, UK listed companies are required by European Union (EU) regulations to adopt international accounting standard 19 (IAS19) and which is broadly similar to FRS17, which it replaces.

The method of calculation

A1.23 Under MFR pension scheme assets and liabilities were valued as follows:

- The scheme's assets were valued at market levels.
- The scheme's liabilities were divided between pensioners and those who had not retired and discounted to a capital value at different discount rates. For pensioners in payment, the rate was the prevailing market yield on gilts (though for some large schemes, liabilities could be discounted using an assumed long

term rate of return on UK equities). For pension rights of scheme members not yet retired, the rate was broadly the assumed long term rate of return for UK equities before retirement and for gilts after retirement, adjusted by a "market value adjustment" factor to reflect prevailing UK equity dividend yield.

A1.24 FRS17 starts from the assumption that the assets and liabilities of a pension scheme are essentially the assets and liabilities of the sponsoring employer, and as such should be recognised at fair value on the company balance sheet.

- The assets of the scheme should be valued at market value at the balance sheet date. Fair value is taken as mid-market value for quoted companies. For unitised securities the average of bid and offer price is used. For unquoted securities an estimate of fair value is used. Property is valued at open market value or in accordance with guideline of the Royal Institute of Chartered Surveyors (RICS).

- The liabilities are measured at the balance sheet date using a projected unit method and discounted at an AA corporate bond rate of appropriate term. Financial assumptions should reflect market conditions at the balance sheet date. For example, the standard suggests that the difference between the yields on longer dated inflation-linked bonds and fixed interest bonds of a similar credit rating can be used to derive market expectation of future price inflation.

- The pension scheme surplus or deficit is recognised in full on the balance sheet.

A1.25 IAS19, like FRS17, aims to give an understanding to the reader of a set of financial statements of the state of the company's defined benefit pension scheme and whether they were sufficient assets to cover liabilities, but:

- Under IAS19, the discount rate is based on high quality corporate bonds which could include bonds rated below or above AA.

- While under FRS17 the gains and losses are recognised immediately in the Statement of Total Recognised Gains and Losses (the "fair value" method), with IAS19 there are three methods of treating gains and losses. The "fair value" method can be used, but there is the option to recognise gains and losses through the income statement (P&L account) using a "spreading" method which can be done in one of two ways. The first approach is immediate recognition of all actuarial gains and losses. The second approach is to amortise actuarial gains and losses that exceed 10 per cent of the defined benefit obligation or 10 per cent of the fair value of the plan's assets over the average of the employees' remaining working lives.

The implications: how to reduce volatility

A1.26 The MFR was judged to distort investment decision-making by its use of a set of reference assets to calculate discount rates for liabilities, namely UK quoted equities and gilts. Pension funds were not required to invest in these assets, but to do so was the best

way of minimising volatility against the funding standard. To quote from the Myners review (2001), "A number of respondents also felt strongly that the MFR was distorting the gilts market, with adverse consequences for capital allocation and economic efficiency, as well as an impact on annuity prices."

A1.27 Likewise, FRS17 uses a discount rate based on AA rated corporate bond yields. By investing in this type of security, expected balance sheet volatility might be significantly reduced. Companies might thus consider investing a higher proportion of pension plan assets in this way. Similar considerations apply to IAS19, though there is a bit more flexibility since "high quality corporate bonds" might be higher or lower than AA.

A1.28 If in practice a significant number of pension plans did switch investment into corporate or other bonds, the thought of those that believe this might have created a distortion appears to be that additional demand would (perhaps temporarily, perhaps permanently, depending on the account offered of the alleged distortion) drive down the yields available on those investments.

Two paradoxes

A1.29 The case offered above would seem to suggest that index-linked gilt returns are distorted by excess demand. It is a view widely held in the City, and repeated in our interview discussions. But this creates two paradoxes:

- First, if index-linked gilt returns fall, why does this not create an arbitrage opportunity versus non-index-linked gilts, given that the latter can be combined with other financial instruments (e.g. inflation swaps) to achieve a similar effect?[139] And if it does not, where is the alleged volume limitation effect arising from under-supply of index-linked gilts? Surely a small under-pricing of index-linked gilts versus non-index-linked gilts would make it more attractive to use non-index-linked gilts in combination with other instruments to achieve the same benefits of matching cash inflows and outflows?

- Second, if index-linked securities are so much more efficient for this matching purpose, and yet index-linked gilts have distortedly low returns, why would firms not switch, instead, to the use of index-linked bonds — either in high ratings or (if such were insufficiently available) in diversified packages of lower-rated index-linked bonds?

A1.30 These paradoxes weaken the argument that the gilt market is being affected by a distortion.

[139] Even in a scenario in which accounting rules meant that a combination of non-index linked debt and inflation swaps failed to achieve the same accounting benefits, this could in theory be addressed through a small amount of additional expenditure explaining to investors the effect of accounting distortions on published company results.

Other considerations

A1.31 Suppose that the demand for index-linked gilts has indeed been affected by the new accounting rules, and more fundamentally by an increased realisation that they are suitable assts for pension funds to hold. If gilts are defined as the relevant risk-free asset for CAPM, such that the yields on gilts are by definition the risk-free rate, then it could be argued that any reduction in gilt yields caused by accounting rules represents a genuine reduction in the risk-free rate rather than a distortion. However, this approach hinges upon acceptance of a definition of the risk-free rate which is open to challenge.

A1.32 Related to this, and more persuasively, if accounting rules have reduced the yield on corporate inflation-linked bonds as well on gilts, then this would imply a genuine reduction in the cost of debt finance for water companies which should taken into account in setting the cost of capital. On the other hand, to the extent that there are currently constraints on the ability of companies to issue inflation-linked bonds (see section 10 on financeability), this would tend to reinforce the second paradox discussed above.

Conclusion on Alternatives to Gilts for Assessing the Risk-Free Rate

A1.33 Though other sources of evidence may well be relevant and useful, including swap rates, evidence of the yields on index-linked gilt securities should continue to represent the single most important piece of evidence in assessing the risk-free rate.

APPENDIX 2: REVIEW OF REGULATORY PRECEDENTS ON COST OF CAPITAL

Competition Commission: Stansted

A2.1 The Airports Act of 1986 requires the Civil Aviation Authority (CAA) to set maximum limits on airport charges for BAA's London airports (Heathrow, Gatwick and Stansted) and Manchester airport. The CAA is required, by statute, to refer its proposed price controls for each airport to the Competition Commission (CC) for review, although the CAA remains the final decision-making body. The Competition Commission presented its recommendations on the maximum level of airport charges that Stansted Airport would be able to levy during the five year period beginning on April 1st 2009 (Q5) on 23 October 2008 (well into the current financial crisis).

Gearing

A2.2 Based on analysis of current debt market conditions, meetings with the three main ratings agencies, and CC's own modelling approach, they settled on a notional 50 per cent gearing level. In the previous price control period, the CC had chosen to base their cost of capital calculations in line with BAA's actual gearing, while in its earlier Q5 recommendations on Heathrow and Gatwick (discussed later), CC recommended using a notional gearing assumption consistent with maintaining a solid investment-grade credit rating.

A2.3 In reaching this particular decision, the CC also believed that their notional gearing level should enable the airport to maintain a solid or comfortable investment grade rating. While a solid investment grade rating was interpreted as BBB+/Baa1 for Heathrow and Gatwick during Q5, the CC were advised that in current market conditions companies with these ratings would be able to raise new debt finance only as long as they were prepared to meet lenders' demand on price. The timing of new issues also had to be planned more carefully and companies typically had to access both bond and bank debt markets. In contrast, companies with ratings in the A category had been less affected by the market turmoil. With ongoing uncertainty around current and future debt markets, the CC decided to adopt a notional gearing level of 50 per cent (as opposed to 60 per cent with Heathrow and Gatwick), which was believed to be consistent with ratings of A3/A-.

Cost of debt

A2.4 The CC decided on a range between 3.4 per cent and 3.7 per cent for the cost of debt for Stansted in Q5, which breaks down as follows.

Table A1.1: Summary of cost of debt calculation for Stansted by CC

Component	Weight	Annual cost (%)
New and floating-rate debt	0.5	3.6 to 3.9
Embedded fixed-rate debt	0.5	3.1 increasing to 3.3
Fees	-	0.1
Total		3.4 to 3.7

Source: Competition Commission

A2.5 In exploring the relationship between gearing, credit ratings and the cost of debt the CC took into account the following aspects:

(a) The cost of debt for new issuance and floating rate debt; and

(b) The cost of embedded debt

A2.6 The CC employed a benchmarking approach with regards to the cost of debt for new issuance and floating rate debt, whereby benchmarks were obtained from the secondary market for debt with A and BBB credit ratings, and from rates observed in recent issuance by comparable regulated entities. On this basis, they concluded that a regulated company with an A3/A rating would, in present market conditions, be expected to pay between 6.5 and 6.8 per cent interest a year on floating-rate debt, which equates to a real cost of debt between 3.6 and 3.9 per cent, with an assumed average RPI of 2.8 per cent a year for the five year period.[140]

A2.7 In considering the cost of embedded debt, the CC decided to focus on the financing that BAA raised prior to its acquisition by ADI Ltd in 2006, and reported that BAA had secured a cost of debt in nominal terms between 6.0 and 6.2 per cent (3.1 to 3.3 percent in real terms) on £4.5 billion of financing. The CC assigned a 50:50 weighting to new and floating rate debt against embedded fixed-rate debt.

A2.8 Finally, the CC made an adjustment to allow for ongoing commitment, agency and arrangement fees paid respectively to lenders, rating agencies and arrangers of finance – a total allowance of 10 basis points.

A2.9 The combination of these three elements gave rise to a 3.4 to 3.7 per cent range.

Cost of equity

A2.10 The risk free rate and equity risk premium (ERP) are economy-wide parameters, and hence recent decisions by other regulators are of direct relevance to Ofwat.

[140] This stems from an assumption of an annual average 4.0 per cent RPI inflation in 2009/10 with 2.5 per cent RPI inflation thereafter.

Risk free rate

A2.11 The CC decided to stick with the traditional approach of using Index Linked Gilts (ILGs) to infer the risk free rate, and chose an assumed risk free rate of 2.0 per cent for the rest of Q5, based on up-to-date observed yields on shorter maturity ILGs.

A2.12 The CC noted that, at the time, the yield curve for ILGs was inverted, and believed that yields on longer dated ILGs were not a good estimator for the RFR for a typical investor.[141] Thus the CC relied on data from 3, 5 and 10 year ILGs.

A2.13 Further, the CC refuted NERA's assertion that evidence from the ILG market should be ignored altogether, and the risk free rate should be derived from interest rate swaps. The CC identified a number of concerns with NERA's methodology: NERA took a ten-year historical average rather than making a more forward-looking estimate; NERA's risk free rate included an inflation risk premium; and research shows that only a proportion of the differential between the return on gilts and the return on other financial assets can be attributed to credit risk, the rest being a liquidity premium or convenience yield.

A2.14 In the Heathrow and Gatwick review, the CC had recommended a risk free rate of 2.5 per cent but they recommended a lower value of 2.0 per cent during this review to reflect latest market data. This revision was believed to recognise the re-pricing of risk and increase in investor risk aversion, which has increased their willingness to accept lower returns on risk-free assets.

Equity risk premium

A2.15 The CC focused on overall market return (derived by adding an equity risk premium to the risk free rate). The CC believed that the expected return on the market portfolio remained in the range of 5.0 to 7.0 per cent, as proposed in the 2007 review for Heathrow and Gatwick. At the time, the range for the equity risk premium (ERP) was 2.5 per cent to 4.5 per cent, and the risk free rate was estimated at 2.5 per cent.

A2.16 Thus, the fact that the CC assumed a lower risk free rate this time must mean an increase in their ERP assumption. In its concluding remarks the CC notes that:

> "…the expected return on the market has, if anything, increased slightly during the last 12 months at a time when the expected return on risk-free assets has fallen. It would be illogical for us to have retained our previous range for the equity-risk premium in the absence of any reason to believe that a lower risk-free rate had translated into a lower cost of equity."[142]

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141 The reasons put forward to explain the current inversion include: segmented market hypothesis; and regulatory and accounting requirements of pension funds such that only pension fund investors are buying long dated gilts at current prices.

142 Stansted Airport Ltd: Q5 price control review, Appendix L, pp L19, October 2008

A2.17 The CC stated that, although recent market data, forward looking models and/or geometric averages may suggest a return at the lower end of the range, this has to be weighed against support for the top end of the range from studies using historical data, especially when arithmetic averages are used. The CC concluded that a range for the market return between 5.0 and 7.0 per cent was a fair reflection of current academic and company estimates.

Equity beta

A2.18 Here the CC faced a problem in that Stansted is not a listed company, and therefore its equity beta could not be estimated directly from market data. Thus they relied on disaggregation of BAA's group beta estimated prior to its de-listing and comparisons with similar businesses, reaching the conclusion that the equity beta for Stansted was in the range 1.00 to 1.24.

A2.19 The analysis drew on the following two types of evidence:

(c) The CC's 2007 assessment of asset betas for Heathrow, Gatwick and the remainder of BAA.

(d) Direct estimates of asset betas for regulated utilities, international airports and UK stock market.

A2.20 The CC was faced with the view from BAA that its historical beta was no longer an appropriate reflection of shareholders' current perception of its risk, in light of evidence of a slowdown in demand for air travel and rising oil prices since 2007.[143] However, upon examining the updated betas of non-BAA comparators, the CC concluded that these betas had stayed broadly the same as compared with their historical value, and therefore it could continue to have confidence in the historical estimate of BAA's beta.

A2.21 The next step was to consider Stansted's beta relative to that of Heathrow and Gatwick and the rest of BAA. The CC agreed with previous assessments by the CAA and BAA which suggested that Stansted was riskier than Heathrow and Gatwick, and therefore its asset beta *could not be lower* than those of Heathrow and Gatwick. With regards to BAA's other non-regulated activities (including other airports, property interests and World Duty Free), the CC felt that the risk facing Stansted was *no greater than* the risk facing these other businesses.

A2.22 On this view, the CC was able to infer that the upper limit for their range of beta estimate should be equal to the beta of these other businesses, which was 0.61. Attaching a point estimate to the lower end of the range proved difficult, since although the consensus was that Stansted was more risky than Gatwick, it was unclear how much more risky it was.

[143] BAA was de-listed in 2006 following its acquisition by ADI in 2006, and therefore more current market data is not available.

Thus the CC decided to choose 0.61 as their final point estimate for the asset beta of Stansted, with a range of 0.06 above and below to allow for estimation error. Re-levering of the asset beta into an equity beta using the 50 per cent notional gearing assumption resulted in a range for the equity beta of 1.00 to 1.24.

Overall WACC

A2.23 Having determined the range for the allowed WACC, and undertaken further comparisons with the 2007 recommendations on Heathrow and Gatwick, as well as considerations of the risk of underinvestment versus over-compensation, the CC believed 7.1 per cent to be the appropriate cost of capital for Stansted.

Table A1.2: Summary table of cost of capital estimates for Stansted at Q5

Component	BAA base case		BAA alternative case		CC	
	Low	High	Low	High	Low	High
Gearing (%)	50	50	50	50	50	50
Pre-tax cost of debt (%)	3.39	4.30	3.39	4.30	3.40	3.70
Risk free rate (%)	1.75	2.25	1.75	2.25	2.0	2.0
Return on market (%)	5.25	7.75	5.25	7.75	5.0	7.0
Equity risk premium (%)	3.50	5.50	3.50	5.50	3.0	5.0
Equity beta	1.26	1.33	1.50	1.79	1.00	1.24
Post-tax cost of equity (%)	6.16	9.57	7.00	12.10	5.00	8.20
Taxation	28	28	28	28	28	28
Pre-tax cost of equity (%)	8.56	13.28	9.72	16.80	6.94	11.39
Pre-tax real WACC (%)	5.97	8.79	6.56	10.55	5.20	7.54
Point estimate of WACC (%)	7.38		8.55		7.10	

Source: CC

A2.24 Finally, the CC recognised the current volatility of financial markets and recommended that the CAA continue to monitor the markets and take into account any new information, particularly concerning any significant re-pricing of long-term risk, before passing its final judgements.

A2.25 Following the CC's report, the CAA released a consultation document with its proposals for setting new price controls on 9th December 2008. In this, the CAA expressed satisfaction with the CC's approach and result:

> The CAA therefore considers that the Commission's cost of capital estimate is a reasonable and appropriate basis for constructing a RAB-based price cap.[144]

[144] Stansted airport: CAA price control proposals; CAA, 9 December 2008, pp. 58

A2.26 Although the CAA reviewed more recent market data, it concluded that the CC's estimate of the risk free rate and its overall estimate of the cost of capital did not need to be changed.

Office of Rail Regulation

A2.27 On 30 October 2008, the ORR released a report which formed the culmination of the periodic review it conducted during the year to set Network Rail's outputs, revenue requirement and access charges for the five years from 1 April 2009 to 31 March 2014. Their decision forms the first periodic review for Network Rail and is one of the two most recent regulatory decisions on the cost of capital in the UK, undertaken in the context of present market turmoil.

A2.28 The ORR has stated its intention to provide Network Rail with an allowed return that reflects its risk-adjusted cost of capital.[145] The original estimates for the cost of capital were derived in June 2007 and updated in April 2008 to reflect market conditions at the time – an exercise which increased the preferred range for the cost of capital from 4.30 - 4.70 per cent to 4.70 - 4.90 per cent. The draft determinations, released in June 2008, set the allowed return at 4.70 per cent on a real vanilla basis.

A2.29 The final decision taken by the ORR in October 2008 was to revise the cost of capital set out in its draft determinations slightly upwards from 4.70 per cent to **4.75 per cent**. Below we outline the analysis undertaken by the ORR's advisors – CEPA – in April 2008 and highlight any subsequent updates. Since the company is not listed, the cost of capital is calculated on the basis of that cost of capital which would be faced by an efficient, conventionally financed business with assets comparable to those of Network Rail's.

Gearing

A2.30 After reviewing market evidence and regulatory precedents, CEPA took the view that a 60 to 65 per cent range for gearing would be defensible. However, it advised the ORR to employ a 60 per cent gearing assumption for the higher end of the WACC range, keeping 62.5 per cent as the upper end of the range. In reaching this conclusion, CEPA took the view that Network Rail needs to maintain an A- credit rating rather than BBB+ to finance itself in current market conditions.

A2.31 In the end, a 'conservative' notional gearing of 62.5 per cent was used in calculating the WACC range.

Cost of debt

A2.32 There were two types of debt considered here: cost of raising unsupported debt; and cost of embedded debt.

A2.33 The April 2008 analysis reported a range of 2.70 – 3.00 per cent real for the cost of embedded debt. This compares with a range of 3.00 per cent to 3.75 per cent for the real cost of unsupported debt. Following the post-April updating, CEPA concluded that the real cost of unsupported debt at the beginning of CP4 should be 4.00 per cent.

A2.34 Having said that, CEPA advised that it was likely that there would be a reduction in the cost of real unsupported debt over CP4 as a result of: a reduction in the new issuer premium; greater familiarity with Network Rail's business risks and credit quality; and possibly increased demand for regulated utility debt. In the end, taking into account recent market developments, Network Rail's proposed capital programme (recent analysis was based on lower capital expenditure), and low cost of embedded debt, CEPA concluded that the weighted average cost of debt should remain in the range consistent with its earlier April findings – **3.25 to 3.50 per cent**.

A2.35 The risk free rate and debt premium (defined as the spread over gilts on corporate bonds) were estimated as part of the methodology. CEPA found a substantial increase in the debt premium since June 2007 (at the time they had indicated the debt premium for A-rated bonds was around 100 basis points). The table below provides spot and 5-year averages for the debt premium.

Table A1.3: Spreads on A- 10, 20 and 30 year corporate bonds

Time series	10 year maturity	20 year maturity	30 year maturity	Weighted average
Spot	1.9	1.9	2.0	1.9
5 year average	0.9	0.9	1.0	0.9

Source: CEPA

Cost of equity

A2.36 An appropriate range for this component of the WACC was thought to lie between 6.5 – 7.0 per cent in the April report, with the belief that the point estimate should be set towards the top end of the range. The calculations of the cost of equity were designed to reflect the financial framework proposed by ORR, in which the cost of capital should be set in line with the WACC of a notional conventionally financed Network Rail.

Risk free rate

A2.37 In determining the appropriate risk free rate, CEPA looked to both UK nominal gilts and UK index-linked gilts, calculating weighted average real yields for 10, 20 and 30 year maturities of index-linked gilts, and the implied real yield on zero coupon nominal gilts. The table below summarises their findings, showing weighted average real yields for 10,

[145] Determination of Network Rail's outputs & funding for 2009-14, pp 227

20 and 30 year maturities of index-linked gilts and the implied real yield on zero coupon nominal gilts.

Table A1.4: Estimates of real risk-free rates

Time series	Index-linked gilts	Deflated nominal gilts
Spot	1.0	1.1
5 year average	1.6	1.8
10 year average	n/a	2.2

Source: CEPA

Equity risk premium

A2.38 CEPA conduct a brief overview of the impact of the financial crisis on the ERP, as well as a review of longer-term studies on the appropriate range for the ERP. Evidence to support a higher ERP is observed such as higher volatility in equity markets and comments from a city institution saying that headline rate of ERP could be as high as 7 per cent.

A2.39 However, CEPA remain of the view that a reasonable long-term range for the ERP is 3.0 – 5.0 per cent, consistent with Smithers (2003).

Equity beta

A2.40 Here CEPA assumed a value of 1 for the equity beta. They pointed out that this estimate was conservative given recent observations of 'flight to quality' effect; however they did not adjust their estimate of beta downwards because doing so can often lead to implausibly low estimates for the cost of capital.

A2.41 Finally, CEPA had used MARs as a cross-check in its June 2007 analysis, and a recap of this analysis and current market evidence implied that the actual cost of equity was not higher than the allowed cost.

Table A1.5: The range for WACC as of April 2008

Component	Lower estimate	Upper estimate
Post-tax cost of equity (%)	6.50	7.00
Pre-tax cost of debt (%)	3.25	3.50
Gearing (%)	62.50	60.00
Post-tax vanilla WACC (%)	4.50	4.90

Source: CEPA

A2.42 As discussed earlier CEPA's preferred range was 4.7 – 4.9 per cent, and the WACC was eventually settled at 4.75 per cent.

CAA: Heathrow and Gatwick

A2.43 The discussion that follows relates to the CAA's final decision, as published in March 2008, on the appropriate cost of capital for Heathrow and Gatwick for the five year period commencing 1 April 2008 (Q5). In November 2007, the CAA adopted the CC's recommendations on the WACC, setting it at 6.2 per cent for Heathrow and 6.5 per cent for Gatwick on a pre-tax real basis.

Gearing

A2.44 A notional gearing assumption of 60 per cent was used, where gearing was defined as net debt to RAB. This was believed to be consistent with companies achieving a solid investment grade rating which at the time was interpreted as BBB+/Baa1. The CAA believed that this struck an appropriate balance between efficiency and robustness, despite calls from stakeholders to revise this assumption in different directions.

Cost of debt

A2.45 The CAA focused its analysis of the cost of debt on the aggregate yield, looking at the funding costs faced by utilities in the past five years at a range of maturities, rather than estimating the individual components.

A2.46 Subsequent to its November 2007 release of a real cost of debt of 3.55 per cent (inclusive of ongoing commitment, agency and arrangement fees), the CAA received numerous analyses of the market data since the onset of greater financial unrest, with different parties vying for adjustments to the original estimate. In the end, the CAA believed there was no 'compelling evidence' to indicate that there had been a fundamental shift in the cost of debt and therefore chose to maintain it at 3.55 per cent.

Cost of equity

A2.47 The CAA also reviewed the evidence it received in relation to the cost of equity, following its November proposals, in light of the view that there may have been 'contagion' to equity markets in the months leading up to the final decision.

Risk free rate

A2.48 The CC, in its recommendations to the CAA, proposed a point estimate for the risk free rate of 2.5 per cent, based on analysis of both historic data on 5 and 10 year index-linked gilts, and forward rates up to the middle of Q5.

A2.49 While the CAA acknowledged the more recent market evidence on the decline in gilt yields, it felt it was 'prudent and internally consistent' to retain the CC's recommendation of a 2.5 per cent risk free rate.

ERP

A2.50 Combined with an ERP assumption of 4.5 per cent, the implied post-tax real market return on equity was 7.0 per cent. The CAA notes that this was right in the middle of the range produced by Smithers and Co. (2003).

Equity beta

A2.51 In arriving at an estimate for the asset beta of BAA, which was delisted in 2006, the CAA gave regard to the analysis of group asset beta for BAA prior to its takeover and delisting, as well as asset betas of broadly comparable companies. The stand-alone estimates of individual airport betas derived from this analysis were re-levered to the notional gearing level to produce equity beta estimates.

A2.52 With regards to the debt beta, the Commission's assessment was based on the decomposition of the debt premium, which gave rise to a range of 0.10 to 0.19. The CAA settled on a cautious assumption of 0.10 for the debt beta in its final assessments.

Table A1.6: Summary of CAA determination of WACC for Heathrow and Gatwick for Q5

Parameter	Heathrow			Gatwick		
	Low		**High**	**Low**		**High**
Gearing (%)		60			60	
Pre-tax real cost of debt (%)		3.55			3.55	
Risk-free rate (%)		2.50			2.50	
Equity risk premium (%)	2.50		4.50	2.50		4.50
Equity beta	0.90		1.15	1.00		1.30
Post-tax real cost of equity (%)		7.3			7.9	
Taxation (%)		28			28	
Pre-tax real cost of equity (%)		10.2			10.9	
Pre-tax real WACC (%)		6.2			6.5	

Source: CAA

Ofgem DPCR5

A2.53 Ofgem sets price controls for 14 monopoly regional electricity distribution network operators every five years. The ongoing price review, to set prices for the period 1 April 2010 to 31 March 2015, saw initial proposals published on 3 August 2009. The final decision is due to be made in the winter.

A2.54 PriceWaterhouseCoopers (PwC) were commissioned to assist Ofgem in estimating the cost of capital. Capital market volatility over the months preceding the initial proposals prompted the cost of capital calculations to be based more heavily on long-term data, although the impact of more recent evidence was accounted for. An initial range for the Vanilla WACC has been estimated at 3.5 per cent to 5.6 per cent. We outline the thinking behind this range below.

Gearing

A2.55 A notional gearing range of 55 to 65 per cent was taken, which was believed to be consistent with credit ratings "comfortably within investment grade".[146]

Cost of debt

A2.56 The volatility in capital markets and subsequent cost of debt uncertainty continues to be a matter of concern in setting cost of capital. The Bank of England's quantitative easing scheme has included the Bank purchasing bonds in electricity distribution networks; however, the sustainability and pace of this relative recovery remains uncertain.

A2.57 Ofgem's preference is to continue with its current approach to setting the cost of debt. It points out that the network businesses typically have long-term debt finance (although some incremental borrowing would be required to finance substantial investment plans) and therefore they are sheltered somewhat from volatile capital markets. In any case, they are of the view that long-term debt is available at rates that are consistent with recent price control decisions, if inflation returns to levels typical in the last ten years.

A2.58 However, PwC proposed the following alternative approaches to deal with continued cost of debt uncertainty:[147]

(e) a more explicit price control disapplication clause making it clearer that DNOs can approach Ofgem for a new settlement if circumstances changed significantly within the price control period,

(f) a mechanistic adjustment (or trigger mechanism) that gave the DNOs extra revenue when a suitable indicator of market interest rates rose above a certain level for a sustained period (and symmetrically reduced revenues if it fell below a certain level).

(g) a substantial effects clause, which would specifically state the circumstances in which Ofgem would consider a reopener of DPCR5,

(h) a time based reopener which would require Ofgem to review allowed revenues if interest rates hit a trigger point.

A2.59 Ofgem have opened these options up to consultation although they indicated their reservations about these mechanism-based approaches, in particular, the second option which would require extensive work on developing a suitable trigger mechanism. Thus it considers that that the RPI-X@20 review provides a more suitable forum for further exploration of these suggestions.

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146 Ofgem (2009) "Electricity distribution price control review initial proposals – allowed revenues and financial issues" 3 August 2009, p9

147 Ofgem (2009) "Electricity distribution price control review: Initial proposals"" 3 August 2009

Cost of equity

A2.60 In line with the precedents set by past UK regulatory decisions, PwC advocated the use of CAPM as the main methodology.

Risk free rate

A2.61 It has been proposed to base the calculation of the risk free rate on ILG data putting greater weight on five to ten year averages rather than the current spot rates. It was felt that the use of alternative approaches such as swap data would be too fraught with difficulties in relation to the quality of the data and thus this method could only be used as a cross-check along with nominal gilts. The estimated range for the risk free rate was between 1.9 per cent and 2.5 per cent.

Equity risk premium

A2.62 The ERP was based primarily on *ex post* (historic) evidence although recent regulatory decisions and forward looking methods such as the DGM were also used as a cross check. A range of 4.0 per cent to 5.5 per cent was identified.

Equity beta

A2.63 A range for the equity beta of between 0.5 and 1.1 was calculated.

Summary

A2.64 The Table below summarises the ranges for the cost of capital components in Ofgem's initial proposals for DPCR5.

Table A1.7: WACC range suggested by Ofgem's advisers

	Minimum	Maximum
Risk free rate (%)	1.9	2.5
Equity beta	0.5	1.1
Equity risk premium (%)	4.0	5.5
Cost of equity (%)	4.0	8.5
Debt spreads (%)	1.2	1.5
Cost of debt (%)	3.1	4.0
Gearing (%)	55	55
Vanilla WACC (%)	3.5	5.6

Ofgem DPCR4

A2.65 We also summarise Ofgem's previous decision during DPCR4, which applies to electricity Distribution Network Operators (DNOs) and covers the period from 1 April 2005 to 31 March 2010.[148]

Ofgem DPCR4

A2.66 Ofgem released a consultation on DPCR5 on the 5th December 2008, with its initial views on the cost of capital due to be released in July 2009, and the final decision to be published in December 2009. Ofgem states that it will continue to monitor developments closely, particularly the effect of recent government policy on the availability and cost of debt instruments. This review summarises Ofgem's previous decision during DPCR4, which applies to electricity Distribution Network Operators (DNOs) and covers the period from 1 April 2005 to 31 March 2010.[149]

A2.67 Ofgem used a post-tax approach to the cost of capital, and consulted on the range 4.2 per cent to 5.0 per cent before its final proposals. Ofgem's initial proposals from June 2004 saw a modelling assumption of 4.6 per cent for the cost of capital, which was subsequently set at 4.8 per cent post-consultation.

Gearing

A2.68 Ofgem's final proposals, released in November 2004, adopted a notional gearing level of 57.5 per cent. Earlier in June, the initial proposals had indicated a gearing level of 60 per cent, which was subsequently revised following a consultation process. Ofgem quoted evidence of the time which indicated that Moody's considered a debt to RAV gearing level in the range of 60 per cent to 65 per cent to be consistent with target A3 (A-) ratings for comparable regulated network businesses.

Cost of debt

A2.69 Ofgem's intial and final proposals put forward a pre-tax cost of debt figure of 4.1 per cent.

A2.70 Ofgem examined the evidence on debt premiums in recent years. Although the premium had been volatile in the year 2000, it displayed a more stable trend thereafter. Because of considerable uncertainty regarding the cost of debt, Ofgem adopted a wide range for the debt premium of 1.0 per cent to 1.8 per cent in its cost of capital calculations. Combining with the range for the risk free rate gave rise to a range for the real cost of debt of 3.25 per cent to 4.80 per cent.

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148 Ofgem, Electricity distribution price control review: final proposals, November 2004
149 Ofgem, Electricity distribution price control review: final proposals, November 2004

Cost of equity

A2.71 For the final proposals, Ofgem adopted a post-tax real cost of equity figure of 7.5 per cent – the top end of the range published in earlier proposals.

Risk free rate

A2.72 Ofgem reviewed the most recent decisions on the risk free rate by the CC, who had at the time concluded on a range of 2.5 per cent to 2.75 per cent. The CC had looked at yields on 5, 10, and 20 year index-linked gilts in arriving at its decision. Ofgem acknowledged that since the CC rulings, yields has dropped even further. Given the sensitivity of both the cost of equity and the cost of debt to the risk free rate, Ofgem went for a wide range in its March 2004 proposals, widening the CC range by 0.25 per cent on either side which gave a range for the risk free rate of 2.25 per cent to 3.00 per cent.

Equity risk premium

A2.73 Ofgem conducted a thorough review of empirical evidence on the return on equity, including Dimson, Marsh, and Staunton (2001), and Wright, Mason and Miles (2003), as well as survey evidence. In the end, Ofgem referred to the CC's most recent decision on the matter, in which the ERP was believed to lie between 2.5 per cent to 4.5 per cent (implied return on equity was in the range of 5.00 per cent to 7.25 per cent). Ofgem did not believe there to be any strong evidence to deviate from this range; they did however believe that it was more likely that the higher end of this range was more relevant.

Equity beta

A2.74 Ofgem had adopted an equity beta of 1 in the previous price review, and in examining the evolution of equity betas since then, they found that they had fallen from approximately 1 between 1993 and 1999 to 0.3 in 2004. Ofgem went on to consider whether this was down to changing risk profile of the companies or other factors.

A2.75 Ofgem commissioned Smithers and Co. to produce a report estimating betas for a range of companies in the water and electricity sector. The report produced beta estimates on a daily, weekly and monthly basis within the CAPM framework, using the FTSE All-Share Index and a broader market index as a proxy for the market portfolio. The report also accounts for the impact of the TMT (Technology, Media and Telecommunications) bubble around the turn of the millennium.

A2.76 In light of the Smithers and Co. report and Ofgem's own analysis of the evidence, Ofgem proposed a range for equity beta of 0.6 to 1 in its March proposals.

Table A1.8: Cost of capital assumptions for DPCR4

	Mid point from initial proposals and September update	Final proposals
Cost of debt (%)	4.10	4.10
Cost of equity (%)	7.25	7.50
Gearing (%)	60.00	57.50
Vanilla WACC (%)	5.40	5.50
Pre-tax WACC (%)	6.60	6.90
Post-tax WACC (%)	4.60	4.80

Source: Ofgem

Ofgem TPCR4

A2.77 This review concluded with Ofgem's final proposals released in December 2006 for the maximum revenue that the four electricity and gas transmission licensees could extract from consumers and other network users over the five year period commencing on 1 April 2007. Ofgem concluded on a pint estimate for the vanilla WACC of 5.05 per cent.

A2.78 Ofgem commissioned Smithers & Co. to provide advice on various components of cost of capital during this review. Ofgem conducted an assessment of differential risk – considering the relative risks faced by transmission and distribution companies. For the purposes of this price review though, Ofgem did not believe there was sufficient robust evidence to suggest that transmission was a lower risk activity as compared with distribution. Further, Ofgem took the view that the same cost of capital should be set for each of the transmission companies.

Gearing

A2.79 Ofgem concluded that a notional gearing level of 60 per cent would be appropriate, having reviewed the available evidence and anticipated financing needs of the companies. This level was broadly consistent with actual gearing levels and the approach adopted in the previous price review.

Cost of debt

A2.80 One of Ofgem's main stated objective for this price review was to "facilitate the necessary capital formation (debt and/or equity) to enable the expected investment in the networks."[150] Ofgem believed that the appropriate range for the pre-tax real cost of debt was between 3.5 per cent and 4.0 per cent.

[150] Ofgem; Transmission price control review: final proposals, December 2006

A2.81 The risk free rate was based on the recommendation in the Smithers & Co. report that the best long-term estimate of the risk free rate was 2.5 per cent. This was also broadly consistent with previous regulatory decisions.

A2.82 With regards to the debt premium, Ofgem noted that the observable premium on utility debt was at historically low levels at the time (in the range of 98 to 130 basis points). Because Ofgem wished to take a longer term view on appropriate returns, it decided to use a cost of debt figure above that implied by market conditions of the time. Analysis of long-term average of the debt premium supported the range 1.0 per cent to 1.5 per cent.

Cost of equity

A2.83 In setting a cost of equity Ofgem gave regard to the CAPM framework as well as wider market evidence, including the aggregate return on equity over time.

Risk free rate

A2.84 As mentioned earlier, the Smithers report recommends a risk free rate of 2.5 per cent.

A2.85 Two important questions were raised in the analysis of the risk free rate: (a) recent past had shown that differences between yields at different maturities (the term premia) had virtually disappeared, but was this a temporary phenomenon? and (b) Should regulators look to yields on nominal or indexed bonds?

A2.86 The report drew on the recent path of inflation forecasts which lent support to the view that indexed yields were providing an unduly depressed picture of forward-looking real returns. The report observed that although the Bank of England's official inflation forecast was lowered from 2.5 per cent to 2.0 per cent, implicit inflation forecasts with the period actually rose closer to 3 per cent. They believe that the most likely explanation for this is that the gap between nominal and real yields is not purely a forecast of inflation, but also contains a risk premium element (i.e. that indexed bonds have traded at an increasing risk *discount*).

A2.87 They note that:

> "Since regulated companies issue barely any indexed debt this suggests that using indexed yields as a benchmark in setting the cost of capital may tend to bias the cost of debt downwards, and that it would be more appropriate to focus on nominal yields, and their associated term premia."[151]

A2.88 Their conclusions on the risk free rate are as follows:

[151] Smithers & Co; Report on the cost of capital provided to Ofgem, September 2006

In the absence of any evidence of a significant term premium, probably the best current market-based estimate of the forward-looking real interest rate is the nominal yield on medium-dated bonds, less the Bank of England's inflation target of 2%: thus a figure of around 2 to 2 ½%. This is remarkably close to that in the benchmark "Taylor Rule", and to the estimate in Mason, Miles and Wright (2003).

Equity risk premium

A2.89 The market return on equity was evaluated during DPCR4 (discussed above), and reviewed by Smithers & Co. in its assessments. The Smithers study found no compelling evidence to deviate from the range for the real arithmetic market return on equity of between 6.5 and 7.5 per cent considered during DPCR4. They note that the real equity return appears remarkably stable over time and across country.

A2.90 Combined with a real risk free rate of 2.5 per cent, this implies an arithmetic equity risk premium of 4 to 5 per cent.

Equity beta

A2.91 The Smithers study found evidence that beta estimates of the time were lower than 1, although they had varied considerably since privatisation. In view of the scale of capital expenditure requirements, Ofgem believed it was important that the assumed cost of equity was sufficient to enable companies to withstand unanticipated risks and to attract and retain equity funding. Although Ofgem wanted to err on the side of caution with its beta estimate, it gave weight to the Smithers finding and chose to adopt a somewhat lower estimate for beta than the one chosen at DPCR4.

Overall WACC

Table A1.9: Overall WACC estimates by Ofgem at TPCR4

	Updated proposals	Final proposals
Risk free rate (%)	2.30	2.50
Debt premium (%)	1.10	1.25
Cost of debt (%)	3.40	3.75
Cost of equity (%)	7.00	7.00
Gearing (%)	60	60
Tax (%)	30	30
WACC (real pre-tax) (%)	6.00	6.25
WACC (after tax at 30%) (%)	4.20	4.40
WACC (vanilla) (%)	4.84	5.05

Source: Ofgem

A2.92 The pre-tax return outlined above is calculated on the basis of a traditional tax wedge assumption. Ofgem's Final Proposals provided an allowance for the expected tax payments becoming due in respect of each year of the new price control, reflecting expected capital allowances and interest payments based on assumptions about gearing.

Ofgem GDPCR4

A2.93 The final proposals, published on 3 December 2007, reset the price control, which specifies the maximum revenue that a network can recover from its customers for the five year period commencing on 1 April 2008.[152] This was the first review, following the sale of four of the gas distribution networks (GDNs) by NGG in 2005, that Ofgem has been able to make meaningful comparisons between the GDNs.[153]

A2.94 Ofgem intended the allowed return on the RAV to be at least equal to the licensee's cost of capital, and set the overall WACC at 4.94 per cent real.

Gearing

A2.95 Ofgem considered a gearing level of 62.5 would be consistent with a credit rating comfortably within investment grade. This approach was consistent with the last price review, and compares with a 60 per cent gearing assumption adopted for the transmission review. This reflects the lower financing requirements, and therefore the lower financial risk, facing transmission companies, as well as observed gearing levels.

Cost of debt

A2.96 By the time the final proposals were released in December 2007, difficulties had already started to become apparent in debt markets. In its initial and updated proposals Ofgem maintained that an appropriate value for the cost of debt was 3.55 per cent, which appropriately balanced the spot rates for the cost of debt, the ten year trailing average, and long-term averages.

A2.97 Ofgem recognised that it had become more difficult to raise substantial levels of finance in markets towards the latter half of 2007, as compared with the benign market conditions in the preceding years. Ofgem believed that the risk of such difficulties was already accounted for through the approach of setting revenue allowances which are consistent with a credit rating comfortably within investment grade, pointing out that where utilities were raising new debt, it was at rates that were often considerably below their assumed cost of debt.

A2.98 Thus they chose to maintain the cost of debt at 3.55 per cent, concluding that it properly balanced the cost of debt over different time periods.

Cost of equity

A2.99 Ofgem assumed a real post-tax return on equity of 7.25 per cent in its final proposals. This compares with the 7.00 per cent assumed in TPCR4.

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152 Ofgem; Gas distribution price control review: final proposals, December 2007

153 The total number of GDNs during the course of this review was eight.

A2.100 Ofgem based the allowed rate of return on equity on the estimated equilibrium level of total market returns, as in TPCR4 and DPCR4. In a review of relative risk, Ofgem concluded that GDNs were overall no less risky, and may be somewhat more risky, than the transmission companies under the current price controls. This lent support to the view that the allowed rate of return on equity for GDNs should be no lower, and could be somewhat higher, than the 7.0 per cent rate assumed in TPCR4.

A2.101 Ofgem recognised that, all other things being equal, the use of a higher gearing assumption should lead to a commensurately higher expected rate of return on equity, reflecting the greater financial risk borne by shareholders. But it was also apparent that the empirical data relating to UK utilities did not fully support the view that the relationship between gearing and expected rate of return on equity was a continuous linear function.

A2.102 Although there may have been other factors affecting the market data and therefore distorting the predicted positive correlation between gearing and equity betas, Ofgem did not believe it would be appropriate to disregard the market evidence entirely.

Overall WACC

A2.103 Taking the above considerations together, Ofgem concluded that an appropriate allowed vanilla return on capital in this instance was 4.94 per cent real.

Table A1.10: Overall WACC estimates by Ofgem at GDPCR4

	Updated proposals	Final proposals
Cost of debt (%)	3.55	3.55
Cost of equity (%)	7.00	7.25
Gearing (%)	62.50	62.50
Vanilla WACC (%)	4.84	4.94

Source: Ofgem

Ofcom

A2.104 In August 2005, Ofcom released a statement setting out its approach to estimating companies' weighted average cost of capital and discussing Ofcom's regulatory approach to real options. The statement focused on BT's cost of capital given its importance in the context of the telecoms review and in relation to a number of imminent Ofcom decisions e.g. valuing BT's copper access network, and the network charge controls.

Gearing

A2.105 The market average gearing ratio of the time was around 30 per cent, as supplied by BT. BT's gearing ratio of the time was around 35 per cent. Ofcom used a low gearing assumption of 30 per cent and a high gearing assumption of 35 per cent in its WACC calculations.

Cost of debt

A2.106 In relation to BT's debt premium, Ofcom noted that the yield on some corporate bonds had declined in recent years.

A2.107 In Ofcom's view it would not have been appropriate for Ofcom to exclusively base its estimates of each parameter on current market values, and therefore Ofcom concluded that a debt premium of 1.0 per cent, as used in the PPC statement, represented a reasonable value for BT's debt premium.

Cost of equity

Risk free rate

A2.108 Ofcom considered arguments in favour of both short and long-term gilts as estimates of the risk free rate. The principal argument favouring shorter term gilts is that a duration equivalent to the price-control period may be more appropriate, whereas the principal argument favouring longer term gilts is that BT is required to make investments with an economic lifetime beyond the duration of a typical price control period.

A2.109 In Ofcom's view, the use of 5-year gilts strike a reasonable balance between the above two arguments. Ofcom's preferred approach is to base estimates on current market yields of bonds of an appropriate maturity, but also to analyse yields over a sufficiently long period of time to avoid allowing short run fluctuations to have an impact on its regulatory estimates.

Equity risk premium

A2.110 Ofcom believed that values in the range 4.0 per cent to 5.0 per cent for the ERP were reasonable. Within this range Ofcom took the view that 4.5 per cent was the appropriate value for it to use in estimating a company's cost of capital. This was half a percent lower than Ofcom's previously applied value of 5.0 per cent.

A2.111 Ofcom believed that the downside risk associated with taking too low a value for the ERP (which would discourage discretionary investment) would be more detrimental to the interests of consumers than taking too high a value (which would lead to higher prices to customers) and has tended to the higher end of the possible range.

Equity beta

A2.112 Ofcom took the view that the appropriate value for BT's group equity beta was 1.1, having initially estimated an equity beta of 1.3.

A2.113 Ofcom did not find any statistical data or qualitative reasoning to support the previous estimate of 1.3. Furthermore, statistical evidence offers some (limited) evidence that there is some tendency for equity betas to revert towards 1 over time. In conclusion, Ofcom said:

> "Since analytical reasoning suggests that BT's group equity beta should be around 1; statistical evidence suggests that it is difficult to find a basis for a BT group equity beta far from 1; and arguments from regulatory precedent and practice suggest that it would be undesirable to reduce BT's group equity beta too far, Ofcom concludes that the appropriate approach is a BT group equity beta of 1.1."[154]

Overall WACC

A2.114 Ofcom considered two gearing scenarios for BT to be appropriate (35 per cent and 30 per cent), with the final estimate of the WACC in each case being the simple average of the two gearing scenarios.

A2.115 In summary Ofcom has calculated the following **pre-tax nominal** WACC estimates for BT's different activities:

(i) copper access - 10.0%; and

(j) the rest of BT - 11.4%.

Table A1.11: Estimates of pre-tax nominal WACC for BT's copper access business

	High gearing (35%)	Low gearing (30%)
Risk-free rate (%)	4.6	4.6
ERP (%)	4.5	4.5
Equity beta (%)	0.9	0.8
Cost of equity (post-tax) (%)	8.7	8.4
Debt premium (%)	1.0	1.0
Cost of debt (pre tax) (%)	5.6	5.6
Corporate tax rate (%)	30	30
Cost of debt (post tax) (%)	3.9	3.9
Gearing (%)	35	30
WACC (post tax) (%)	7.0	7.0
WACC (pre tax) (%)	9.99	10.04
Average WACC (pre tax) (%)	10.0	

Source: Ofcom

[154] Ofcom's approach to risk in the assessment of the cost of capital: final statement, Ofcom, August 2005, pp 66

Table A1.12: Estimates of pre-tax nominal WACC for rest of BT

	High gearing 35%	Low gearing 30%
Risk-free rate	4.6	4.6
ERP	4.5	4.5
Equity beta	1.23	1.14
Cost of equity (post-tax)	10.1	9.7
Debt premium	1.0	1.0
Cost of debt (pre tax)	5.6	5.6
Corporate tax rate	30	30
Cost of debt (post tax)	3.9	3.9
Gearing	35	30
WACC (post tax)	8.0	8.0
WACC (pre tax)	11.37	11.42
Average WACC (pre tax)	11.4	

Source: Ofcom

Ofwat PR04

Context

A2.116 This section covers Ofwat's last review of price limits for the 23 water companies in England and Wales for the period April 2005 to March 2010.[155] Ofwat concluded on a WACC of 5.1 per cent in real terms on a post tax basis (or 7.3 per cent pre-tax). This was a weighted average of a real pre-tax cost of debt of 4.3 per cent and a real post-tax cost of equity of 7.7 per cent.

A2.117 Ofwat had initially come up with a range for the cost of capital of 4.2 per cent to 5.3 per cent, but believed a number near the top of the range – in their view 5.1 per cent – should allow companies to "maintain access to the capital markets at reasonable rates and enable the water industry to remain attractive to a diverse range of finance, including equity."

A2.118 In this instance, water only companies were allowed a premium on both the cost of debt and the cost of equity, with the total small company premium skewed towards the cost of equity. The full range for the premium was 0.3 per cent to 0.9 per cent on a post-tax basis, with the actual premium dependent on the size of the company which could fall under any of four different size bands using RCV as a proxy for size.

A2.119 In addition to the CAPM, Ofwat assessed a wide range of evidence, including evidence from the Dividend Growth Model, Market to Asset Ratios and transaction-based evidence.

[155] Ofwat, Future water and sewerage charges 2005-10: Final determinations.

Gearing

A2.120 In setting the cost of capital, Ofwat assumed a consistent level of gearing for all companies. Ofwat proposed a range of 55 per cent to 65 per cent gearing to be consistent with a credit rating that lies comfortably within the investment grade category. Ofwat adjusted companies' opening balance sheets to bring them to the bottom of this range at March 2005. Industry average gearing for 2003-04 was 59 per cent; however, excluding the very highly geared companies lowered this average to 51 per cent.

Cost of debt

A2.121 Ofwat used a range of 80 to 140 basis points for the debt spread on publicly traded debt. They believed that the low debt spreads would be unlikely to be sustained throughout the five-year period and there was a much greater risk that spreads would rise over the period than that they would remain unchanged or fall.

A2.122 In respect of the cost of debt, Ofwat placed greater emphasis on longer term historic averages for the risk-free rate and the debt premium, identifying a range of 3.3 per cent to 4.4 per cent for the cost of debt with the view that higher end of the range was more appropriate. Consequently, the arguments for an embedded debt premium were much weaker, and Ofwat concluded that no additional premium would be required.

Cost of equity

Risk free rate

A2.123 Ofwat used a range for the risk free rate of between 2.5 per cent to 3.0 per cent. This was based on historical average level of yields on medium-term index-linked gilts. Ofwat noted that recent yields appeared suppressed – an average of yields over the six month period preceding Ofwat's analysis came to just under 2.0 per cent. But Ofwat believed simply taking account of the current market spot rates would not lead to a sustainable WACC over the medium term, and thus did not lower its range for the risk free rate.

Equity risk premium

A2.124 On this issue, Ofwat's advisors concluded that the data supported a range of 3.5 per cent to 5 per cent with the view that the top of the range was more appropriate.

A2.125 The Smithers report touched on the difficulties in estimating separately the risk-free rate from the equity risk premium, and suggested that this may be best overcome by examining historic overall equity returns (rather than the individual components). The Smithers study summarised a range of evidence which suggested that equity returns had, over reasonably large samples, been fairly stable over time and across different markets.

A2.126 Ofwat chose to use a range of 6.5 per cent to 8.0 per cent for the cost of equity (the Smithers study reported a range of 6.5 per cent to 7.5 per cent based on arithmetic averaging).

Equity beta

A2.127 Ofgem pointed out that since July 2004 equity betas had averaged just under 0.4. Taken at face value this may imply that equity markets regard investment in water stocks as considerably less risky relative to the time when estimated betas were higher. However Ofwat stated that the low beta factors are more likely to be a statistical product of the increase in market volatility. Work undertaken by Smithers & Co Ltd (2004) for Ofgem recommended that, when betas are unstable, regulators may want to give more weight to an expectation of a beta of 1. Bearing this in mind, Ofwat used a value of 1 for the geared equity beta.

Overall WACC

Table A1.13: Cost of capital estimates during PR04 by Ofwat

	Low	High
Gearing (debt:RCV) (%)	55	55
Cost of equity		
Risk-free rate (%)	2.5	2.5
Equity beta	1.0	1.0
Equity risk premium (%)	4.0	5.0
Cost of equity (post-tax) (%)	6.5	8.0
Cost of debt		
Risk-free rate (%)	2.5	3.0
Debt premium (including transaction costs) (%)	0.8	1.4
Cost of debt (gross of tax shield) (%)	3.3	4.4
WACC (gross of tax shield) (%)	4.7	6.0
WACC (post-tax) (%)	4.2	5.3

Source: Ofwat

Table A1.14: Small company premiums

RCV	Companies	Premiums				
		Total		Equity	Debt	
		Gross of tax shield (%)	Post-tax (%)	Post-tax (%)	Pre-tax (%)	Post-tax (%)
< £70m	Cambridge, Dee Valley, Folkestone & Dover, Tendring Hundred	0.9	0.9	1.5	0.5	0.4
£70m - £140m	Bournemouth & W Hampshire, Portsmouth, Sutton & East Surrey	0.8	0.7	1.3	0.4	0.3
£140m - £280m	Bristol, Mid Kent, South Staffordshire	0.7	0.6	1.2	0.3	0.2
£280m - £700m	South East and Three Valleys	0.3	0.3	0.5	0.1	0.1

Source: Ofwat

APPENDIX 3: HOW OTHER REGULATORS HAVE DEALT WITH FINANCEABILITY

Ofgem

Distribution Price Control Review 5 (DPCR5)

A3.1 In developing the initial proposals for PRCR5 published on 3 August 2009, Ofgem undertook some financeability tests to ensure that businesses would be able to finance themselves.

A3.2 Ofgem tested their financial model for each DNO against the same ratios (and same target values) as in DPCR4 to see whether the proposals would be consistent with a comfortable investment grade under the notional gearing assumption.

Financial indicators used by Ofgem at DPCR5

Ratio	Range
Funds flow from operation (FFO)/Interest	Not less than 3x
Retained cash flow/Debt	Not less than 9%
Debt/ Regulatory asset value (RAV)	Not higher than 65%

A3.3 The test indicated that all the DNOs' financial profiles for 2010-2015 were consistent with a comfortable investment grade. However, the sensitivity of the ratios to the cost of capital component makes it important to review the results again before the final proposals.

A3.4 Ofgem refuted the call by some DNOs to target an A- credit rating explicitly at a time where A rated companies are looked on as more favourably than before as compared with BBB rated companies. Ofgem did not think it practical to link a set of target ratios with a specific credit rating as rating agencies have advised that the rating system allows for a broad range of ratio levels for each rating category. Further other factors such as the quality of the regulatory environment have an influence on the ratings attached. On this basis, Ofgem considers a financial profile which meets their target ratio is broadly consistent with an A- rating without needed to make it an explicit target in itself.

Distribution Price Control Review 4 (DPCR4)

A3.5 This particular price control applies to electricity Distribution Network Operators (DNOs) and covers the period from 1 April 2005 to 31 March 2010.[156]

[156] Ofgem, Electricity distribution price control review: final proposals, November 2004

A3.6 Ofgem endorsed the same approach as in its previous price review and proposed an adjustment to smooth the depreciation allowance over time. For most electricity distribution companies, the lifespan of post-Vesting assets was shortened from 33 years to 20 years once Vesting assets were fully depreciated.[157] In order to maintain neutrality in NPV terms, the difference between asset values obtained using 33 years and 20 years was calculated and added in equal instalments to the depreciation spread over 15 years. The motivation for this adjustment was to avoid a "cliff-face" reduction in depreciation allowances once Vesting assets became fully depreciated.

A3.7 When it came to financeability, Ofgem indicated that it intended to propose price controls that were consistent with the regulated companies being able to maintain credit ratings that were "comfortably within investment grade." Ofgem employed a financial model to examine a range of financial indicators to assess whether the proposals were in line with this requirement.

A3.8 For three indicators, test values consistent with credit ratings comfortably within investment grade were set out, as shown in the table below

Table A2.1: Financial indicators used by Ofgem at DPCR4

Ratio	Range
Funds flow from operation (FFO)/Interest	Not less than 3x
Retained cash flow/Debt	Not less than 9%
Debt/ Regulatory asset value (RAV)	Not higher than 65%

A3.9 Following discussions with ratings agencies, Ofcom concluded that, for standalone distribution companies, weaker test ratios than those shown above could still be consistent with ratings comfortably within investment grade.

A3.10 On the basis of Ofgem's modelling, all the distribution companies, with the exception of EDF-SPN, were able to satisfy the conditions laid out in Table A2.1. The problem with EDF-SPN was that, without further adjustments, the financial indicators would have deteriorated towards the end of the control period. This was largely due to a low starting RAV combined with relatively higher projections of capital expenditure. Ofgem acknowledged that some adjustments were required for EDF-SPN to reflect its particular circumstances, and proposed two adjustments to the price control proposals applicable to EDF-SPN only, in order to:[158]

> "adjust the balance between the P0 and X factors, to provide additional revenues in the latter years of the price control period when cash flow would otherwise be weakest, by

[157] Vesting assets refer to those assets held by the company during privatisation of the regional electricity companies in 1990, while post-Vesting assets relates to operational assets acquired after privatisation.

[158] Ofgem, Electricity distribution price control review: final proposals, pp 114, November 2004

setting X so that prices increase by RPI+2 in 2006/07 and thereafter, with a corresponding reduction in the P0 value to ensure that the present value of revenues continues to equal the present value of costs and other allowances; and

provide an additional revenue allowance of £1.6m per year to provide a small cushion against downside risks and improve the projected financial ratios."

A3.11 Taken together, Ofgem believed that these adjustments would be sufficient to move the company to comfortable investment grade range. They also reiterated that these adjustments were designed to reflect EDF-SPN's particular circumstances and should not be considered a standard adjustment procedure for other companies (or indeed SPN at a different review) faced with similar financial ratios.

A3.12 Hence, Ofgem used a mixture of price sculpting within the price control period alongside additional revenue allowances to ensure financeability was maintained for the company whose financial ratios were not adequate (the latter element appearing to be similar to the approach taken by Ofwat at PR04).

Transmission Price Control Review (TPCR4)[159]

A3.13 This review concluded with Ofgem's final proposals for the maximum revenue that the four electricity and gas transmission licensees could extract from consumers and other network users over the five year period commencing on 1 April 2007.

A3.14 As with DPCR4, Ofgem intended to propose price controls that were consistent with the regulated companies being able to maintain credit ratings that were comfortably within investment grade. In analysing the impact of its final proposal, Ofgem considered a range of capital expenditure scenarios. They indicated that if their proposals did not allow licensees to maintain appropriate credit ratings, they would assume that this meant companies would require additional equity and, as such, an appropriate allowance for the direct costs of equity issuance would be made.

A3.15 Ofgem employed the financial ratios set out in the table below in its assessment.

Table A2.2: Financial indicators used by Ofgem at TPCR4

Ratio
Debt to RAV
Funds flow from operation to RAV
Funds flow from operation plus interest to interest

[159] Ofgem Transmission price control review: final proposals, December 2006

A3.16 Where the above mentioned financial ratios for a licensee showed a deteriorating trend, such that in the final year of the forthcoming price control this would result in a credit rating of BBB/Baa2 or lower, Ofgem assumed that new equity would be raised earlier in the period to stabilise the ratios at a level which would be consistent with a rating comfortably within the investment grade.

A3.17 Consultation with the ratings agencies helped determine the hurdle level necessary to trigger this. If financial ratios that were problematic in earlier years became acceptable by the final year, Ofgem would use a different approach (e.g. by re-profiling X) to address this, since new equity would not be acceptable.

A3.18 Ofgem's analysis found that financeabilty issues were only likely to arise for the two Scottish transmission operators, Scottish Power Transmission Limited (SPTL) and Scottish Hydro-Electric Transmission Limited (SHETL), under the higher capital expenditure scenario. It was anticipated that SPTL would require an addition £43 million of new equity if it was to invest up to the maximum forecast level, including all expenditure already allowed for under the Transmission Investment for Renewable Generation (TIRG) scheme. For SHETL, it was anticipated that financeability issues would arise at much lower levels of capital expenditure and an additional £39 million of new equity would be required to finance baseline capital expenditure allowances and expenditure under the TIRG scheme. There is a possibility of this rising to £165 million, should SHETL be required to undertake an additional £250 million of capital expenditure to connect new generation.

A3.19 In determining the cost allowances for the issuance of new equity, Ofgem believed it was important to consider the following three factors:

(k) The appropriate cost to allow per unit of equity raised;

(l) The mechanism for determining the appropriate amount of new equity required; and

(m) Whether the allowance should be provided ex-ante or ex-post.

A3.20 So, in conclusion, Ofgem proposed a "use it or lose it" approach in dealing with the financeability problem, whereby an appropriate allowance for the cost of equity issuance would be made, under the assumption that if Ofgem's proposals did not allow the licensee to maintain appropriate credit ratings, it would require additional equity.

Gas Distribution Price Control Review (GDPCR 2007-13)

A3.21 The final proposals, published on 3 December 2007, reset the price control, which specifies the maximum revenue that a network can recover from its customers for the five

year period commencing on 1 April 2008.[160] This was the first review, following the sale of four of the gas distribution networks (GDNs) by NGG in 2005, that Ofgem has been able to make meaningful comparisons between the GDNs.[161] The importance of benchmarking is expected to increase further in the next price review.

A3.22 Ofgem used a notional capital structure assumption and tested their financial model for each of the GDN against four key financial ratios indicated in the table below.

Table A2.3: Financial indicators used by Ofgem at GDPCR 2007-13

Ratio
Funds flow from operation (FFO)/interest
Retained cash flow (RCF)/debt
Debt/regulatory asset value (RAV)
Post maintenance interest cover ratio (PMICR)

A3.23 The assessment was based on a consideration of whether a given GDN funded with nominal debt was likely to achieve financial ratios consistent with a "comfortably investment grade credit rating."[162] The first three ratios were used by Ofgem in DPCR4 and their target value remains consistent with those used in previous reviews. PMICR was introduced to represent adjusted interest cover ratio, which is already used by the major credit rating agencies to rate independent GDNs.

A3.24 Ofgem's assessment of financeability was carried out for the round and therefore it is not a requirement for the notional financial model to meet the target values for all ratios in every year.

A3.25 Some reservations were expressed by Ofgem[163] about the usefulness of PMICR in testing the financeability of an Ofgem financial model since it reduced to a function of the cost of capital. Ofgem also noted that in sectors where PMIRC was a key ratio, most companies had adopted a certain proportion of index-linked debt, which reduced their annual cash interest payment, in turn improving this ratio. Where PMIRC was at a level consistent with a weaker credit rating, consideration was given as to whether a modest change in the level of index-linked debt would improve the ratio such that it was in line with comfortable investment grade ratings. Ofgem acknowledges that the market for index-linked debt may not always be available to the companies, especially in light of recent problems in debt markets.

160 Ofgem; Gas distribution price control review: final proposals, December 2007
161 The total number of GDNs during the course of this review was eight.
162 Ofgem; Gas distribution price control review: final proposals, December 2007 pp 108
163 Ofgem; GDPCR fourth consultation, March 2007

11.9 An increase in the assumed cost of equity at the final proposals had a positive impact on financial ratios, as did the increase in capex and repex assumptions relative to the GDN's views. In conclusion, Ofgem stated that "Our review of financeability indicates that the package of ratios arising from our notional assumptions for each GDN appears consistent with a comfortable investment grade credit rating."[164]

A3.26 There was variation in the performance of the GDNs. Scotland, in particular, performed relatively poorly, although its ratios were consistent with comfortably invest grade ratings in the next round. Southern and Wales & West also stood out as having relatively weak levels of PMICR.

Civil Aviation Authority (CAA)

Q5 Heathrow and Gatwick price review

A3.27 The Airports Act of 1986 requires the Civil Aviation Authority (CAA) to set maximum limits on airport charges for BAA's London airports (Heathrow, Gatwick and Stansted) and Manchester airport. The CAA is required, by statute, to refer its proposed price controls for each airport to the Competition Commission (CC) for review, although the CAA remains the final decision-making body. The discussion that follows relates to the CAA's price control decisions in respect of Heathrow and Gatwick airports for the five year period commencing 1 April 2008 (the fifth quinquennium, or Q5).[165]

A3.28 CAA conducted its own analysis of financeability for each airport to ascertain the extent to which the combination of assets, liabilities, costs and revenues implied by the CAA's proposed price caps, cost of capital and notional capital structure would allow the proposed investments at each airport to be financed.

A3.29 During the consultation process, CAA received submissions from BAA and BA on the issue of financeability as well as the CC's advice.[166] A number of concerns in relation to CAA's methodology were expressed by BAA, including: the inappropriateness of CAA's revenue projections; implicit assumption that there would be an index-linked debt market for unsecured corporate borrowers rated at BBB or below; and the assumption that airports would be able to raise sufficient capital in the debt markets with a BBB+/Baa1 credit rating to finance the envisaged capital programmes. BAA also suggested that a more probable credit rating for Heathrow was Baa2 rather than Baa1.

A3.30 After a careful evaluation of the available evidence, the CAA took the view that, for Heathrow, its proposed price caps were likely to be consistent with the maintenance of a solid investment grade credit rating from at least two ratings agencies.

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164 Ofgem; Gas distribution price control review: final proposals, December 2007 pp 108
165 CAA; Economic regulation of Heathrow and Gatwick airports 2008-2013: CAA decision, March 2008

A3.31 For Gatwick, most of the evidence pointed towards the same conclusion. However, one particular ratio – the Adjusted Interest Cover Ratio (AICR) – raised concerns as it exhibited a declining profile suggestive of a Baa2, rather than the desired Baa1, credit rating. The CAA considered changing its proposed price control profile, such that revenues were differed to later years of Q5. However, in the end, it was decided that the original proposed price controls should not be changed since they were broadly cost-reflective and it made little sense to defer revenues (which would otherwise be due to the business) to later years just to improve notional financeability in particular years. Thus, a consideration of financeability did not lead to adjustments to proposed controls in this case.

A3.32 CAA did make two adjustments to the initial base case used in its assessment. The first of these was an acknowledgement that while both Heathrow and Gatwick would be able to access debt markets for nominal debt at a BBB+/Baa1 rating, index linked debt was not available at the time. Thus they made the conservative assumption that no new debt issued in Q5 would be index-linked. The other change relates to assuming that the cost of the existing debt reflects the costs that a reasonably efficient, notionally financed airport operator might have incurred up to that point.

Office of Rail Regulation (ORR)

Periodic Review 2008 (PR08)

A3.33 The currently ongoing 2008 periodic review (PR08) will set Network Rail's outputs, revenue requirement and access charges for the five years from 1 April 2009 to 31 March 2014.[167] It is the first periodic review to take place since the passing of the Railways Act 2005. What follows is a brief discussion of how the ORR has proposed to deal with financeability in its *draft* determinations, which therefore may be subject to change. [168]

A3.34 The ORR states that it has "a duty to act in a manner that will not render it unduly difficult for Network Rail to finance its activities". Network Rail is required to use all reasonable endeavours to ensure that it maintains an investment grade credit rating, which the ORR must bear in mind in making its proposals. ORR said they will consider financeability in the round i.e. taking into account a range of financial indicators, consistent with those used by rating agencies, and the business risks and regulatory protections to inform their assessment.

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166 The CC evaluated 6 financial ratios (interest cover, FFO interest cover, PMICR, adjusted ICR, FFO/debt and gearing) and reached the conclusion that the ratios resulting from their price control recommendations would be consistent with an investment grade credit rating taking Q5 as a whole, although the ratios would not be met in each year.

167 ORR; Periodic review 2008: Draft determinations, June 2008

168 Although, ORR has indicated that their approach to assessing financeability has been confirmed by consultation. Refer to ORR; Periodic Review 2008: Financial issues update and further consultation, September 2007.

A3.35 ORR required the companies to achieve a 'solid' investment grade under their proposals of BBB+/Baa1 or above. The financial indicators being used by ORR in this periodic review is set out in the table below.

Table A2.4: Financial indicators used by ORR in PR08

Ratio
Adjusted interest cover ratio (AICR)
Debt/Regulatory asset base (RAB)
Funds from operations (FFO)/Interest
Adjusted retained cash flow (RCF)/Debt

A3.36 Consultation with credit ratings agencies is being used to determine the target level of these ratios. ORR believes that the above set of indicators adequately covers both long-term solvency and shorter-term cash flow for the relevant control period (CP4). As with the other regulators, they consider the overall set of indicators across the control period as a whole, rather than relying on a particular indicator or year which would be misleading.

A3.37 Financeability was modelled using Network Rail's proposed financial strategy, which contained their proposed debt structure rather than relying on a notional level of gearing, as is the usual precedent. This was considered an appropriate approach for Network Rail's particular circumstances given constraints on its capital structure and the importance of providing them with a hard budget constraint.

A3.38 ORR calculated the values for each of the financial ratios for every year of the control period. Based on these modelled values, ORR was able to conclude that

> "We consider that these ratios, considered in the round and combined with our assessment of the risks facing Network Rail compared to those facing other regulated network industries and the protections provided to the company as part of the overall package for CP4, are consistent with a solid investment grade credit rating, in current and prospective market conditions."

A3.39 In addition ORR conducted sensitivity analysis, running Monte Carlo simulations, to test the robustness of Network Rail's financial position in the face of cost and revenue uncertainty. The conclusion of this exercise was that Network Rail would be able to maintain a solid investment grade credit rating in the face of a range of fluctuations in cash flow.

Ofwat

Periodic Review 2004 (PR04)

A3.40 Ofwat last had to address the issue of financeability in the context of its review of price limits for the 23 water companies in England and Wales for the period April 2005 to March 2010[169].

A3.41 Ofwat has a duty to secure that companies are able to finance the proper carrying out of their activities as licensed undertakers. It saw this as having two strands, firstly to see that if a company was efficiently managed and financed it could earn a return at least equal to its cost of capital and secondly, that its revenues, profits and cash flows must be such as to allow it to raise finance on reasonable terms in the capital markets. It referred to the second strand as financeability. Ofwat noted that a consequence of requiring companies, even efficient ones, to undertake large capital programmes was persistent negative cash flow which could worsen a companies credit rating, increasing their cost of finance and jeopardising their ability to deliver services and improvements.

A3.42 An important aspect of Ofwat's approach to calculating financeability adjustments was the use of a notional level of gearing instead of the actual gearing of water companies. Ofwat took the view that,

> "The actual capital structure that companies choose is a matter for their management and the market. This should not be at the expense of customers, however".

11.10 Thus Ofwat chose to use the same package of financial indicators for all companies, regardless of their capital structure."

A3.43 Ofwat set its price limits with the view that companies needed to maintain credit ratings comfortably in the investment grade range, so that they could continue to raise the finance necessary to undertake their investment programmes.

A3.44 The financial indicators Ofwat looked at, along with their critical values, are summarised in Table A2.

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169 Ofwat, Future water and sewerage charges 2005-10: Final determinations.

Table A2.5: Ranges for financial indicators used by Ofwat at PR04

Ratio	Value
Cash interest cover (FFO/gross interest)	Around 3 times
Adjusted cash interest cover i (FFO less capital charges/gross interest)	Around 1.6 times
Adjusted cash interest cover ii (FFO less capital maintenance expenditure/gross interest)	Around 2 times
FFO/debt	Greater than 13%
Retained cash flow (RCF)/debt	Greater than 7%
Gearing (net debt/regulatory capital value)	Below 65%

Source: Ofwat, Future water and sewerage charges 2005-10: Final determinations, p233

A3.45 Revenue uplifts were granted to certain companies in selected years to ensure their projected financial ratios under Ofwat's proposals were compliant with the critical values set out above. Ofwat found that, generally, the ratios for the water only companies (WoCs) implied by the price limits were better than those for water and sewerage companies (WaSCs). This was to be expected in light of allowing a small company premium to the cost of capital and the smaller capital programmes required for WoCs relative to their size.[170] The bulk of the £430 million additional revenues accrued to water and sewerage companies (WaSCs) who all received adjustments, while the water only companies (WoCs) received £10 million in adjustments.

A3.46 Another key point that underpins Ofwat's calculations of financeabilty adjustment is the assumed level of distributed dividends. It is Ofwat's view that if companies adopt dividend policies which seem too generous, the argument that financeability adjustments are needed would be undermined. This raises the possibility that companies paying too much in dividends will jeopardise the possibility they might financeability adjustments at the next review.

A3.47 So, in summary, at its last price review Ofwat made upward adjustments to revenue allowances for certain companies to ensure the financing of large investment programmes would not be jeopardised. Unlike its previous price review (PR99), these adjustments were of a higher value and were applied more widely.

[170] Note that Ofwat decided not to include a specific uplift to ratios for small companies at this review, although it allowed a small company premium to the cost of capital.