RIIO reviews

Financeability study

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Submitted to Ofgem by

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1 Introduction and summary

This study has been designed to inform Ofgem's assessment for its RIIO price control reviews utilising data from the RIIO-T1 and GD Initial Proposals. The terms of reference identified two related areas for the study:

- Recognising there are now only a limited number of listed energy network companies, Ofgem sought to understand how a link may be established between its cashflow analysis and the beta assessments for its cost of equity allowances.
- Ofgem also sought to make a link between its cash flow analysis and its financeability assessment, informed by credit metrics.

In this report, we consider the underlying nature of an investment in the RAV and the evidence from uncertainty in cash flows and accounting returns. We develop a methodology for relating uncertainty in regulatory returns to the beta assessment. We find the evidence strongly indicates relatively low levels of beta.

In order to reconcile this evidence with evidence from share price movements for those companies that remain listed on the stock exchange, we analyse the main drivers for changes in observed betas in recent years and consider the underlying evidence for equity betas.

On financeability, we identify some critical tensions between the credit metrics used by the rating agencies and the underlying economics of the regulated sectors. We also consider from first principles the ranges of cash flow uncertainty that we should expect for a regulated business with an appropriately calibrated cost of equity allowances. Our analysis leads us to conclude that Ofgem's approach to financeability is inherently cautious.

2 A preface on the economics of regulation and risk

A useful starting point for analysing risk, and thus the equity beta, in a regulated utility is a rebuttable assertion that an investment in the Regulatory Asset Value (RAV) has a risk profile similar to a bond.

The RAV certainly has some of the characteristics of an index-linked bond, or more accurately a portfolio of bonds. The regulatory regime provides safeguards around the rates of return and the return of value through regulatory depreciation. Ofgem now has a long track record of effective regulation and the legal and institutional safeguards around the regime are well established, tested and well regarded.

An investment in the RAV does however also have an overlay of equity risk as returns on the RAV are dependent on business performance. Some of that risk will be business-specific (diversifiable) and some will be systematic (non-diversifiable). We are also open to the possibility that there is some systematic risk in regulation itself, although we believe Ofgem has erected effective defences against political influence that might have a systematic component (e.g. the possibility that regulation may be tougher when the economic cycle is down and consumers are struggling most). However, beta risk exists, and the asset beta for the RAV appears to be higher than typical estimates of debt betas[1].

We are also aware of potential risk asymmetries. If there is a risk of a downside catastrophe of Railtrack proportions, there is unlikely to be much scope for a corresponding upside. Other asymmetries, in particular information asymmetries, may tend towards the upside for investors and, broadly, this appears to have been the main experience of regulated utilities. It is difficult to know where the balance of risk asymmetry lies.

But the question of asymmetry highlights a more fundamental difference between the RAV and a bond. A bondholder is exposed to the risk of default when things go badly, but does not have any access to the upside when things go well. An (equity) investment in the RAV does not in the same way need to price in default risk[2].

This rebuttable assertion is, of course, rebuttable. But we believe it is a helpful starting point for considering the equity beta.

[1] Beta is a measure of systematic risk in a financial instrument. There is generally systematic risk in shares (equity beta) and some systematic risk in debt (debt beta). The asset beta is the combined effect of equity and debt betas (broadly, the average of the two weighted by the gearing ratio) and would relate to the equity beta of the business if there were no debt at all.

[2] This is one of two reasons why we do not concur with a common assertion that it is implausible that the cost of equity could be below the cost of debt (e.g. paragraph 152(a) of Appendix N to the August 2010 Competition Commission report on Bristol Water). The other reason is the cost of equity is a post-tax concept while the cost of debt is a pre-tax concept and they are taxed differently in the hands of the investor.

3 The evidence from cash flows and profits

The presence of a beta, and thus a risk premium in the cost of equity, is due to the presence of risk. Returns to investors, in particular returns to shareholders, are uncertain. Some of those uncertainties will correlate with uncertainties present in the generality of investments in the stock market, and financial theory says it is such correlation[3] that would lead shareholders to require a risk premium in expected returns to make an investment worthwhile.

Estimating a beta for a particular sector requires consideration of how much correlated uncertainty (often called systematic or non-diversifiable risk) exists in businesses operating in the sector.

We do not have a sufficiently deep understanding of how systematic risk manifests itself through the cost and revenue drivers of electricity transmission and gas transmission and distribution businesses to be able to robustly estimate beta directly from models of the businesses. However, features of the periodic review process allow us to estimate an upper bound for beta by considering historical accounting or cash flow returns information or forward-looking risk-based forecasts.

To do this, we have developed a methodology that decomposes equity beta risk into two components, a performance beta and a valuation beta:

$$\beta_E = \beta_E^P + \beta_E^V$$

The performance beta relates to uncertainty in regulatory returns during control periods, while the valuation beta relates to uncertainty in the differential between market values of regulated businesses and regulatory asset values at the end of each control period. We set out our technical explanation of the methodology in Annex A1.

The methodology allows inferences about the performance beta component to be drawn from a comparison between the volatility of regulatory accounting returns on regulatory equity (RoRE) and the volatility of investor returns on the stock market. We can draw separate conclusions about the valuation beta component with reference to the factors that influence regulatory decisions at price reviews. We recognise that it is a novel and previously untested approach.

We consider these two components in turn.

3.1 Performance betas

Annex A1 explains how we can gain insights for performance betas by measuring the variability of annualised accounting or cash flow returns over a control period and comparing it with the expected variability of annualised returns on the stock market over an equivalent period.

[3] It would be more accurate to say 'covariance' rather than 'correlation'.

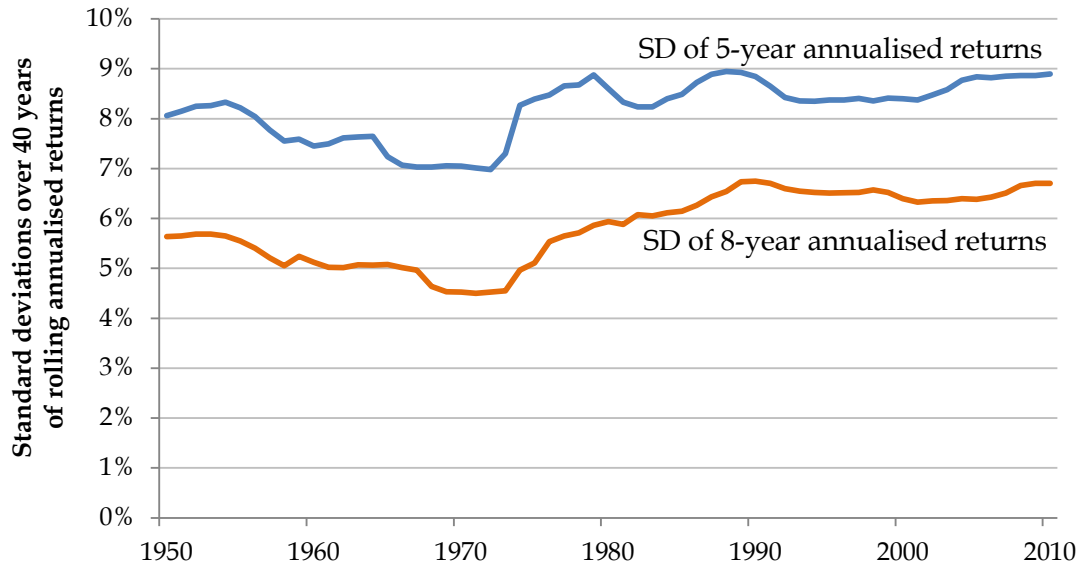
We consider two sources of evidence on the variability of accounting or cash flow returns in the network sectors:

- the ranges for returns on regulatory equity (RoRE) analysed by Ofgem in its RIIO T1 and GD1 analysis, and
- The variability of historical returns in the water sector, which is generally thought to have a similar risk profile to energy networks, using returns on capital employed (RoCE) reported by Ofwat.

We compare these measures of variability with measures of variability in returns on the stock market.

Over the past 100 years or so, the standard deviation of annual returns on the UK stock market has been in the region of 20 per cent, but annualised returns over periods longer than a year will tend to smooth out some of this variability. The standard deviations of annualised returns over 5 and 8-year periods have been in the region of 8.5 per cent and 6.5 per cent respectively, as shown in Figure 1 using data going back to the start of the last century[4].

Figure 1: Standard deviations of annualised UK stock market returns



Source: DMS dataset, ECA calculations

The rationale we explain in Annex A1 allows us to infer evidence that a regulated utility with a standard deviation of annualised accounting or cash flow returns over 5 or 8-year control periods of 8.5 per cent or 6.5 per cent respectively could have a performance beta of around 1.0. The performance beta would be less than 1.0 if not all of that variability were systematic. If the variability of annualised accounting or cash flow returns were lower than 8.5 per cent or 6.5 per cent, it would be stronger evidence of a performance beta lower than 1.0.

[4] The volatility of annualised returns naturally reduces as the periodicity of the measure increases.

Ofgem's ranges for energy networks' returns on regulatory equity

Ofgem has carried out sensitivity analysis of the companies' returns on regulatory equity to inform its financeability assessments. Paragraph 4.11 of Ofgem's July 2012 finance supporting documents to its initial proposals[5] identifies its approach:

> *"We regard an appropriately calibrated price control package as one in which RoRE upside (ie the reward available for the best-performing companies) provides the potential for double-digit returns on (notional) equity, and RoRE downside (ie the penalties that would apply to the worst-performing companies) is at or below the cost of debt."*

Ofgem presents graphs which show its "estimates of upside and downside potential" RoRE, which it developed "using a mixture of historical performance and projected plausible values".

Ofgem has refined its analysis a little since it published its initial proposals and we summarise the resulting ranges between the upside and downside RoRE in Table 1.

Table 1: Ofgem's ranges for RoRE in RIIO T1 and GD1 reviews

Excluding IQI additional income

	SPTL and SHETL	*NGET and NGGT*	*GDs*
Smallest range	6.6%	5.9%	5.9%
Largest range	7.4%	6.7%	7.1%

Ofgem does not specify what confidence interval these ranges represent.

We have reviewed Ofgem's calculations and note that Ofgem has adopted a high level judgement-based approach to compute RoRE ranges for each of a number of key variables. The upsides and downsides for all variables are respectively added together to give an aggregate upside and an aggregate downside for each company.

We make the following observations:

- The largest contributor to the RoRE ranges is totex. Ofgem has assumed the range of upside and downside risk for totex is equal to 20 per cent (± 10 per cent) of each company's totex each year, calculating the impacts on equity returns after taking into account the relevant IQI incentive rate and tax[6].
- For many of the variables, and in particular for totex, Ofgem assumes the upside and downside returns are symmetrical about the central

[5] See also paragraph 5.31 of Ofgem's February 2012 supporting document for its initial proposals for SPTL and SHETL.

[6] Tax is accounted for by applying the IQI incentive rate on a post-tax basis, in line with the RIIO T1 and GD1 initial proposals.

estimate. We would expect large investment projects in particular to have a significant risk of overspends. Over a large number of projects, we might expect these overspends to balance out with contingencies built into costings and the consequent prospects of underspends, but it might be realistic to recognise larger potential downsides than upsides. However, we acknowledge that there are a number of potential sources of asymmetry in regulatory assessments and note that the history of returns in these sectors does not provide evidence of downside asymmetry overall.

- Adding the upsides together for all the variables and adding the downsides together for all the variables implicitly simulates circumstances in which the variables are all positive together or all negative together. The upper and lower bounds of Ofgem's RoRE calculations, therefore, represents rather extreme outcomes. Unless the variables are strongly correlated with each other, this might be expected to generate a more extreme view of the potential upsides and downsides.

- Treating these potential upsides and downsides as ranges for annualised returns over the eight years of a control period would be equivalent to simulating the circumstance in which a company will show consistent downside results or consistent upside results for each of the eight years. This would also be expected to generate a more extreme view of the potential upsides and downsides.

We acknowledge that the analysis of risk is necessarily limited by the quality of the risk assumptions, and that high level assumptions can be more reliable than combinations of more detailed assumptions. Apparently sophisticated risk models populated with assumptions about the distribution of detailed variables can be highly misleading unless the detailed assumptions and the relationships between them are carefully calibrated. As we understand the quality of available information on risk at a detailed modelling level across the sectors is incomplete, we consider Ofgem's relatively high-level approach is broadly reasonable.

The key question for our analysis is what kind of confidence interval results.

Ofgem has explained to us how it has reached a broad judgement that ± 10 per cent for totex variability fairly represents plausible upsides and downsides. It is noticeably a round sum amount. In our view, reflecting our comment on high level assumptions above, using a round sum amount does not invalidate the judgement but it does highlight the fact it is a judgement.

We have also considered the evidence on historical RoRE accumulated by Ofgem on electricity distribution companies since DPCR5, Figure 2[7], and TPCR4, Figure 3.

[7] Figure 2 is based on provisional analysis by Ofgem and may be subject to revisions.

Figure 2: 2-year RoRE for electricity distribution companies since DPCR5

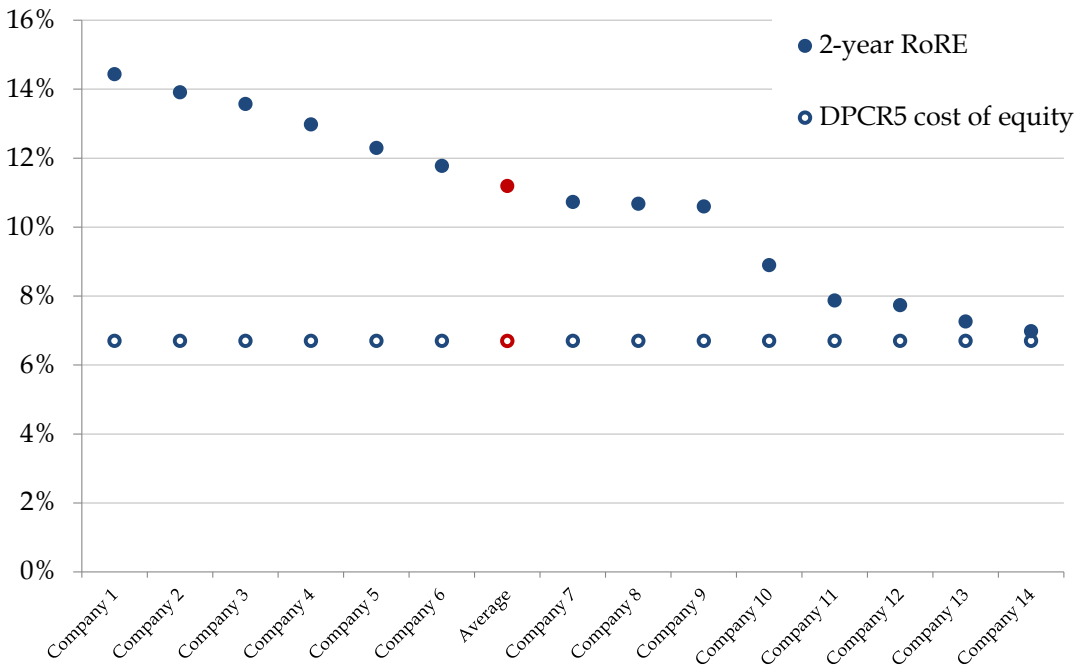
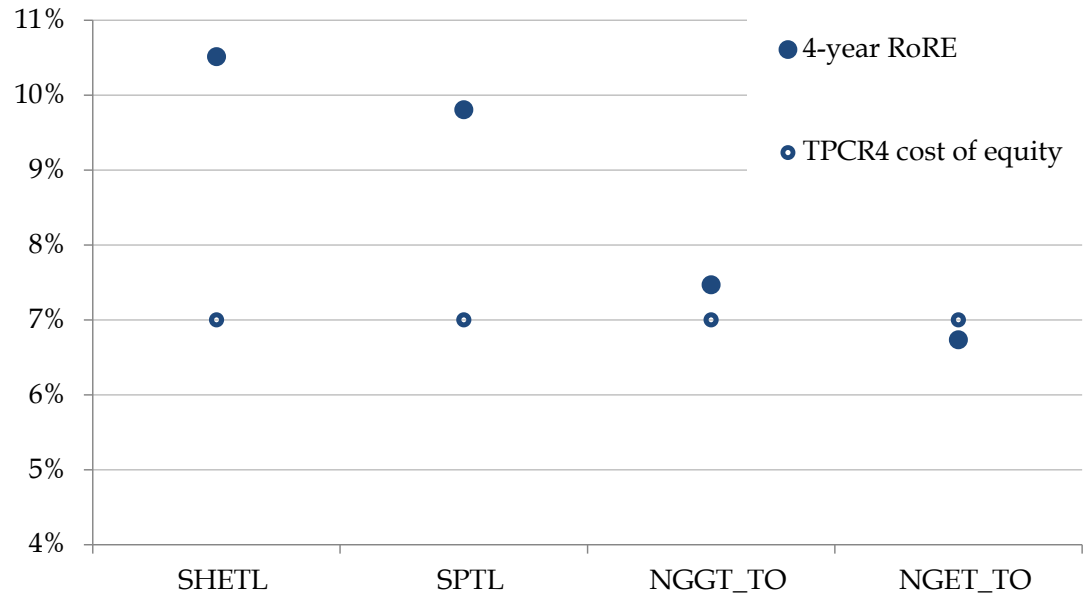


Figure 3: 4-year RoRE for transmission businesses since TPCR4



These two charts indicate a maximum range of about 3.5% for the four-year results for transmission businesses and a maximum range of about 8% for the two-year results for electricity distribution businesses. We would expect the ranges to narrow for longer periods, and we consider neither provides any indication that the underlying ranges assumed by Ofgem for T1 and GD1 are unreasonable. We note

that the four-year TPCR 4 results span the period 2007-11, a period of some economic volatility.

Our overall judgement, taking all factors into account, is that Ofgem's RoRE ranges represent a confidence interval for annualised returns over the eight-year control period of no less than about 90 per cent, suggesting that the extremes of the ranges are likely to be no less than about 1.6 standard deviations from the mean.

Taking the largest range from the companies tested, 7.4 per cent shown in Table 1 above, halving it to give deviations from the mean and dividing by 1.6, it would suggest a standard deviation a little over 2 per cent, say 2.5 per cent.

We infer the following for the equity beta using the expression explained in Annex A1 and our 8-year stock market SD benchmark:

$$\beta_E < \frac{St.dev(RoRE)}{St.dev(r_M)} + \beta_E^V$$

In other words: $\beta_E < \frac{2.5\%}{6.5\%} + \beta_E^V$ or $\beta_E < 0.4 + \beta_E^V$

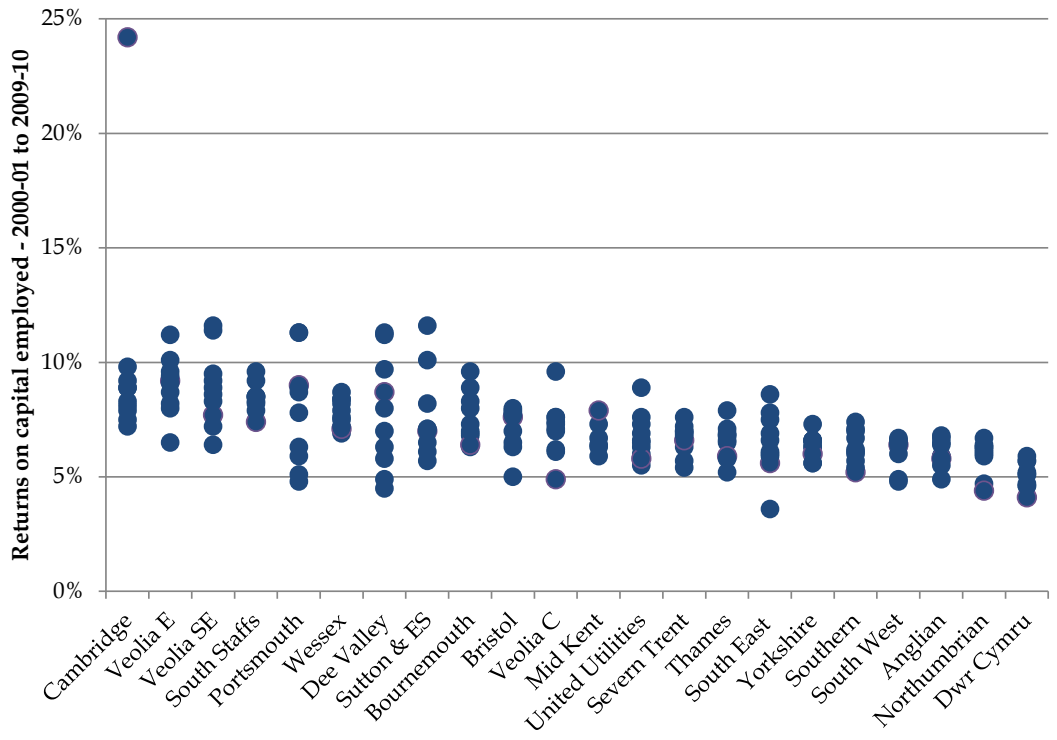
Water sector returns on capital employed

We now consider evidence from the water sector.

Up to 2009-10, Ofwat reported returns on capital employed (current cost operating profits for the year divided by the average RCV for the year) for each company in its annual financial performance and expenditure reports[8]. We summarise the results over the period from 2000 through to 2010 in Figure 4.

[8] Although Ofwat no longer publishes these reports, the information for subsequent years is available from companies' regulatory accounts.

Figure 4: Returns on capital employed, water sector 2000-01 to 2009-10



We calculate that the standard deviation of annualised returns over the two five-year control periods was a little under 1.5 per cent[9].

The returns on capital employed are before financing and tax. To translate these standard deviations into a post-financing and post-tax basis (consistent with a return on regulatory equity, or RoRE), we can divide by one minus the gearing ratio of about 60 per cent and multiply by one minus the (now prospective) tax rate of 22 per cent, which results in a standard deviation of about 3 per cent.

If all of the variability was systematic and the pattern of the 10-year period covered by the data was broadly representative, we might infer a beta using the expression explained in Annex A1 and our 5-year stock market SD benchmark:

$$\beta_E < \frac{St.dev(RoRE)}{St.dev(r_M)} + \beta_E^V$$

In other words: $\beta_E < \frac{3\%}{8.5\%} + \beta_E^V$ or $\beta_E < 0.35 + \beta_E^V$

[9] The standard deviation of the returns across all companies and all years, on a single-year basis, was about 1.9%. Note that the exceptionally large return (in 2003-04) for Cambridge Water was due to a one-off property transaction – we have not excluded this result from our standard deviation calculations.

Relative cost structures and relative risk

We now compare the relationship between expenditure levels and asset values across the sectors to gain some insight into relative exposure to performance beta risk.

From first principles, we consider the level of exposure to performance beta risk for regulated utilities will be a function of three factors:

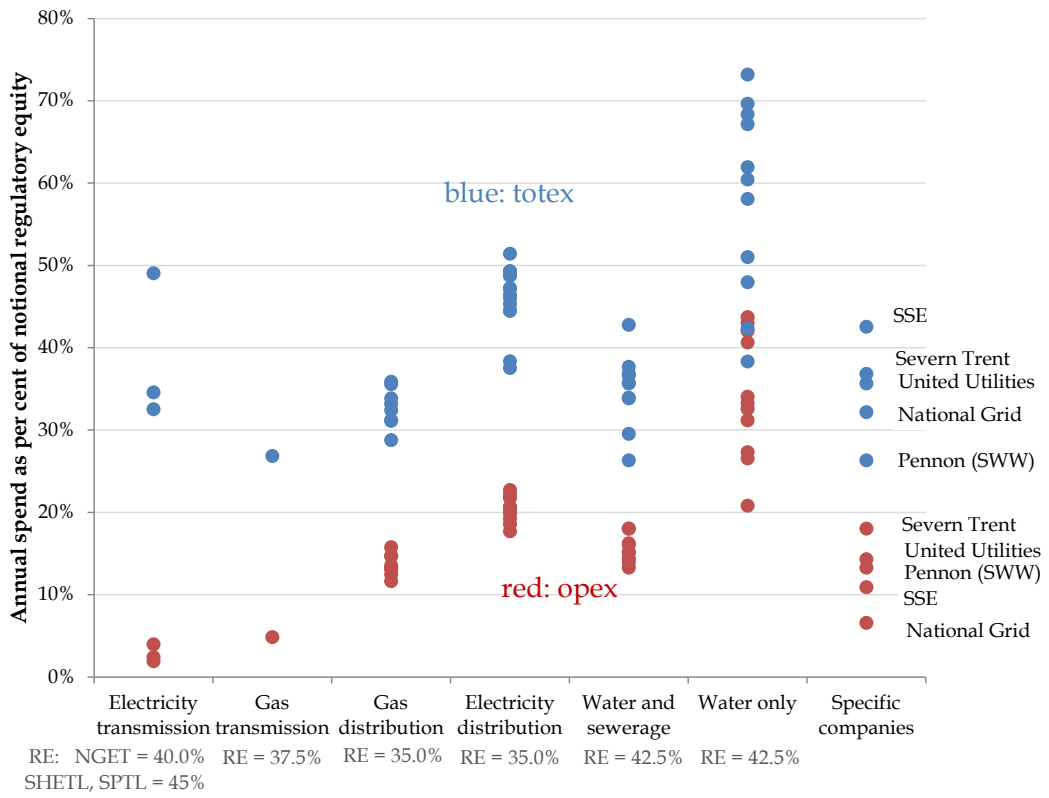
- activity levels relative to asset values,
- the exposure of those activities to markets (e.g. labour markets) and other factors that will affect businesses in general within the economy, and
- the incentive characteristics of the regime, specifically how variances in inputs and outputs related to those activities are translated into returns for investors.

We recognise that there are significant differences between the specification of regulatory regimes for different sectors – notably, for the companies we consider here, between those regulated by Ofgem and those regulated by Ofwat. However, we also recognise that there are probably more similarities than differences in these regimes. They are generally RAB-based regimes with revenue-based rather than price-based controls, with a balance between cost and output incentives and a balance between incentives for outperformance in operating and capital expenditure.

An important driver of performance beta is therefore liable to be activity levels relative to equity levels. The relationships between levels of expenditure (operating and capital, including repex), which we take as proxies for activity levels, and notional regulatory equity (RE)[10] for the main networks regulated by Ofgem and Ofwat are illustrated in Figure 5.

[10] Relating activity levels to notional regulatory equity in this way is applicable for informing regulatory assessments of equity betas. Other things being equal, if there were an equal level of systematic risk for each £1 of activity across the companies, higher activity/RE ratios should lead to higher equity beta assessments. Since Ofgem and Ofwat set different assumptions for notional RE in the different sectors, a direct comparison across sectors based on Figure 5 to inform anything other than equity betas should be interpreted with caution.

Figure 5: cost structures across sectors



Sources: projected average totex and opex spend as % of notional regulatory equity from most recent regulatory price control determinations

Figure 5 indicates that the sectors subject to RIIO T1 and GD1 have annual totex/RE ratios of around 30%[11], water and sewerage companies broadly in a similar range, perhaps a bit higher centering on about 35%, electricity distribution business somewhat higher around 45% and water only companies substantially higher at about 60%[12].

We note that opex levels are relatively low in the transmission businesses. These businesses are more weighted towards investment programmes and Ofgem's risk analysis emphasises both the capex to RAV ratio and the relative size of projects in those programmes in its risk analysis (see Chapter 3 of 'RIIO-GD1: Initial Proposals, Finance and uncertainty'). Accordingly, Ofgem ascribes more beta risk to these businesses and allows for higher costs of equity in its proposals than for the gas distribution businesses.

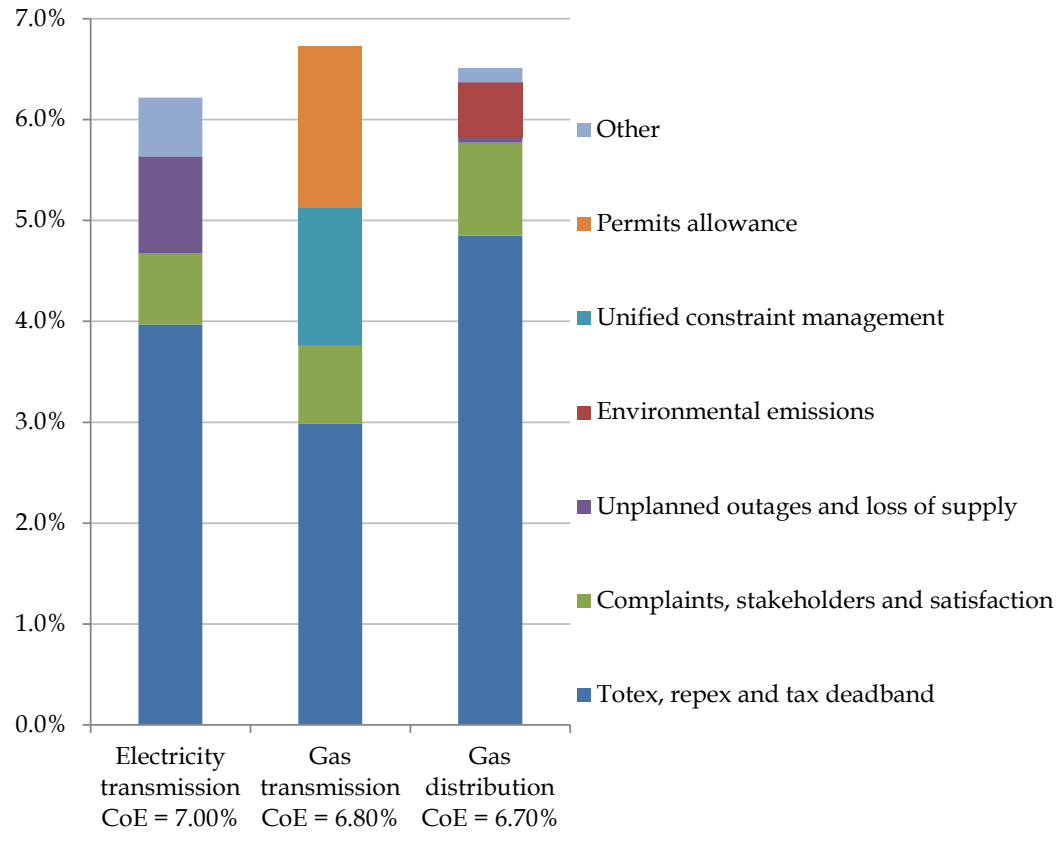
[11] With the exception of SHETL with a large TIRG programme, which we understand receives a higher rate of return.

[12] Of course, these relative spend/RE ratios are based on most recent notional gearing assessments and would move if either Ofgem or Ofwat came to different notional gearing assessments in future reviews. Furthermore, there is a dynamic in the spend/RE ratio in the water sector arising from the large differential between the RCV and replacement cost values at the time of its privatisation.

We note that Ofgem has not factored in any additional risk for capex or large projects in its RoRE analysis, adopting a range of 20% of totex for all companies.

We summarise the results of Ofgem's RoRE analysis in Figure 6[13].

Figure 6: Summary of Ofgem's modelled RoRE ranges[14]



While Ofgem provides for a larger beta allowance for sectors with higher levels of capex and higher proportions of large projects, it is not clear to us that these factors would necessarily lead to greater exposure to systematic risk than one might estimate from the RoRE analysis.

However, as we note above, we would expect large investment projects to have a asymmetric risk of overspends. Over a large number of projects, we might expect these overspends to balance out with contingencies built into costings and the consequent prospects of underspends, but it might be realistic to recognise larger potential downsides than upsides and the scope for mismatch between this asymmetry and the contingencies built-in to the costings. Any overall balance of downside asymmetry would provide a rationale for a higher cost of equity allowance.

[13] Figure 6 shows averages for each sector, taking the sum of the relevant RoRE ranges across the companies and dividing by the sum of the notional regulatory equity values for those companies.

[14] Note that the column for electricity transmission is predominantly represented by NGET, with SHETL and SPTL representing less than 30% of the total.

On the other hand, we recognise that when regulatory capex allowances are set *ex ante*, and if construction prices are pro-cyclical, tending to increase faster when the economy is expanding faster than trend and more slowly when the economy is growing slowly, high exposure to construction prices through a large capex programme might lessen the exposure to systematic risk rather than increase it[15]. This is because network utility companies might expect to benefit through their incentive regimes from lower construction prices when average returns for the rest of the market are under most pressure in a recession.

We are open to the possibility that incentive mechanisms other than that for totex could transmit some systematic risk, but we consider they are likely to be substantially company-specific rather than systematic and are unlikely to represent a significant component of beta risk.

We recognise that there is an inevitable degree of judgement in assessing relative risks between sectors. We do not have the evidence base to disagree with Ofgem's judgement that gas distribution businesses require a lower cost of equity, but we would recommend a more explicit rationale for the judgement in terms of risk asymmetry and systematic risk.

Conclusion on performance betas

We identified above that the upper bounds for performance betas are in the region of 0.4. Analysis of the historic variability of returns (Figure 2, Figure 3 and Figure 4) suggests that a large part of the returns uncertainty is company-specific rather than systematic, which leads us to the conclusion that performance betas in these sectors will be small. An estimate of about 0.2 for all of the transmission and gas distribution sectors might be cautious.

3.2 Valuation betas

Annex A1 describes how we can decompose the equity beta concept into two separate components, the performance beta and the valuation beta. The analysis above derives estimates of the upper bounds and a cautious estimate for performance betas. We need now to consider the potential scale of valuation betas.

Valuation betas represent market-covariant movements in the differences between market capital values and the RAVs of a regulated business. In broad terms, these differences will represent the value of anticipated outperformance (or underperformance) and the value of any anticipated differences between allowed rates of return and the implied discount rates in the market's valuation of future cash flows. They will also reflect any cash flows, assets or liabilities of the regulated business that are excluded or disregarded in the regulatory assessments of required revenues.

[15] See also paragraph 3.73 of Estimation of Cost of Capital of BAA London Airports – Report for CAA by Europe Economics', November 2006

At first glance, it is difficult to see why valuation betas should be greater than zero. In principle, they would be greater than zero if the regulator's forecasts of future cash flows and the cost of capital would tend to advantage investors when share prices in general are relatively high and disadvantage investors when share prices in general are relatively low. This might be the case, for example, if the regulator were inclined to take a tougher stance with regulated companies when consumers were suffering most as a consequence of an economic downturn, and a more lenient stance when economic conditions were more positive. While this is a plausible effect, we consider that Ofgem has (and Ofwat has) established safeguards around the objectivity and transparency of its estimates and judgements during price reviews to make any such effect relatively small, and possibly negative[16].

However, an interesting possible source of equity beta relates to pension schemes. A regulated utility generally operates defined benefit pension schemes, which means it will have an economic interest in the assets of the schemes and the actuarial liabilities of the schemes. The value of the assets of the schemes will naturally rise and fall with the markets. This means that, absent any regulatory mechanism to fund contributions through charges to customers, investors in a regulated utility will be exposed to market volatility.

Historically, and especially since it set out principles for the treatment of pensions costs in 2003, Ofgem's approach to the funding of pension schemes has provided investors with some protection. Its policy has been that consumers should fund pension scheme deficits. In 2008, Ofgem lunched a review of those principles and concluded in its June 2010 decision, 'Price Control Treatment of Network Operator Pension Costs Under Regulatory Principles'. Ofgem's decision reaffirmed the 2003 principles and provided for full funding of historic pension deficits.

Ofgem also decided that "any deficit payments that arise as a result of service after the relevant cut-off date will be treated as part of the benchmarked employment costs and subject to the same incentive as employment costs in general". The relevant cut-off dates are 31 March 2012 for transmission businesses and 31 March 2013 for gas distribution businesses. This means there will be some exposure for investors to market volatility in the accumulated pension assets arising from contributions for service after the relevant cut-off dates, where companies continue to operate defined benefit schemes. However, we recognise that defined benefit pension schemes in the relevant companies are generally closed to new members and the assets relating to service after the cut off are likely to be relatively small in relation to the RAV, and so should not represent a sizeable source of beta risk going forward.

We consider that the 2010 decision established a firmer basis for investor protection than had previously existed, but that investors might reasonably have expected some residual exposure to variations in pension scheme asset values for much of the period since 2000.

[16] The effect might be negative if the regulator's judgements were informed by history which might be expected to dampen the effects of current economic circumstances rather than exaggerate them.

We note the position on pension funds in the water sector, where Ofwat has adopted a policy that consumers should fund only 50% of any deficit recovery payments.

To quantify the possible impact, we set out in Table 3 our high level assessment of the contribution of pension scheme assets to equity betas for National Grid, Severn Trent and United Utilities[17] on the assumption that investors may have relied on regulation to protect them from 50% of systematic risk arising. We have referred to the latest accounts for each company to give us an indication of the relative exposure of each company to pension scheme assets.

Table 2: Pension scheme contributions to equity betas

As at 31 March 2012	*Severn Trent*	*Pennon*	*United Utilities*	*National Grid*	*SSE*
	£m	*£m*	*£m*	*£m*	*£m*
Share price (£)	15.44	7.115	6.015	6.305	13.29
Number of shares (m)	238.1	358.7	681.8	3,701	944.7
Market capital value	3,676	2,552	4,101	23,335	12,555
Total pension scheme assets	1,557	517.2	1,399	21,149	2,695
. . . of which US				6,219	
Proportion of assets in equity - UK	51%	52%	21%	33%	39%
Proportion of assets in equity - US				48%	
Indicative investor share of exposure	50%	50%	50%	50%	50%
Implied exposure to equity	399	135	146	3,969	520
Implied contribution to equity beta	0.11	0.05	0.04	0.17	0.04

Sources: annual reports

Given that there is relatively little room for performance beta given the cash flow and profit uncertainties analysed in Section 3.1, this indicates that pension scheme assets might historically have represented a significant component of equity beta for these businesses. We note that the issue may have been particularly material for National Grid. Looking forward, as we discuss above, we consider that Ofgem's June 2010 decision will have clarified the position on full funding of historic pension deficits.

3.3 Assessment of evidence from profit variability

The evidence in Section 3.1 from historical profits and prospective uncertainty in profits indicates that there is not much room for underlying performance beta risk in these regulated network businesses. The levels of uncertainty in regulated returns are, in principle, consistent with equity betas substantially below 1.0.

[17] The statutory and regulatory accounts of the companies do not permit us to relate pension fund assets and regulatory values for SSE and Pennon. We note that National Grid's equity beta will also be affected by its US interests and its US pension schemes' assets, which we have not analysed.

The scale of the challenge thrown up by the evidence is magnified further when one considers that a large part of the overall profit variability is liable to be a function of non-systematic factors such as the relative performance of company managements. The pattern of historical RoRE shown in Figure 2 and Figure 3 would suggest that a large part of the variability on RoRE is company-specific and therefore not systematic.

To reconcile this evidence with evidence from the stock market itself means we need to focus on the sources of valuation beta. We have identified four possible explanatory factors.

- The confidence intervals on beta estimates from stock market evidence are quite large and the stock market evidence may therefore not be statistically inconsistent with rather lower beta estimates.
- The market may tend to over-react in the pricing of shares in network businesses to new market-wide information, which might be evident in subsequent corrections in the prices of those shares.
- The regulatory periodic review process could introduce significant systematic risk which would not be evident in the variability of profits.
- Over the past decade or so, there may have been limited market confidence that Ofgem would persist with a policy of full investor protection for pension scheme deficits and Ofwat's regulatory regime has offered only partial funding of pension deficits, suggesting that exposure to market volatility in pension scheme assets might represent a significant source of equity beta.

We consider the evidence behind the first two factors in Section 4.

Regarding the third factor, a systematic influence in the regulatory process itself, we are open to the possibility[18], although we doubt that much systematic risk could be transmitted that way. If it could, it would have potentially profound implications for the efficient conduct of price reviews by regulators.

We considered the contribution from pension scheme assets in Section 3.2.

It appears that uncertainty within the network businesses themselves may represent a relatively small part of the beta risk story.

We now consider the evidence from share price movements, with a view to reconciling that evidence with our conclusions from this section.

[18] It is possible that the regulatory process introduces a systematic component of risk through tougher assessments when markets are performing badly and more lenient assessments when markets are performing well. This would create an exposure to systematic risk that would not be captured within RoRE, but we estimate such an effect should be small in the case of Ofgem. We do not consider it plausible that regulatory 'inertia' in cost of capital assessments, as they are informed by longer term averages rather than immediate market perspectives, which could also generate variances in MAR, could be considered a rationale for a higher beta assessment.

4 The evidence from share price movements

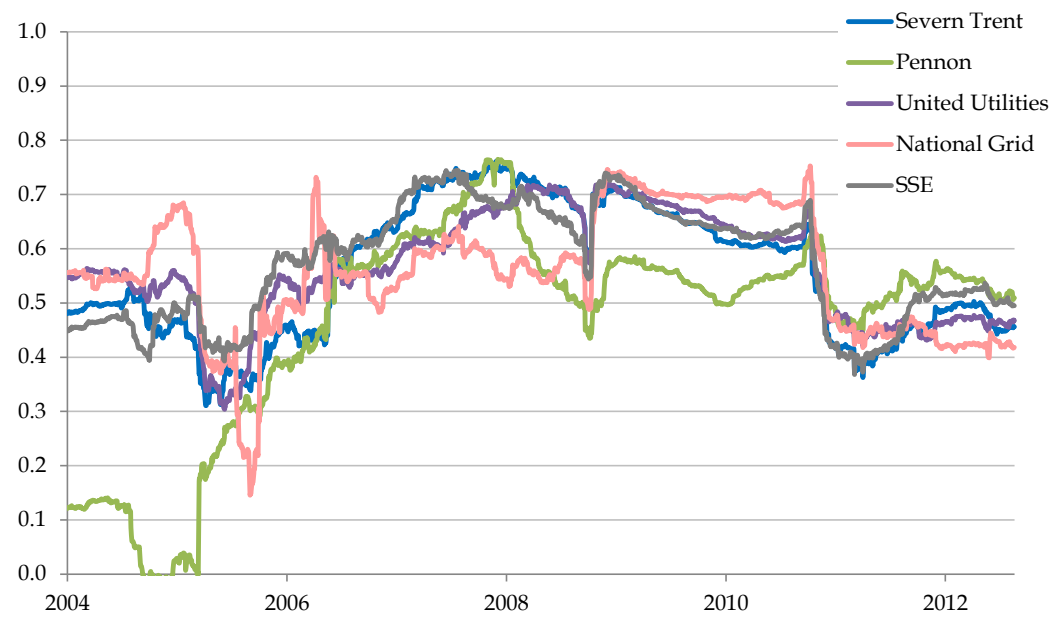
It is conventional to consider beta evidence from movements in the prices of frequently-traded shares. In the regulated energy network sectors, there remain two listed companies, National Grid and SSE, although both have substantial interests outside the UK regulated sectors. In the water sector, there remain three listed companies, Pennon, Severn Trent and United Utilities. All three are predominantly involved in the water sector, although Pennon does have a significant waste management business within the group.

We consider the evidence from a number of perspectives.

Daily data

We have calculated rolling two-year equity betas for each company on the basis of daily data. The raw betas we calculate are as shown in Figure 7.

Figure 7: 2-year daily equity betas



The betas for Severn Trent, United Utilities and National Grid show a similar pattern (correlation of over 0.9).

The overall betas and 95 per cent confidence intervals[19] for share returns since 2000 are as set out in Table 3.

[19] Because the daily data show some autocorrelation, we report Newey-West standard errors and confidence intervals in Table 3.

Table 3: Estimated underlying equity betas

	Central beta estimate	*Standard Error*	*95% confidence interval* *Low*	*High*
Severn Trent	0.488	0.032	0.426	0.550
Pennon	0.406	0.030	0.347	0.465
United Utilities	0.550	0.026	0.499	0.601
National Grid	0.594	0.030	0.504	0.684
SSE	0.532	0.019	0.449	0.615

Although these results suggest there is some confidence that equity betas are no higher than about 0.7, the pattern of 2-year betas over the last decade raises a question over the assumption that there is a stable underlying beta. The pattern suggests a marked drop in betas from about October 2010. It looks possible that underlying betas had been rather higher than 0.7 for some of the period and, until we can understand why, there is an unknown possibility that underlying betas might become higher again in future.

We have therefore looked into what lies behind the drop in betas around October 2010.

Our analysis has identified two particular events that appear to have influenced the beta calculations: the stock market fall in May 2006 and the larger stock market fall in September to October 2008. It is the 2008 event falling out of the data that causes the 2-year beta figures to fall in October 2010.

We note that there are large swings in the covariations around these periods. Considering the data for Severn Trent, for example, we identified 17 occasions between 9 August 2007 to 31 December 2008 when the daily covariates between share and stock market returns were 3.5 standard deviations away from the covariance. This suggests the existence of outliers in the data, and it is these that were the main cause for the significant movements in the 2-year beta results rather than any underlying change in betas.

Given the existence of outliers in the data, we have applied a technique to control for the effects of those outliers in the daily data for the five companies. We consider the technique is useful given the evidence that the price movements associated with these outliers are quickly reversed and that such reversals would be explained by the underlying economics of regulated sectors we describe in Section 2.

The technique is called winsorization. We have recalculated the betas over the period from 2000 for each company in Table 4 after winsorizing the daily covariates at 95 per cent. Covariates above the 95th percentile are set to the 95th percentile and, for the final column in Table 4, those below the 5th percentile are set to the 5th percentile.

Table 4: Winsorized daily equity betas, 2000-12

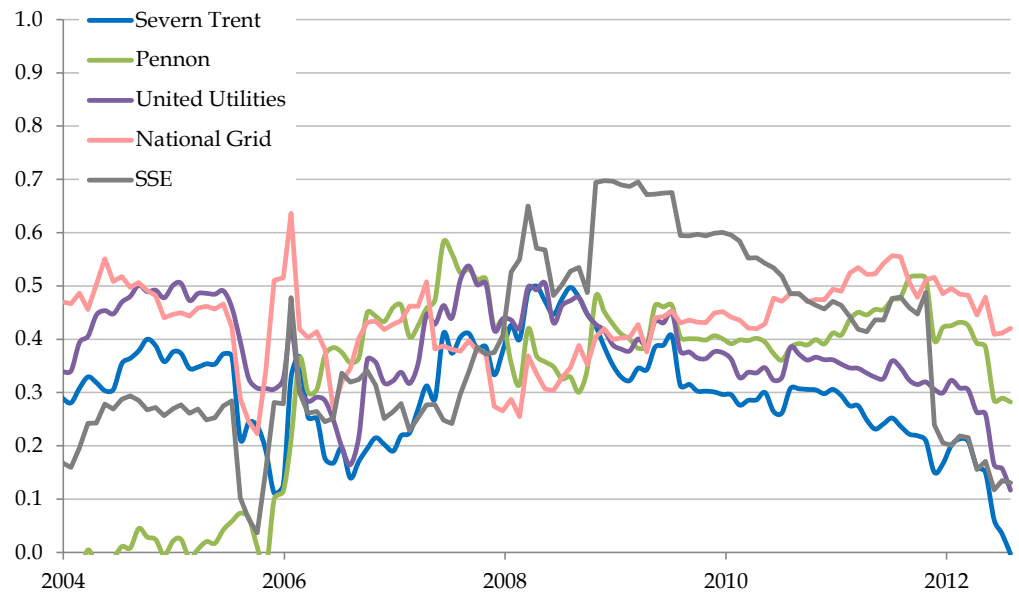
	Betas without winsorization	*95% upper-tail winsorization*	*95% two-tails winsorization*
	Daily	*Daily*	*Daily*
Severn Trent	0.488	0.281	0.381
Pennon	0.406	0.293	0.325
United Utilities	0.550	0.383	0.432
National Grid	0.594	0.341	0.463
SSE	0.532	0.310	0.413

Other periodicities

The middles of the two events that influenced the daily beta results occurred a multiple of four-weeks apart. We find that considering 4-weekly rather than daily data provides some insight into the beta influences.

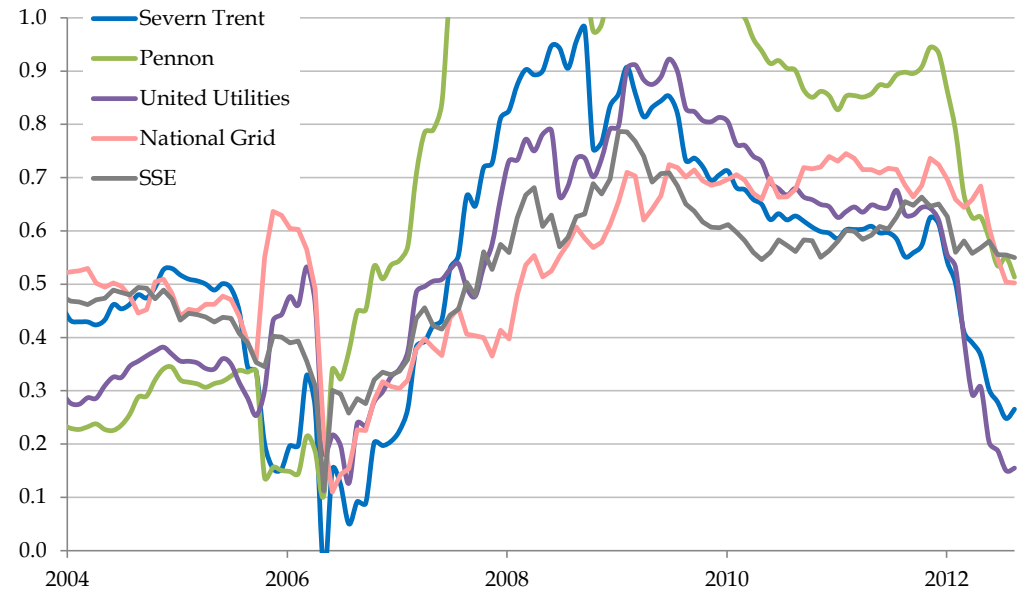
We set out two charts. Both charts show betas calculated using 4-weekly data on a rolling 160-week basis (namely 40 observations for each calculation), using exactly the same source data[20], but the data samples for the two charts are simply two weeks apart – apart from the different sampling cycles, the calculations are identical. They show dramatically different results.

Figure 8: Betas based on 4-weekly data – Series 1



[20] Source: Yahoo Finance

Figure 9: Betas based on 4-weekly data – Series 2

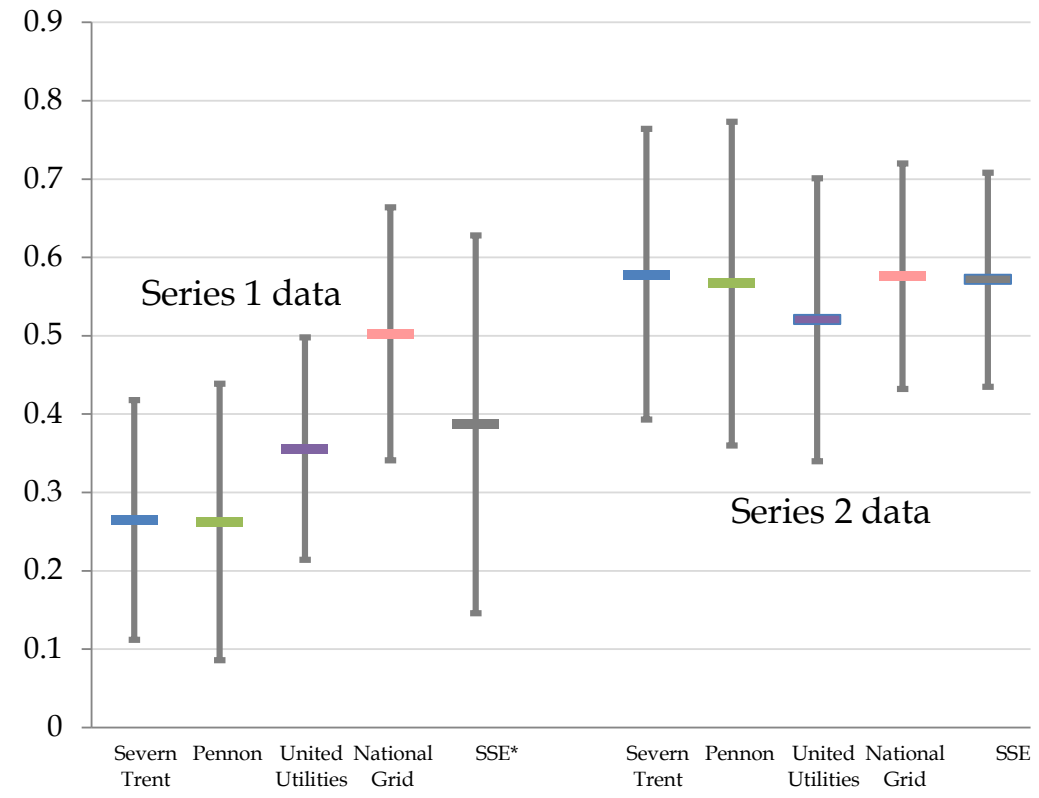


The dates for the Series 2 data, illustrated in Figure 9, include dates immediately before and after the two major falls in stock market valuations. Utility shares also fell just as dramatically at those times and, being such large falls, the calculated betas are strongly influenced. However, unlike the stock exchange in general, the utility shares fairly quickly bounced back up. The Series 1 data, illustrated in Figure 8, captures this effect by being specified two weeks apart from the Series 2 data.

After considering the underlying economics of systematic risk in the utilities sector, which we describe in Section 3, we should not be too surprised to see a correction in utility share prices after big stock market falls. This is because the regulatory regime inherently protects investors from much of the effects of new economy-wide information that would influence valuations for the generality of companies on the stock market.

Our overall beta calculations on 4-weekly data for the period since 2000, together with the 95 per cent confidence intervals, are illustrated in Figure 10.

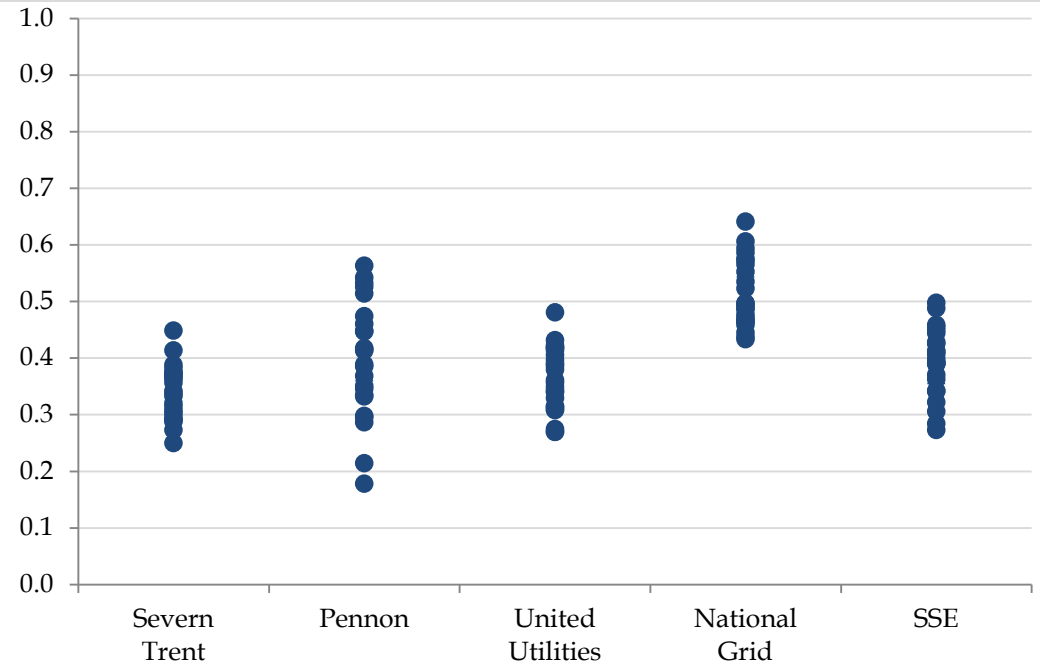
Figure 10: 4-weekly beta 95 per cent confidence intervals



** Newey-West confidence intervals are indicated where tests show data are auto-correlated*

We have considered betas calculated for a large number of different periodicities and starting dates. Some periodicities, such as the 4-week data sets analysed above, show a wide range of results. We find that a 5-week periodicity generates a relatively tight range of results, across the 25 possible start dates, for the period since 2000 as shown in Figure 11.

Figure 11: Spread of betas for 25 start dates for 5-week betas 2000-12



Conclusions on evidence from the stock market

We note that the relatively high observed betas for National Grid over the period since 2000 in most of the results appears to correlate with the company's relatively high exposure to pension scheme assets, identified in Section 3.2. We would expect any exposure of the company's share value to systematic risk in pension scheme assets to have reduced in recent years following Ofgem's review of its treatment of pensions costs and we observe that the daily beta results since 2010 would seem consistent with this interpretation.

We consider the evidence would be consistent with an underlying (after adjusting for pension scheme concerns) equity beta estimate of between 0.35 and 0.5 for the listed network companies. Higher assessments would be outside the range supported by the 4-week Series 1 data illustrated in Figure 8, lower assessments would be outside the range supported by the 4-week Series 2 data, and the range would be consistent with the other data sets we have considered.

We also consider that any higher estimate would look implausible in the light of the evidence we analyse in Section 3. Our assessment is that the regulatory regime profoundly conditions the risk environment for investors and, in the absence of a strong regulatory component to beta risk, there is little scope for economy-wide factors to impact on the underlying value of investment in regulated utilities. It would appear to us that the full scope of regulatory protection for investors may not be factored into observed betas.

5 The evidence from share price levels

The rationale for considering share price levels for an assessment of the cost of capital for a regulated utility is that high valuations relative to the value of equity in the RAV (namely RAV less net debt) would imply that shareholders value the prospective cash flows more highly than the regulator assumes.

There are two possible reasons for this. The first is that shareholders may anticipate future outperformance against regulatory assumptions and thus additional shareholder value (through the effect of incentives) than the regulator might have assumed in the past or will assume in the future. The second is that shareholders discount those cash flows at a lower rate than the regulator assumed in the past and is expected to assume in the future.

In practice, it is not really possible to isolate these two influences. Even if one could identify value attributable to the discount rate, we would not know how much of the value to ascribe to differentials between the allowed and actual costs of capital during the current and next price control period and how much to subsequent control periods.

Nevertheless, we note that a number of recent high profile transactions involving regulated networks have shown significant premiums on regulatory asset values:

- The July 2010 sale of EDF's electricity distribution networks to Cheung Kong Infrastructure and Hongkong Electric at a reported premium of 27 per cent[21] on the RAV,
- The March 2011 sale of E.ON's Central Networks to PPL Corp at a premium of around 30 per cent[22] on the RAV,
- the June 2012 sale by Veolia Environnement S.A. of its water businesses to a consortium of Infracapital Partners, M&G Infrastructure Fund and Morgan Stanley Infrastructure Partners at a reported premium of 30 per cent[23] on the RCV.

Taking net debt into account, these premiums would translate into a very substantial valuation of equity in excess of the regulatory equity (RAV/RCV less debt). It would be at least plausible to interpret this level of excess as providing some support for the view that the current cost of capital allowance is high relative to the actual cost of capital for an efficiently financed network utility.

[21] Reuters (30 July 2010), "Li Ka-shing to buy EDF's UK grids for £5.8 billion"

[22] Reuters (2 March 2011), "PPL to buy E.ON networks for £3.5 billion cash" reported a 17% premium on RCV, which increases to around 30% when £0.5 billion of external debt is taken into account. Other contemporary estimates ranged around 30%.

[23] Reuters (29 June 2012), "S&P places Veolia Water Central on credit Watch negative"

We consider that high equity valuations provide some corroborating, but not primary, evidence for the cost of capital. We do not believe it is appropriate to place significant weight on them.

6 A note on Blume and Bayesian adjustments

6.1 Blume adjustments

It is common practice to apply high level adjustments to observed beta calculations to derive an adjusted beta closer to 1.0. The insight behind these adjustments was a finding by Marshall Blume described in a 1971 paper[24] which showed that there was "a consistent tendency for a portfolio with either an extremely low or high estimated beta in one period to have a less extreme beta as estimated in the next period. In other words, estimated betas exhibited … a tendency to regress towards the grand mean of all betas, namely one." From the data presented in that paper, an adjustment to the raw betas can be made as follows[25]:

$$\beta_{adjusted} = 0.371 + 0.635\ \beta_{raw}$$

In his 1975 paper[26], Blume explored the reasons for the regression tendency in observed betas and concluded that it arose mainly because companies of extreme risk (either high or low) tend to have less extreme risk characteristics over time.

He identified two logical explanations:

- Risk in existing projects become less extreme over time, which he suggested was plausible for high risk firms but less so for low risk firms.
- New projects may tend to have less extreme risk characteristics than existing projects.

It seems clear that neither of these explanations is a plausible reason for regression in the regulated network sectors. Regulated activities are specified in licences and thus inherently stable and the risk characteristics of the sectors are fundamentally conditioned by the nature of economic regulation, which is substantially a constant.

For these reasons, Blume adjustments are generally, and rightly, rejected by regulators. There appears to be no justification for applying them to betas in the network sectors.

6.2 Bayesian adjustments

A Bayesian adjustment is another type of adjustment commonly applied to raw beta calculations. The rationale for applying a Bayesian adjustment relates to the inherent biases that arise when sampling data, that there is a higher chance that a lower than expected observed beta is an underestimation than an overestimation. The

[24] Marshall Blume, 'On the Assessment of Risk', Journal of Finance, March 1971

[25] Practitioners sometimes apply slightly different factors reflecting updated analysis or simply rounded to one third plus two thirds of the raw beta.

[26] Marshall Blume, 'Betas and their regression tendencies', Journal of Finance, June 1975

principles were described by Oldrich Vasicek in a 1973 paper[27], who explained that the adjustment can be interpreted as an adjustment of the estimate towards the best prior estimate. The relevant information available prior to sampling is some knowledge of the cross-sectional distribution of betas, in the form of a mean and standard deviation of expected betas or 'prior density'. These must be specified for the calculation of the adjustment.

Vasicek further explained that "If nothing is known about a stock prior to sampling except that it comes from a certain population of stocks …, an appropriate choice of the prior density is the cross-sectional distribution of betas observed for that population". If the population is all stocks traded on the London stock exchange, then the mean of that density would be 1.0.

In the case of utility shares, however, we do have prior information, analysed in Section 3, that indicates the expected betas would be rather less than 1.0. Properly applied given this information, Bayesian adjustments would tend to reduce the beta estimates analysed in Section 4, although the reductions would be small for betas derived from daily data.

We have not made such reductions.

[27] Oldrich Vasicek, 'A note on using cross-sectional information in Bayesian estimation of security betas', Journal of Finance, December 1973

7 Financeability and credit metrics

7.1 Tensions arising from the key credit metrics

Credit rating agencies consider a number of factors in assessing credit risk. We would not want to overstate the importance of credit metrics, but agencies (e.g. Moody's August 2009 rating methodology for regulated electricity and gas networks) do give evidence from credit metrics a significant weighting towards their rating assessments.

In its RIIO principles, Ofgem has signalled a focus on "financeability in the round" and concludes that a properly assessed notional gearing and cost of capital allowance should assure financeability. We also note the RIIO principle that short-term shortfalls in credit metrics should be resolved by companies through dividend policy or new equity. Although Ofgem's financeability assessment does not intend to replicate the different rating agencies' methodologies, the main credit metrics referred to by the rating agencies have been given weight in Ofgem's judgements on the overall package in its initial proposals. Like the agencies, Ofgem's analysis also takes account of a wider range of criteria, including the credit-supportive nature of the regulatory environment[28].

Of the credit metrics used by the rating agencies, the rating agencies highlight the following as particularly important[29]:

- The gearing ratio (net debt-to-RAV)
- A cash-based interest cover ratio, the FFO interest cover ratio
- An interest cover ratio adjusted for regulatory depreciation allowances, known as the adjusted interest cover ratio or the post maintenance interest cover ratio (PMICR)
- The FFO-to-net debt ratio

Our analysis indicates that there is a tension between these ratios, i.e. the threshold values for them that rating agencies currently refer to, and the underlying economics of regulation, and that this tension is liable to increase.

There are two main sources of tension:

- The evidence we refer to in this report may point to lower levels of equity returns being appropriate – this will affect the FFO interest cover ratio, the PMICR and the FFO-to-net debt ratio,

[28] See also paragraph 4.6 of Ofgem's March 2011 supplementary annex for its RIIO T1 and GD1 Strategy decision.

[29] We recognise that other metrics relating to the scale of investment programmes are also important, but these have a more company-specific bearing on the allowed return judgements.

- Recent evidence from the Office of National Statistics (ONS) suggests there has been an underlying increase in the 'formula effect' in the difference between the RPI and CPI, which would mean higher longer term RPI inflation in a CPI-based inflation-targeting regime and potentially higher nominal interest costs – this will affect the FFO interest cover ratio and the PMICR.

In both cases, the tensions may increase.

At the time of writing, the ONS is consulting on options for changes to the basis of calculating the RPI[30]. The options being considered include options that would reduce or even eliminate the formula effect.

Table 5 describes the underlying economic form of each metric. In practice, the metrics are all calculated from accounting information and will be further influenced by a number of specific factors, including company performance, the impact of incentives, timing and other effects such as movements in working capital and differences between the company's capital structure and debt costs and those assumed by Ofgem. The underlying economic form of each metric can be described in terms of the profits before and after depreciation, cash interest costs and gearing.

Table 5: Economic form of key credit metrics

Credit metric	*Underlying economic form*
Gearing	$\frac{Net\ debt}{RAV}$
FFO interest cover	$\frac{\mathrm{WACC}_{\mathrm{vanilla}} + \frac{\mathrm{Depreciation}}{\mathrm{RAV}}}{\mathrm{g} \cdot \mathrm{CoD}_{cash}}$
PMICR	$\frac{WACC_{vanilla}}{g \cdot CoD_{cash}}$
FFO-to-net debt	$\frac{WACC_{vanilla} + \frac{Depreciation}{RAV} - g \cdot CoD_{cash}}{g}$

There are some differences in the specifications of these metrics by the three main rating agencies, and also different weights are attributed to them. The main differences in specification relate to the treatment of index-linked debt interest.

[30] 'National Statistician's consultation on options for improving the Retail Prices Index', 8 October 2012.

Table 6 sets out the underlying metric values (based on fundamentals in Table 5 rather than forecasts[31]) for the four transmission businesses and the average of the gas distribution businesses arising from Ofgem's assumptions in the initial proposals, and assuming RPI inflation of 2.75%[32].

Table 6: Underlying metric values from initial proposals

	Moody's	S&P	Ofgem	*BBB-/Baa3 thresholds**	*RIIO T1 SHETL*	*RIIO T1 SPTL*	*RIIO T1 NGET*	*RIIO T1 NGGT*	*RIIO GD1 average*
Gearing *(net debt-to-RAV)*				75.0%	55.0%	55.0%	60.0%	62.5%	65.0%
Cost of equity *(post-tax)*					7.00%	7.00%	7.00%	6.80%	6.70%
Cost of debt estimate					3.03%	3.03%	3.03%	3.03%	3.03%
WACC *(Vanilla)*					4.82%	4.82%	4.62%	4.44%	4.31%
Depr'n 2021 as % of RAV					5.16%	6.45%	5.71%	3.13%	6.33%
RPI inflation					2.75%	2.75%	2.75%	2.75%	2.75%
Cost of debt *(nom. incl. indexation)*					5.78%	5.78%	5.78%	5.78%	5.78%
Proportion of index-linked					-	-	25.0%	25.0%	25.0%
Cost of debt *(cash)*					5.78%	5.78%	5.09%	5.09%	5.09%
Underlying metric values									
FFO cover *(interest expense)*		✓		2.50	3.14	3.54	2.98	2.10	2.83
FFO cover *(interest coupon)*	✓		✓	2.50	3.14	3.54	3.38	2.38	3.22
PMICR *(interest expense)*					1.52	1.52	1.33	1.23	1.15
PMICR *(interest coupon)*	✓		✓	1.40	1.52	1.52	1.51	1.40	1.30
FFO-to-net debt	✓			8.0%	12.4%	14.7%	12.1%	7.0%	11.3%
FFO-to-net debt *(index-adjusted)*		✓	✓	8.0%	12.4%	14.7%	11.4%	6.3%	10.6%

** See Paragraph 4.9 and Figure 4.1 of Ofgem's March 2011 RIIO-T1 and GD1 Financial Issues paper*

The results indicate that the underlying metric values (based on fundamentals in Table 5) are under pressure in some cases[33]. In particular, underlying FFO interest cover and FFO-to-net debt is under pressure for NGGT due mainly to relatively low levels of depreciation, while PMICR is under pressure with the gas distribution companies due to a relatively high notional gearing coupled with a lower cost of equity allowance.

These calculations are of course only high level and indicative, and do not by themselves add to or necessarily correspond to the analysis carried out by Ofgem. But they do provide a basis to consider the effects of significant changes in some of the assumptions, notably the equity beta and inflation:

[31] Note that the results in Table 6 are based on fundamentals, for example inferring an expected nominal interest cost from a real cost of debt assumption and adding inflation, and will therefore not correspond to ratios calculated by Ofgem in its financeability assessment.

[32] We have used a common assumption for RPI, being the Bank of England target rate of inflation of 2.00% plus a formula effect of 0.75%.

[33] We highlight indicative thresholds for investment grade, BBB- (S&P/Fitch) or Baa3 (Moody's) , reflecting the long-standing regulatory benchmark of credit metrics that are consistent with an investment grade credit rating.

- ❑ Section 4 suggests conventional regulatory estimates of equity beta may be overstated

- ❑ Recent evidence from the Office of National Statistics and the Office for Budget Responsibility indicates that the underlying differences between RPI and CPI may have increased permanently from about earlier assumptions of about 0.8 per cent to 1.2-1.4 per cent[34], although some of this increase might be expected to translate into lower real (RPI-based) debt costs[35].

Table 7 analyses the impact of incremental changes in beta and inflation assumptions (down 0.1 and up 0.1% respectively) and the combined effect of plausible changes of four times these increments.

Table 7: Impact of changes in beta and inflation

Credit metric	*Impact of 0.1 increment reduction in the equity beta*	*Impact of 0.1% increment increase in RPI inflation*	*Impact of combined increments*	*Impact of 4x combined increments*
FFO interest cover	**-0.06**	**-0.05**	**-0.11**	**-0.45**
PMICR	-0.06	-0.02	-0.09	-0.35
FFO-to-net debt	-0.4%	-0.1%	-0.5%	-1.8%

This analysis indicates that the credit metrics derived from economic fundamentals may come under rather more pressure in future if the issues raised above materialise. The PMICR is particularly prone to potential problems, as the impact would put the underlying level below the threshold levels that Moody's and Fitch consider as consistent with investment grade debt (minimum values of 1.4 to 1.5).

The problem arises due to the construction of the PMICR. It is an adjusted cash flow ratio, adjusting for the portion of revenues not available to cover interest because it relates to the continuing cost of maintaining the asset base. The operating cash flows in the numerator are thus driven by the allowed real return, while the denominator

[34] See Working paper No. 2, 'The long-run difference between RPI and CPI inflation', OBR, November 2011. The permanent status of the increase would be subject to the outcome of the ONS review referred to in footnote 30.

[35] As gilts and most index-linked bonds are, like the RAV, indexed with reference to RPI, an underlying increase in the RPI-CPI differential would tend to make index-linked instruments more attractive for investors. This would also affect the risk-free rate suitable for inclusion in the WACC calculation.

is generally driven by nominal interest rates. It is a hybrid measure that doesn't quite measure the cash headroom (the numerator sits somewhere between cash available before and after taking into account investment needs) and doesn't quite measure economic headroom (the denominator does not deduct from interest costs the portion that is compensated for in the indexation of the RAV).[36]

The confluence of mounting evidence of low betas and a higher formula effect in the RPI would have a bearing on the balance of cash flows of a regulated business, but our assessment is that the PMICR measure, as specified, somewhat accentuates the impact. Importantly, it should have only a limited bearing on the underlying economic sustainability of a regulated business.

The implications are that one or more of the following will need to happen:

- Ofgem places less weight on traditional credit metric thresholds,
- The industry moves to rather lower levels of gearing,
- Ofgem awards returns rather higher than the risk-adjusted cost of capital
- Rating agencies modify the specification of the metrics to reflect the emerging evidence of low risk in these sectors and, possibly, a higher level of RPI inflation.

Our view, echoing the approach set out in the RIIO principles, is that the underlying economic sustainability should be the primary driver of financeability.

7.2 Interpreting financeability for RIIO T1 and GD1

Section 7.1 considers some issues arising from metrics used by the credit rating agencies. There is a further metric, one not generally used by the rating agencies, that Ofgem has referred to in its judgements about its initial proposals. It is a metric from Ofgem's RoRE analysis, which we describe in Section 3.1 in the context of equity betas.

That metric is the RoRE range, and in particular the bottom end of that range.

Ofgem's stated intention is that "companies should be able to achieve an upside return on (notional) equity in the low double-digits, and be exposed to a downside return at or below the cost of debt", and that the RoRE ranges represented a sense-check on the calibration of its initial proposals: "If we selected the right levels of cost of equity and notional gearing for the cash flow risk of the businesses, we should find that the RoRE ranges are comparable".

[36] We consider that the established status of the UK network regulatory regime and the inherently long-term nature of the businesses points towards long-term economic rather than short-term cash flow indicators. We believe the logical extension would be a revised credit metric, based on PMICR, but adjusting interest costs in full with the portion that is compensated for in the indexation of the RAV. Such a revision would require new threshold levels to be determined, and those threshold levels would ideally be informed by an evidence-based assessment of RoRE volatility.

For its initial proposals, the lowest bottom end of the RoRE ranges for the transmission and gas distribution companies was a little below three per cent, close to the real cost of debt estimated by Ofgem on a notional gearing basis for modelling purposes.

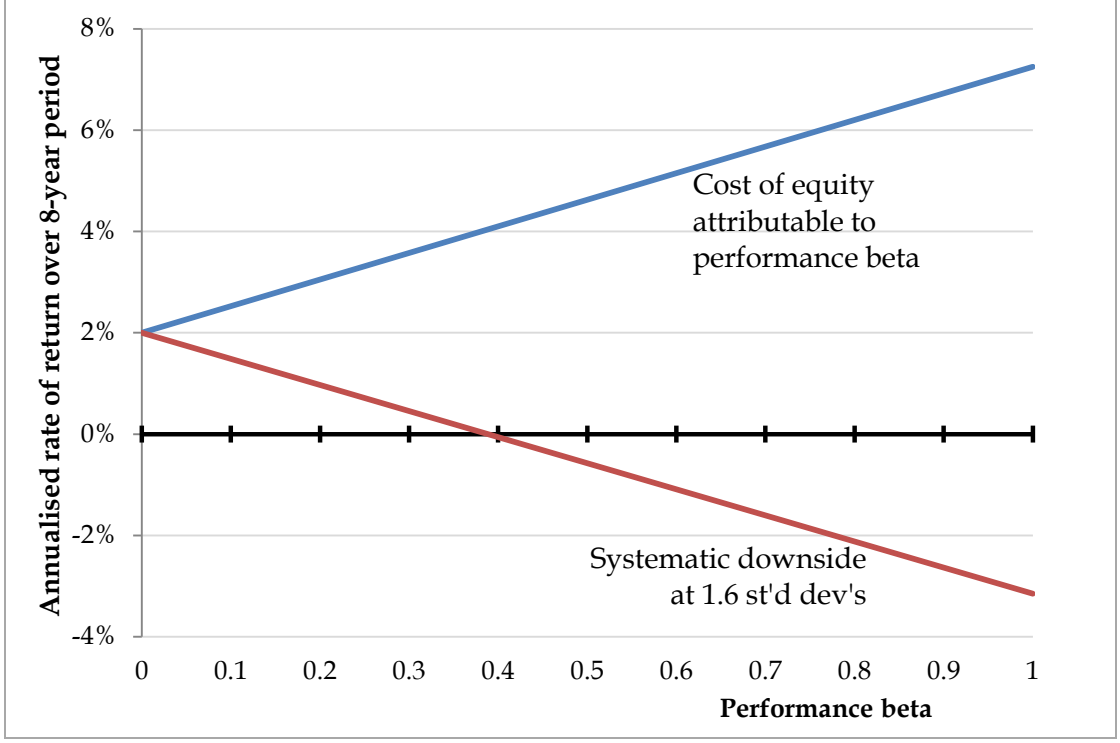
Downside scenarios from first principles

The real cost of debt may be a convenient reference point for RoRE analysis, but we question its economic appropriateness as a benchmark for downside scenarios for an appropriately calibrated equity return. Investments in equity markets come with the risk of losses and the history suggests, as illustrated in Figure 1, that the standard deviation of returns on the market portfolio over 8-year periods has been in the region of 6.5%. Consequently, there is a significant risk of losses, even with the most diversified portfolio.

Investment in a single utility business cannot be considered a diversified portfolio; there will be some company-specific, i.e. diversifiable, risk which will tend to make downside returns proportionately lower than those for the market (on a risk-adjusted basis).

Figure 12 illustrates a systematic downside at 1.6 standard deviations (i.e. broadly consistent with a 90% confidence interval) for a business with its cost of equity appropriately set according to its equity beta (assuming Ofgem's assumptions for the risk-free rate and the market risk premium).

Figure 12: Theoretical systematic downside returns



It indicates that we should expect to see RoRE downsides rather lower than the cost of debt, even with very low betas, and especially after taking into account company-specific risks.

Another possible benchmark for RoRE downsides is the real rate of growth in the RAV. Provided RoRE can be sustained in the longer term at a level no lower than the real rate of growth in the RAV, it should be possible to maintain a gearing ratio consistent with Ofgem's notional assumption without resorting to new equity issues.

The scope for new equity issues is, of course, underpinned by the balanced expectation of returns being rather higher than those downside scenarios, but the significant risk of downside scenarios is an integral and normal part of equity investment.

Recognising that some of the RoRE variability will be systematic, and thus outside the control of a company's management, lenders may reasonably be primarily concerned about persistent (or very substantial) underperformance in respect of the non-systematic portion of RoRE variability. This is because we would not expect persistent underperformance in respect of systematic RoRE variability as Ofgem should be able to respond to new information about the wider economy at each price review.

This suggests that the real concern for lenders might therefore be about the management of very high value risk and about persistent underperformance at the level of company management. It would seem reasonable for Ofgem to recognise that it is normal for investors, including lenders, to be exposed to that kind of performance risk and to recognise that corporate governance and rights attaching to debt instruments should provide suitable safeguards against such risk.

Ofgem's criteria for RIIO T1 and GD1

In the light of the discussion above, we would characterise Ofgem's benchmark for risk analysis of downside equity returns around the level of the cost of debt as inherently cautious.

ANNEX

A1 Relating betas to regulatory returns

This annex sets out the rationale for the relationship between variability in profits and variability in market returns.

The financial theory behind the Capital Asset Pricing Model (CAPM) is based on insights developed by Harry Markowitz in the 1950s about the risks for an investor who holds a portfolio of investments[37]. Markowitz showed that a balanced portfolio of investments would help minimise the level of risk for a given level of expected return. This insight implies that the rate of return required by the market from any one investment will relate to the level of non-diversifiable, or systematic, risk in that investment, the beta.

The risk in any one investment, the uncertainty in its future returns, can be thought of as having two components, diversifiable and non-diversifiable risk. Non-diversifiable risk will be the uncertainty that 'co-varies' with the returns on a diversified portfolio, or with the market as a whole. That level of uncertainty will be lower than the overall level of uncertainty in the investment[38]. This means that if we have a measure of the overall level of uncertainty in an investment and the overall level of uncertainty in the market as a whole, we should be able to infer an upper bound on the level of non-diversifiable risk in the investment.

We can do this more easily for regulated businesses because of a feature of price setting using regulatory asset values (RAVs). In general, the regulator will set prices at each price review so that the discounted net present value of forecast cash flows will correspond to the RAV at the start of the control period. In this calculation, the discounted net present value of cash flows after the end of a control period will be represented by the RAV projected for the end of the period. If the regulator fairly forecasts the cash flows and fairly estimates the discount rate (and can be expected to in later periods), the RAV at the start of the period should equate to the market's valuation of those same cash flows.

In practice, the market's valuations and the RAV will not coincide at the start and end of each control period, but the principle allows us to derive expressions for the overall investor return (R_A) and equity return (R_E) over a control period.

[37] CAPM itself was subsequently developed by others, including John Lintner, William Sharpe, Jack Treynor and Jan Mossin.

[38] This is because of a well-known statistical result:
$Var(D + ND) = Var(D) + Var(ND) + 2 \cdot Covar(D, ND)$, the last term of which will be zero when D and ND are statistically independent.

Deriving accounting expressions

We derive the expressions from an accounting perspective. The accountant's framework, based on double-entry bookkeeping, results in statements that balance. The essential balance is a relationship between a profit and loss account and movements in the balance sheet, which we can describe with the following expression:

$$P + T_E + RV = E_1 - E_0$$

In this expression, P represents profit for a period, T_E represents transactions with shareholders during the period, such as share issues less dividends, RV represents revaluations and E_1 and E_0 represent shareholders' equity at the start and end of the period. In a set of accounts, the equation is demonstrated in the statement of changes in equity.

Although regulators do not formally keep books of credits and debits, the RAV-based price control process is underpinned by the accounting concept of financial capital maintenance[39]. For energy networks, movements in the RAV will reconcile to operating profits and transactions with investors (lenders as well as shareholders), while movements in regulatory equity will reconcile to the post-tax profits and dividends and equity issues necessary to maintain the notional gearing assumption.

We can use this form of equation to consider two parallel perspectives on equity returns for a regulated utility with listed shares. The first is a view of shareholder returns as evidenced in movements in share prices, the stock market valuations of equity at the end (MEV_1) and start (MEV_0) of a period:

$$R_E + T_E = MEV_1 - MEV_0$$

In this expression, the R_E equity returns are those used in the calculation of beta estimates and T_E represents shareholder transactions (principally equity issues less dividends).

The second is a view of equity returns from a regulator's perspective, recognising that RAV revaluations are in principle avoided, where RP_E represents profits after regulatory depreciation, financing and tax (related to RoRE and the cost of equity) and T_{EN} represents the dividends and equity issues necessary to maintain the notional gearing assumption:

$$RP_E + T_{EN} = RE_1 - RE_0$$

[39] Ex ante FCM is a principle adopted at price reviews (regulated charges are set to be sufficient to allow the recovery of all capital invested, the rolled-forward RAV, irrespective of the 'operating' value of any assets), and FCM lies behind Ofgem's accounting for returns on regulatory equity (all incentive adjustments are included in returns).

On a forward-looking basis, we can simplify our analysis by assuming that shareholder transactions will align with those required to maintain an assumed gearing ratio[40], namely:

$$T_E = T_{EN}$$

We can also assume that the market and regulatory values of debt are the same[41], namely (with MCV representing the market capital value of the enterprise):

$$D_1 = MCV_1 - MEV_1 = RAV_1 - RE_1,$$

$$D_0 = MCV_0 - MEV_0 = RAV_0 - RE_0$$

From these expressions we can derive an expression for equity returns, in absolute terms:

$$R_E = RP_E + (MCV_1 - RAV_1) - (MCV_0 - RAV_0)$$

And as rates of return:

$$r_E = \frac{RP_E + (MCV_1 - RAV_1) - (MCV_0 - RAV_0)}{RE_{ave}}$$

Deriving beta expressions

The purpose of this exercise is to consider non-diversifiable risk in those returns, beta risk, which we can measure with reference to the covariance between uncertainty in equity returns (r_E) with uncertainty in market returns.

We represent market rates of return as r_M.

We start by identifying two components of the equity beta: performance beta, with reference to the RP_E, and valuation beta with reference to the differences between MCV and RCV in the expression for r_E above. We express beta in the conventional way as the ratio between the covariance and the variance in market returns.

$$\beta_E = \frac{Covar(r_E, r_M)}{Var(r_M)} = \beta_E^P + \beta_E^V$$

[40] Whether or not this assumption is realistic for a particular company, shareholder transactions are most unlikely to be a driver of systematic risk so, for the purpose of this exercise, it is a safe assumption to make.

[41] Market values of debt are liable to differ from the nominal value of debt principal. However, this difference can be ignored in the calculation of MCV from the perspective of the company (and for the purposes of this analysis) as Ofgem's allowances for the cost of debt are not based on returns required for prospective new issues but take into account the history of interest rates by simulating a notional portfolio of debt held by a company.

Where we define our valuation beta as:

$$\beta_E^V = \frac{Covar\left[\frac{(MCV_1 - RAV_1) - (MCV_0 - RAV_0)}{RE_{ave}}, r_M\right]}{Var(r_M)}$$

And we define our performance beta as:

$$\beta_E^P = \frac{Covar\left(\frac{RP_E}{RE_{ave}}, r_M\right)}{Var(r_M)} = \frac{Covar(RoRE, r_M)}{Var(r_M)} = Corr(RoRE, r_M)\frac{St.dev(RoRE)}{St.dev(r_M)}$$

Since a key purpose of an incentive-based regime is to incentivise company-specific performance through the profit motive, and Figure 2, Figure 3 and Figure 4 indicate that a significant portion of profit variability is company-specific and thus not systematic, the correlation terms in the expressions above will be less than 1.0, and possibly a lot less than 1.0.

This allows us to specify the following:

$$\beta_E = \beta_E^P + \beta_E^V < \frac{St.dev(RoRE)}{St.dev(r_M)} + \beta_E^V$$