Reframing our understanding of risk in regulated energy networks

8 March 2022

Ian Rowson
imr@imrecon.co.uk

Professor Seth Armitage, academic advisor

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1. Introduction and high level summary

We were asked by SSE to carry out a study into what drives systematic risk in regulated networks, with reference to the ongoing RIIO-ED2 review. The idea that prompted the request was one originally discussed in Ofgem's November 2012 RIIO Financeability Study. Returning to the idea nearly a decade later highlights that there are some considerable weaknesses in conventional analysis of risk in these sectors.

The analysis of risk is especially important for regulated energy networks in Great Britain as we do not have direct observations of betas in the sector. Beta estimates can only be made after considering the risk exposure of licensees in the sector relative to exposure in other sectors, especially water, other jurisdictions such as the US or Europe, or energy networks subject to different regulatory frameworks such as offshore transmission operators (OFTOs).

The originating idea

The core of the originating idea is that there is simply not enough variability in returns arising from what we conventionally think of as the source of systematic risk to explain observed beta levels, specifically in the comparator sector of water. We developed this insight into a test for the presence of regulatory risk. This test uses straightforward statistical mathematics and is carried out in Chapter 2. It demonstrates that the substantial part of beta risk for these sectors cannot come from in-period outturn variability but must instead come from the big strategic influences over regulatory processes that could create structural shifts in the prospects for returns.

We cross-check this implication with a bottom-up consideration of the 'in-period' risks facing regulated networks in water and energy. It becomes clear that the nature of those risks is predominantly idiosyncratic, with little scope for economy-wide influences to have a significant bearing.

This insight, that systematic risk must in fact come from 'between-period' regulatory processes, has far-reaching implications for how we understand risk in these sectors. In particular, it can help guide how we evaluate the differences in risk exposures between GB energy networks and other sectors within and outwith Great Britain.

A structural difference between energy and water

Having established that it is the regulatory processes that must drive systematic risk in regulated networks, the focus of any relative risk evaluation must be on differences that may affect those processes.

In many respects, energy and water networks are regulated under very similar regimes. The two sectors were privatised within a short period between 1986 and 1991 and the electricity and water regimes evolved in parallel during a formative period for utility regulation in the early 1990s. Ofwat and Ofgem have often tracked each other's innovations and have at times shared senior advisers.

There are some important differences between the two regulatory environments. Water networks have a direct customer relationship with its consumers while energy networks operate as a key component in a value chain and are paid by energy suppliers rather than consumers directly. The two sectors are subject to different strategic drivers, with water focused on water resources and the natural environment while energy is focused on climate change and the net zero imperative.

We may expect these differences to have some impact on relative exposure to systematic risk, but the direction and scale of the effects are difficult to divine.

There is, however, one important structural difference between the two sectors, a difference that has become decidedly more apparent in recent weeks. That is the fact that the appeals frameworks for the two sectors diverged in 2011. The appeals framework is a central feature of a regulatory environment, designed to provide important protections for affected parties, notably investors, so we might expect a marked divergence in the appeals frameworks to have a material effect on risk exposure.

Chapter 3 explains that the implications of that divergence were not clear at the time the legislation was introduced. We had sight of some of the implications in the first cycle of four energy appeals in 2015 to 2017, but the full impact only became apparent with the CMA's provisional determination of the RIIO-T2/GD2 appeals in August 2021, confirmed in the final determination on 28 October 2021. This came only five months after the CMA's price control determination for the four water sector PR19 appellants. In some important respects, the two appeals addressed similar issues and appellants mounted similar arguments. The outcomes, however (in the case of energy, subject to confirmation), were somewhat different. In effect, the framework for energy appeals leaves intact a significant margin of regulatory appreciation. The scope for successful appeals of Ofgem's decisions is substantially lower than for Ofwat's.

In Chapter 4, we analyse this difference. We isolate from the two chains of decisions (the regulators' and the CMA's) key generic components, components that are common to both sectors and where there is a need for judgement in making estimates. These components lie in allowances for the cost of equity where the use of the capital asset pricing model means that estimates must be made of market-wide parameters, independent of the sector at issue.

Our analysis indicates that the new energy appeals regime provides a substantially weaker form of protection for investors than the water equivalent. We measure the impact as a factor of 1.7x difference in the exposure to regulatory judgement. In Chapter 5, we consider the implications for energy network betas relative to those observed in water. We consider the wider context of risk exposure but also the structural importance of appeal rights. We would not translate this 1.7x factor directly into a beta difference, but it would be difficult to discount much of the effect. We conclude that an estimate of the effect of 1.1x[1], for example, would be unreasonably low.

Implications for wider relative risk analysis

The insights arising from Chapter 2 also have far reaching implications for how we consider risk relative to sectors in other jurisdictions or different regulatory frameworks. In this report, we articulate what those implications are to help guide further work on relative risk for RIIO-ED2. The analysis we do carry out in this report, which focuses on risk relative to the water sector in England and Wales, may therefore provide a template for wider relative risk analysis.

[1] on an equivalent gearing basis, and leaving aside other risk differences

2. A test for the presence of systematic regulatory risk

This chapter uses some straightforward statistical mathematics and market information to test for the presence of systematic regulatory risk. It is a test originally discussed in Ofgem's November 2012 RIIO Financeability Study.

It exploits some important features of RAV-based regulation, and in particular the financial capital maintenance principle that lies behind it. It is an important principle that provides a firm foundation for regulators to operate incentive mechanisms. It means that incentives can be maintained irrespective of the cash flow dynamics of these complex businesses. Companies can respond confidently to incentives on offer, safe in the knowledge that the underlying financial capital is strictly maintained by the way the RAV, under and over-recoveries and other value components are rolled forward from control period to control period.

The null hypothesis

The null hypothesis is a concept often used in mathematical reasoning. It is a default hypothesis which is assumed to be true, but if the reasoning that follows leads to an impossible or inconsistent answer (or, in statistics, a very low probability answer), the null hypothesis can be rejected[2].

Our null hypothesis is that at each control review the regulator will set a fair control, based on ex ante expectations for the ensuing period taking into account all factors outside the control of management, that maintains the value of financial capital in the business without introducing systematic risk[3]. The financial capital maintenance principle arguably underpins network regulation as we know it in the UK. With this assumption, the risk facing investors is of outturns during successive control periods that diverge from those ex ante expectations. That risk is central to incentives, as it rewards above-normal efficiency and penalises inefficiency.

These in-period outcomes can be measured as returns on regulatory equity, or RoRE. The risk of variability in the underlying value of the enterprise, as represented in the RAV, is dealt with in our assumption that the regulator will set another fair control at the next review that maintains that value.

The business may, of course, benefit/suffer from sustained performance differentials, eg due to an exceptionally well/badly performing management team. By construction, any such structural effect would not be systematic – if it were systematic, it would be outside the control of management and, to be consistent with the null hypothesis, the regulator should take it into account.

For this reason, we can consider the systematic risk in each control period as independent of the systematic risk in other control periods. We can validly consider a single control period in isolation.

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[2] For example, to prove there is no highest prime number, you could take a null hypothesis that there is a highest prime number, which we call H. You then consider the number X = H! + 1, which the null hypothesis tells you cannot itself be prime. But it can be simply shown that X cannot be divided by any of the divisors of H!. Since the divisors of H! include H and all numbers lower than H, which according to the null hypothesis includes all prime numbers, X must therefore be prime. Which breaks the null hypothesis. We can then conclude the null hypothesis is not true and there is no highest prime number.

[3] There is no requirement or expectation in practice for regulators to exclude systematic risk. Indeed, we argue in this paper that some systematic risk would be a necessary consequence of regulators properly making decisions in light of their wider economic/societal context.

Testing the null hypothesis

We can test the null hypothesis by evaluating what it would imply for a regulated network's systematic risk exposure, its beta, and consider whether the conclusion is consistent with betas observed in the market. We can do this with reference to RoRE, the return on regulatory equity. Under our null hypothesis, we can take this measure to be directly analogous to investor returns in the market since the regulator's adherence to the financial capital maintenance principle would imply there would be no other capital gains or losses – it would ensure the value of the business at the end of the control period is incremented only by the network's net investment, any under or over recoveries and any market expectation of future under/outperformance of regulatory benchmarks due to (idiosyncratic) weaknesses/strengths of a particular company's management.

Statistically, viewing the RoRE within our representative control period as a variable, we can decompose it into its beta component, β x the market return (variable M), and an idiosyncratic component (variable A) independent of M:

$$RoRE = \beta \cdot M + A$$

Because A is by construction independent of M:

$$Var(RoRE) = \beta^2 \cdot Var(M) + Var(A)$$

$Var(A)$ must be positive so, if there is any idiosyncratic risk at all:

$$Var(RoRE) > \beta^2 \cdot Var(M)$$

Rearranging gives us:

$$\beta < \frac{StDev(RoRE)}{StDev(M)}$$

We have good evidence of $StDev(M)$ from the history of returns in the stock market. We can refer to data from the UK market using the DMS dataset[4]. This tells us that the 5-year $StDev(M)$ is no less than about 35%.

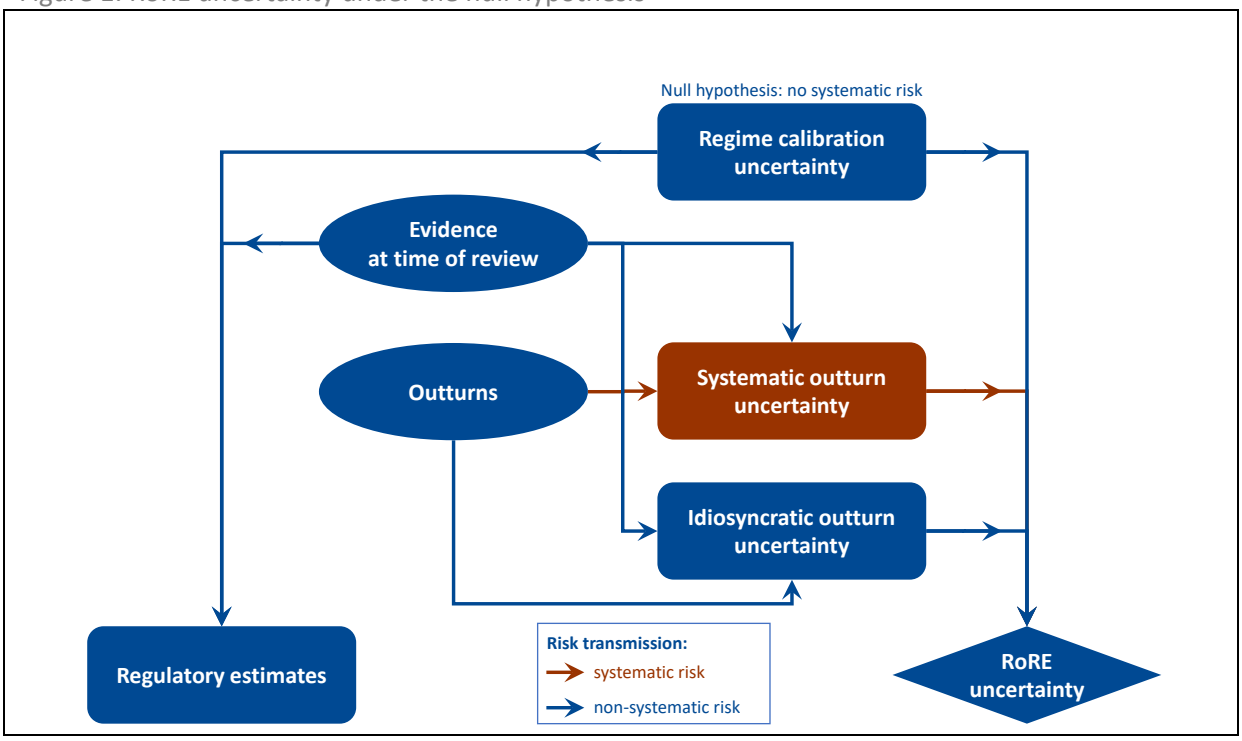
We can also estimate an upper bound for the variability of RoRE returns. A rule of thumb to characterise the range of uncertainty in annual RoRE returns is +/- 3-4%. This is, for example, broadly consistent with the range of possible RoRE performance for a typical company in Ofwat's PR19 final determination risk ranges[5].

Actual levels of RoRE would be driven by allowed returns, any uncertainty (period-to-period variability) in the calibration of the regime (up or down) and underlying RoRE uncertainty arising from direct risk influences such as variability in performance, input prices and the effects of incentives. Underlying RoRE variability would arise from both systematic factors and idiosyncratic

[4] The dataset compiled annually by E Dimson, P Marsh and M Staunton which forms the basis for the annual Credit Suisse Global Investment Returns Yearbook and related publications.
[5] Described in Figure 3.11 of the PR19 final determinations 'Aligning risk and return' technical appendix.

factors. Under our null hypothesis, any calibration uncertainty cannot be systematic, which means the systematic risk component of RoRE variability must lie in outturns that were not predicted at the time of the review at the start of the period. We can call these in-period risk influences.

Figure 1: RoRE uncertainty under the null hypothesis



If the annualised RoRE range is, say, +/- 3-4%, we might estimate $StDev(RoRE)$ over 5 years as no more than about 15%. This implies that attributable beta is less than 0.4. If there is a lot of idiosyncratic risk, it would be a lot less than 0.4. The discussion in Appendix 1 below indicates that these in-period risk influences would be substantially idiosyncratic. In turn, this means the beta risk arising could only be relatively small.

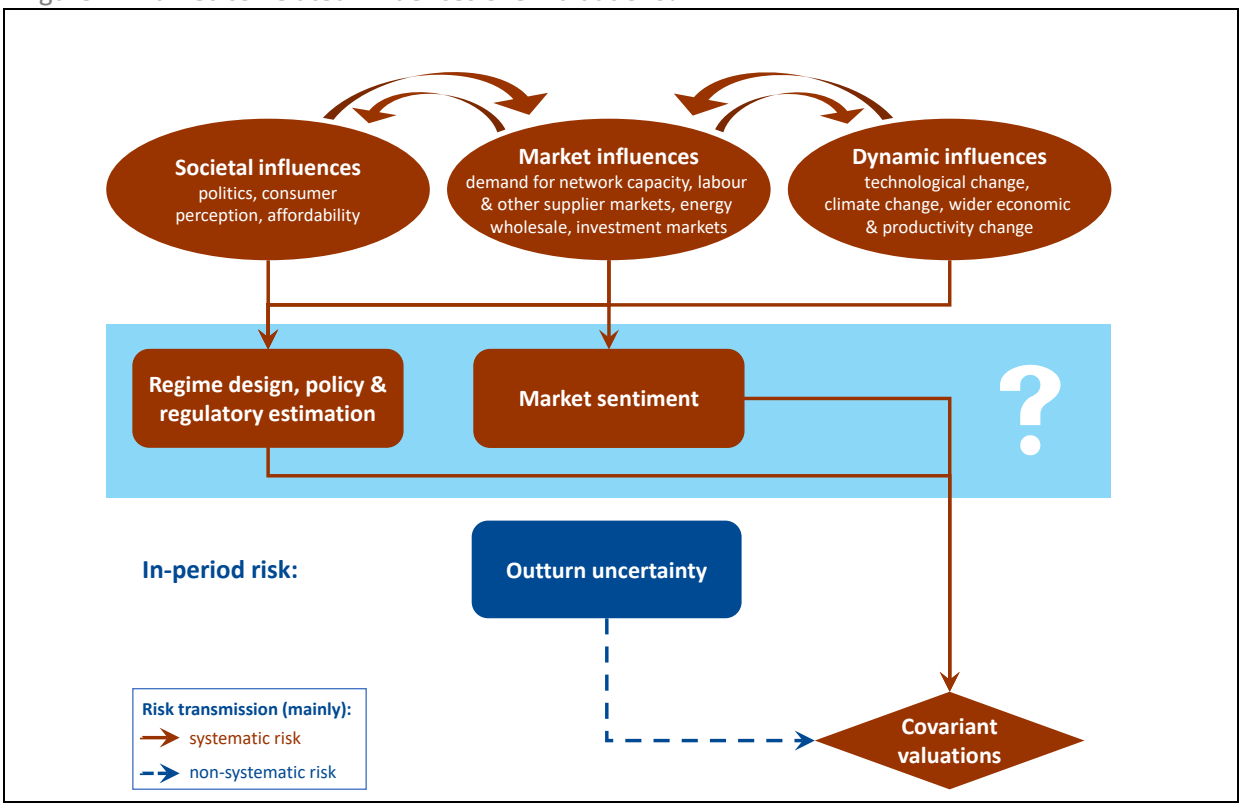
Logically, our null hypothesis must therefore be wrong. We go on to show that means that 'between-period' regulatory processes such a price control reviews must be the main source (or transmission mechanism) for systematic risk for regulated networks.

Could the effect be driven by market sentiment instead of regulation?

We have just disproved the null hypothesis. However, at this point, we have only disproved the strict assumption we made which was that the regulator succeeds in maintaining the value of financial capital in the business. Bearing in mind we observe beta in a market, we need to consider whether a failure to maintain financial capital, specifically the market value of that capital, is a consequence of systematic influences over regulation or unrelated market-correlated influences over market valuations.

We can illustrate these two propositions in the light blue box in the following diagram, Figure 2.

Figure 2: Market-correlated influences over valuations?



We can consider this in two ways.

Secondly, in Appendix 2 below, we establish that it is more than just plausible that there are systematic influences over regulatory decision-making.

Taken together, we can conclude that disproving our null hypothesis is equivalent to proving the significance of systematic influences over regulation.

But profit variability in other listed companies is also far too low to explain beta

The observation that cash flow volatility is lower than stock price volatility is not unique to utilities. What is unique to utilities is the periodic regulatory process of resetting revenue allowances. In the case of non-utilities, non-regulatory risks to the prospects of future returns beyond just short term profit variability must play an important role. Those risks would be exhibited in continuing stock valuations, ie not just short term profitability, and must be enough to explain observed betas.

There is an analogous effect for regulated businesses too, but the resetting process means that equivalent longer term risks can only be expressed through regulatory decisions. If future market conditions are to have an influence on profit expectations beyond the current price control, they

must somehow affect the regulatory price-setting process. By design, the regulator sets prices on a financial capital maintenance basis. The variability in that financial capital necessary to explain observed betas implies the design is quite malleable.

The mechanism at play for the generality of businesses in the economy is that share prices will be affected by broader market sentiments about the future. There is limited mean reversion in these sentiments, let alone the automatically applied mean reversion that is in principle built into the periodic price control process. Our null hypothesis was that the regulator would implement this mean reversion perfectly at each price control review, taking account of all relevant economic conditions including revealed information about economic cycles. The result of our test proves that the regulator's judgements far from 'perfectly' implement it. In other words, analogous factors that operate in classic unregulated businesses, that would affect market valuations, must also apply to regulated businesses, and the mechanism must be the process of resetting price controls. In other words, it is 'regulatory risk'.

Regulatory risk, in this sense, is a natural consequence of being informed by and responsive to developments in society and the economy. It is not necessarily a bad thing, provided it is balanced and its implications are recognised. At the time of privatisation, legislators recognised the importance of safeguards to ensure regulatory risk is appropriately contained, notably securing the independence of the regulator and putting in place an appeals regime. Chapter 3 discusses how the safeguard of the appeals regime has changed in recent years.

Implication

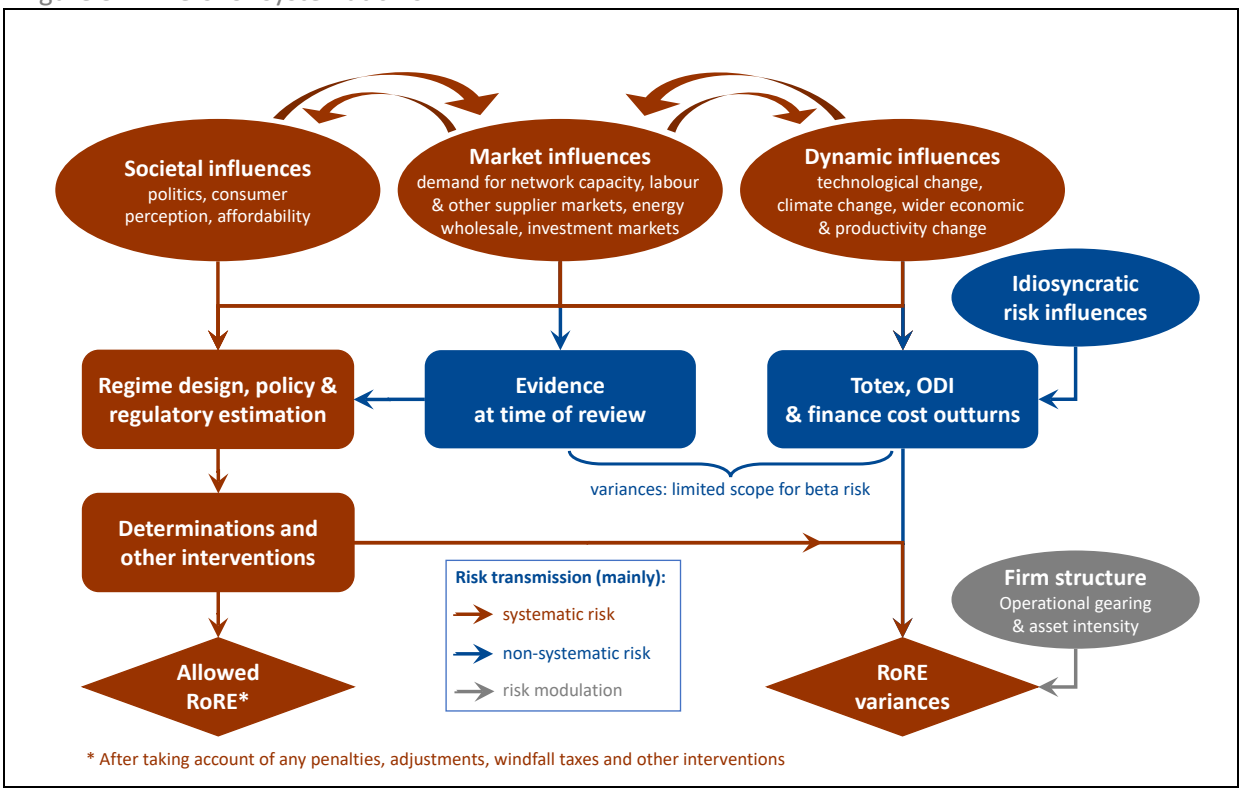
By the construction of our null hypothesis test, disproving it implies that much of beta risk must be driven by what we might call 'between-period processes' rather than in-period RoRE uncertainty. By between-period processes, we mean the processes that could affect the strict integrity of the financial capital maintenance principle at successive price control reviews, which means variability in the process of regulation itself. This would include the effects of external factors that the regulator would disregard, an old example of which would be the 1997 Windfall Tax but could also include penalties and DIWE adjustments[6].

We can conclude that beta risk comes not from in-period outturn variability but from the big strategic influences over regulatory processes that could create structural shifts in the prospects for returns. The systematic character of such structural shifts would indicate broad, economy-wide influences, changes in the economy, including financial markets, and inter-related changes in societal attitudes. These would be influences on regulation that are positively correlated with influences that affect stock market values. We can call these between-period risk influences, recognising that it's an imperfect description of influences that would classically affect periodic reviews but could also affect within-period regulatory interventions where discretion is involved, for example some uncertainty mechanisms. We discuss these further in Appendix 2.

The following diagram, Figure 3, illustrates the insight more broadly.

[6] These examples may or may not have systematic influences, but are simply examples of value-changing events outside of the usual price control process.

Figure 3: Drivers for systematic risk



3. A structural difference in relative risk

At the time of privatisation, it was recognised that the regulatory process should be independent of political influence and should be subject to safeguards. An important safeguard was the right afforded to companies to appeal regulatory decisions. Some 30 years later, it is unclear whether regulators behave as independently of politics as the legislators had imagined. But what is certainly clear now, after the RIIO-T2/GD2appeals, is that the revised legal framework for appeals has reduced the quality of protection for investors. Where there is external influence on regulatory decisions, investors can no longer rely on a panel of experts to substitute their independent judgement for the regulator's.

Having shown above that beta must be substantially driven by such influence, the clear inference is that beta will now be structurally higher – structurally higher than it was and structurally higher than a direct read-across from the water sector (because that sector is subject to a more comprehensive appeals regime).

This project is about how this can be brought to bear during the RIIO-ED2 review and position the DNOs to ensure any failure by Ofgem to respond appropriately is appealable.

The insight can shine light on other changes in regulation, not just the appeals regime. These may, for example, include any reduction in reliance on objective econometrics for cost assessments and greater weight on PCDs and UMs with the potential exercise of regulatory judgement.

The new appeals framework

The new legal framework for appeals was introduced by The Electricity and Gas (Internal Markets) Regulations 2011[7], itself part of the government's implementation of the EU's Third Package of reforms for an internal gas and electricity market in the European Union. These reforms did not apply to the water sector – the water sector's appeals framework remains broadly consistent with the pre-2011 framework for energy. Some changes to the then existing legal framework were necessary to implement the Third Package. However, the government (then DECC) explained in its September 2010 consultation on licence modification appeals that it proposed to exceed the minimum requirements of the Directive. It explained its view that it was preferable to introduce a new appeals mechanism for all licence modifications to obviate the need for two parallel appeals mechanisms, one for Ofgem's normal regulatory tasks and another for its Third Package duties.

In that consultation, the government expressed the view that:

> *"the grounds for an appeal should be wide enough to anticipate legal, factual and economic issues which may give rise to a dispute, and yet be sufficiently focussed so as to prevent trivial and vexatious appeals and avoid unnecessary repetition … The Government is minded to introduce a carefully defined right of appeal on the merits enabling the appeal body to assess whether;*
>
> *a) Ofgem failed to have regard to its statutory duties;*
> *b) Ofgem failed to give proper weight to the above;*
> *c) Ofgem's decision was based on an error of fact; or*
> *d) Ofgem's decision was based on an error of law."*

[7] which amended the provisions in the Electricity Act 1989 and the Gas Act 1986 relating to appeals.

In the finally adopted legislation, this list was supplemented by an additional ground, that the licence modifications fail to achieve the effect Ofgem stated[8].

The consultation also noted that the new approach would be familiar to industry participants as it would be similar to the procedure for reviewing amendments to industry codes in the Energy Act 2004.

The June 2011 impact assessment (IA) for the proposals included a section on the cost of capital. The section noted that *"Building up case law under appeals, on the technical merits of Ofgem's decisions in relation to the specified grounds, going beyond what judicial review would usually consider, may increase regulatory stability and in turn may lower the cost of capital faced by market participants".* This comment seemed to disregard the fact that the pre-existing regime for appeals already went beyond, and even further beyond, what judicial reviews would usually consider. The section went on to note that *"Some respondents to the consultation felt that the proposals could increase regulatory uncertainty."* This concern was dismissed on the basis that *"It is possible that this risk may in part arise as the equal right of appeal may give increased power to contest Ofgem's licence modifications to some licensees* [and Consumer Focus (as was), under the option finally adopted]*."*

It would therefore seem evident that any adverse effect on the cost of capital was an unintended and unanticipated consequence of the new regime.

The emerging picture

As the preceding discussion suggests, any effect of the new regime on regulatory risk was not strongly evident from the start. For the first cycle of appeals[9], the CMA explained its interpretation of the regime and highlighted that the new regime was different from the old one. Specifically, it pointed out that the CMA would *"engage with the merits of the decision under appeal and … conclude whether it was right or wrong in accordance with the statutory requirements"* and *"should not substitute its views for GEMA's solely on the basis that it would have taken a different approach"*.[10]

Those statutory requirements are pivotal. Section 11E(4) of the Electricity Act gives unqualified instructions: the CMA *"may allow the appeal only to the extent that it is satisfied that the decision appealed against was wrong on one or more of the following grounds …"*. By contrast, the requirement in the Water Industry Act 1991 is written in Section 12(3)(b): *"it shall be the duty of [the CMA] to determine any question or other matter referred [to it by Ofwat, including any questions or matters concerning the review of a price control (12(3A)(a), on being required to do so by an appointee (12(3)(a)] in accordance with the principles which apply … in relation to determinations [by Ofwat]."*

The contrast between the two legal frameworks is clear: in water, the CMA has to put itself in Ofwat's position and redetermine the questions or matters referred to it under the same principles that applied to Ofwat; in energy, the CMA is subject to the same duties as Ofgem but can redetermine a matter only if it can conclude Ofgem had been wrong on one or more of the grounds specified in the Act to determine it in the way it did.

[8] Electricity Act 1989 s.11E(4)(d)
[9] the two RIIO-ED1 appeals in 2015, and those for Firmus and SONI in 2017
[10] Both from para 3.42 of the September 2015 BGT RIIO-ED1 appeal final determination – it used similar phrasing in other appeals, eg para 3.17 of Firmus and 3.32 of SONI final determinations

The legal framework for energy appeals means that Ofgem has some room for manoeuvre in making a decision within some kind of boundary of wrongness, within which its decisions are safe from redetermination by the CMA. Ofwat has no such room for manoeuvre.

In the first cycle of appeals, the CMA introduced the notion that a regulator would have a margin of appreciation, an established term in Competition Appeal Tribunal (CAT) cases in the telecoms sector[11]. The term can be thought of as meaning a margin of discretion. The CMA identified the CAT approach as a useful analogy in both of the RIIO-ED1 appeals and explicitly used the term 'margin of appreciation' in the 2017 final determinations for Firmus and SONI. The CMA used the term extensively in the RIIO-T2/GD2 PD and FD.

What was not clear to observers was how wide Ofgem's margin of appreciation would be. The scopes of the two RIIO-ED1 appeals were relatively narrow[12] and, at first glance, the CMA reached comprehensively different conclusions to the Utility Regulator in the SONI appeal. The outcome of the SONI appeal may well have felt like the CMA substituting its views for the regulator's. The width of that margin only fully emerged with the 11 August 2021 provisional determination for the RIIO-2 appeals, confirmed on 28 October 2021 in the CMA's final determination.

The RIIO-2 appeals were notified during the closing stages of the CMA PR19 water sector appeals, on which the final report was only published on 17 March 2021. In the PR19 appeals, the CMA substituted its own views for Ofwat's on a wide range of issues. The effects included a 54bps uplift on the cost of equity[13].

It was evident from the RIIO-2 companies' notices of appeal that, while they recognised there were differences in the appeals regimes, they believed Ofgem's margin of appreciation would not leave room for material weaknesses in methodology, evidence or judgement[14]. Accordingly, appellants commonly cited positions adopted by the CMA for the PR19 appeals in their RIIO-T2/GD2 notices of appeals[15]. Such beliefs would be confounded by the CMA's determination of the RIIO-2 appeals. The CMA rejected all grounds for appeal concerning the cost of capital[16]. In its summary document of its provisional determination, the CMA wrote *"provided that there is evidence that the decision-maker did not wholly disregard its 'have regard to' duties, then a challenge will only succeed if it can be shown that the decision was irrational."*[17] In its final determination, the CMA explained that this stance specifically related to Ofgem's 'have regard to' duties[18].

This CMA stance implies that Ofgem has a strikingly wide margin of appreciation and the protection afforded by a licensee's right to appeal is somewhat more limited than it is in the water sector as a result. We can start to quantify this effect by analysing the PR19 and RIIO-T2/GD2 decisions.

[11] For example, see paragraph 76 of the 8 August 2012 CAT judgement in appeal brought by British Sky Broadcasting and others
[12] For example, no DNO appealed on grounds relating to the cost of capital
[13] Table 9-37 of the 17 March 2021 Final Report.
[14] For example. See paragraph 3.3 of the 2 March 2021 notice of appeal by National Grid Electricity Transmission (NGET)
[15] For example, NGET's notice of appeal made 110 references to PR19
[16] It did determine that a separate but related
[17] Paragraph 40, Summary of provisional determination, CMA, 11 August 2021
[18] Paragraph 8.276.

4. Analysis of PR19 and RIIO-T2/GD2 decisions

For the purpose of this paper, it is helpful that we have recently experienced two nearly parallel sets of CMA appeals under the separate appeals regimes for both water and energy. Water is relevant as the comparator sector where we have relevant observations of beta. We can consider the outcomes of those appeals for the generic issues involved in estimating the cost of equity (CoE). Reflecting the parallel nature of these generic issues, the arguments cited by companies on those issues were strikingly similar in both sets of appeals.

To help evaluate the effects of the appeals regimes, we can track the evolution of the various parameter estimates since the previous price control reviews, through to the regulators' decisions and finally the appeals outcomes.

To firmly root the analysis, we have constructed consistent reference points for both sets of decisions. Because of timing and contextual differences between the sectors and the presence of a non-generic aspect of the CoE, beta, there are some differences between the two reference points. The timing and contextual differences relate to estimates of risk-free rate (RFR), since Ofgem operates a RFR-index and the market for ILGs moved a little between the respective decision dates. These differences are reflected in the reference points to ensure our analysis disregards those timing/contextual and beta differences.

Construction of the reference points

Our construction of these reference points is illustrated in Figure 4 and Figure 5 below. To construct the reference points, we have firstly identified and taken into account structural changes since the previous reviews. These structural changes are relatively straightforward to quantify objectively[19]. They relate to changes in the basis of measuring the CoE, driven by changes in notional gearing assumptions, movements in markets, new evidence, a definitional change in the basis of inflation or a policy change. These changes do not by themselves imply a subjective shift in the prospect of returns, although they may leave lots of questions for consideration.

We have secondly calibrated for differences in beta estimates and incorporated adjustments to represent the potential scope of judgement in two issues that emerged in the PR19 appeals. These are the potential weight that might be ascribed to spreads in AAA-rated corporate bonds in determining the RFR and a potential uplift on the midpoint of CoE estimates to account for parametric uncertainty.

These reference points then can help us isolate the effects of judgements by regulators and the CMA on the following generic matters:

- To what extent should the TMR estimate diverge from the arithmetic average of historical real annual returns on the UK market, recognising the salience of issues such as uncertainty in historical inflation data and methods of averaging for long-horizon returns (identified as 'TMR averaging', 'RPI-weighting' and 'Ex-ante weighting' in Figure 7 below)
- To what extent should expected forward movements in spot rates and spreads on AAA-rated corporate bonds relative to gilts be taken into account in estimating the RFR (identified as 'Forward ILG and 'AAA-spread' in Figure 7 below)

[19] There is some judgement involved in the split between two components of RFR movement, the ILG market movement and adoption of a non-gradualist RFR, but this does not affect the combined result.

- What value for debt beta should be assumed when converting betas from observations for lower-geared companies for a higher notional gearing assumption (identified as 'Debt beta' in Figure 7 below)
- To what extent should the estimate for the cost of equity exceed the result of using the midpoint estimates of all cost of equity parameters given the nature of uncertainty in those parameters and the asymmetric effect of uncertainty on the policy objectives (identified as 'Uplift' in Figure 7 below).

The following two charts show the relationship between the reference points for each sector's decision and the CPIH-adjusted estimates in the previous price control reviews.

Figure 4: CoE movements: RIIO-GD1 to T2/GD2 reference point

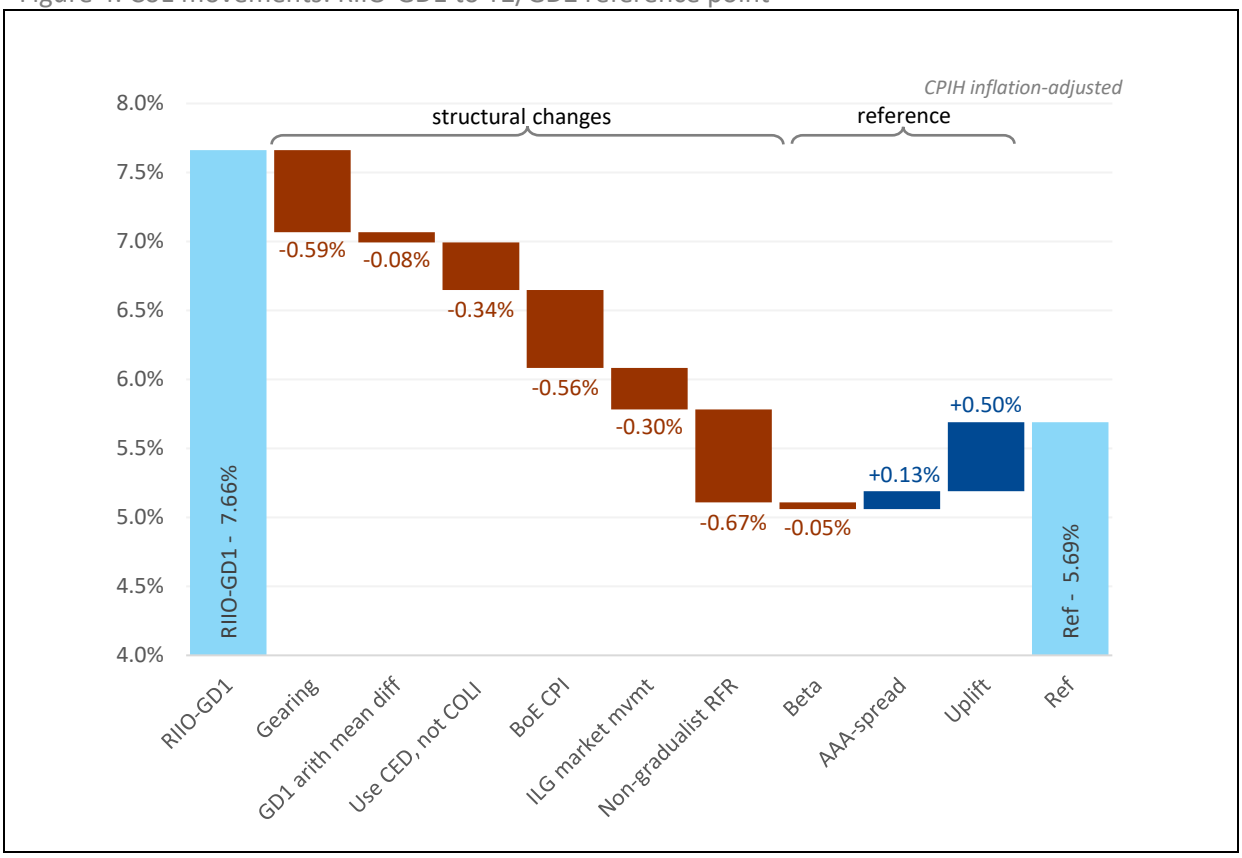
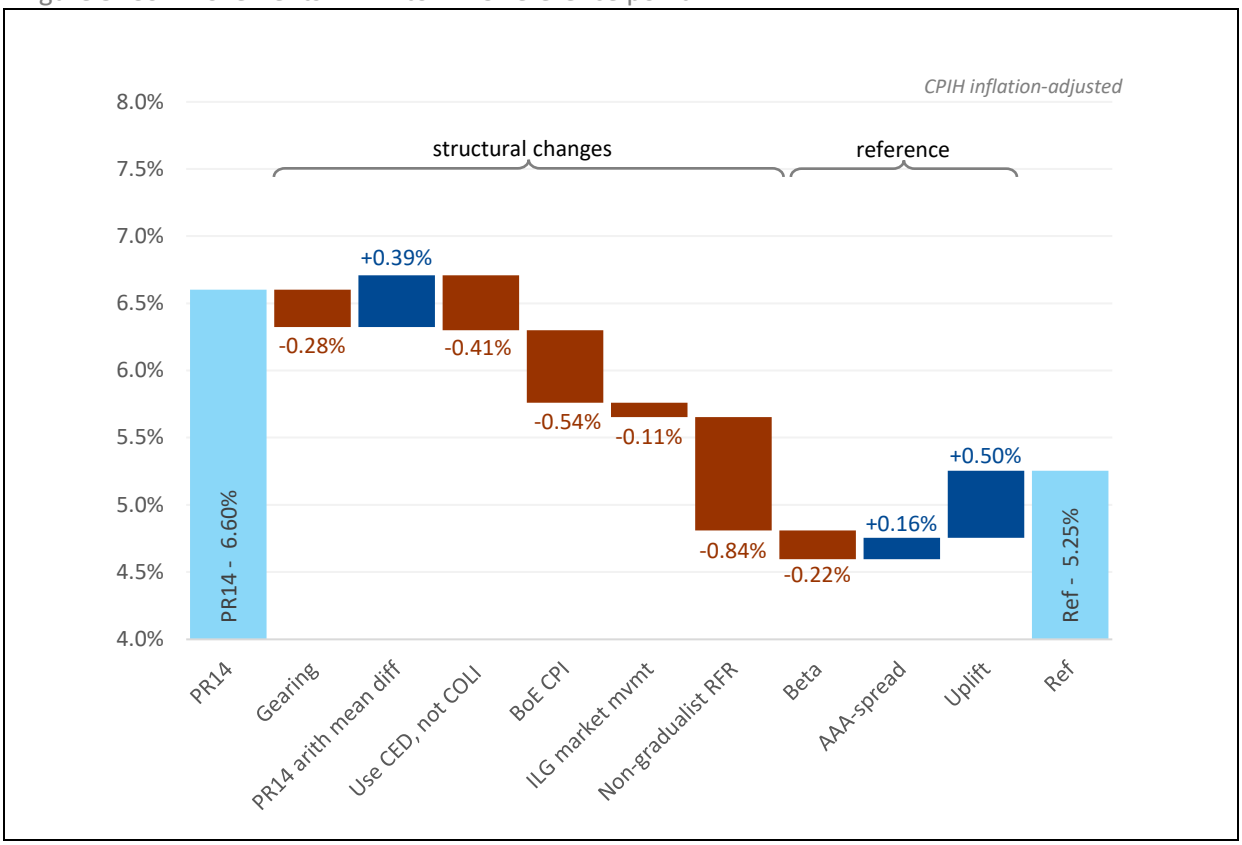


Figure 5: CoE movements: PR14 to PR19 reference point



Details for the light blue columns are included in Appendix 3.

In general, these are changes in measurement basis, market, evidence or policy. It is not that there are no judgements involved in the detail of implementing these changes, but that they are structural and provide the basis for a neutral reference point.

Gearing

The notional gearing assumptions for both water and energy sectors changed since the previous price control reviews. Both regulators have now adopted a 60% gearing assumption, lower than their 65% (RIIO-GD1) and 62.5% (PR14) estimates. This conventionally creates a technical change in the estimate of the cost of equity, recognising that the same risk will be spread over a larger quantum of notional equity, and thus a lower CoE would be appropriate.

Arithmetic mean differences (in previous reviews)

For PR14 and RIIO-T1/GD1, both regulators estimated TMRs at levels different from the longer term historical average of arithmetic annual means (as measured at the time in RPI terms). Although there is a great deal of judgement involved in in estimating forward-looking expected market returns, the regulatory convention, reconfirmed in the UKRN cost of capital study, is to refer to historical averages. The difference in Ofgem's case was small, but Ofwat had made adjustments for what it then judged to be lower forward-looking market returns.

Use of CED in place of COLI

An increased focus on inflation measurement issues since the conclusion of the ONS review of RPI in 2013 highlighted significant issues in the reliability of the Cost of Living Index (COLI). COLI was an index maintained from 1904 through to 1947 and which has been used in the DMS dataset for

deflating UK market returns, and in turn used by both Ofwat and Ofgem. The purpose of COLI was described in 1921[20] as "a measure of the average increase in the cost of maintaining unchanged the pre-war standard of living of the working classes". It was not designed to as a measure of economy-wide inflation and, due to the onset of WWII, did not reflect substantial changes in in the original 1904 expenditure weights (over a period of considerable social change) that had been considered necessary. The Bank of England (BoE) millennium database of economic statistics instead used a consumer expenditure deflator that had been derived from work carried out in the 1970s in a project led by CH Feinstein of Cambridge University to retrospectively construct national income and expenditure data for the years 1855 to 1965. That project was not designed to provide a basis for measures of inflation, but it was coherently constructed and plausibly provides a more reliable basis than COLI.

BoE CPI

To determine estimates of TMR consistent with the CPIH basis of regulation going forward, both regulators adopted a CPI-based backwards-looking inflation series included in the BoE millennium database, which uses CPI data and back-cast CPI estimates derived from RPI data for the period after 1947. Use of this series in place of the RPI/CED series adjusts the measure of TMR by about 0.7%. We estimate that this effect is slightly more than the structural change in RPI that took place in 2010 when the ONS adopted new data collection methods for clothing and footwear. The total impact on RPI can be separated into two parts:

i an intended increase in clothing and footwear CPI inflation to correct what had been a long-time and quite severe underestimate due to inadequate data collection protocols, and
ii an unintended increase in the RPI-CPI wedge due to an increase in the formula effect arising from the new protocols generating substantially more granular and volatile data.

Of these two, the first has sometimes been overlooked as a component of the structural change in RPI. We estimate the total impact on RPI in 2010 was around 0.6%, and would have represented an artificial uplift in real returns for regulated networks until the effect was corrected. The 0.7% rebasing of historical market returns arising from adopting the BoE series could therefore be thought of as in large part a correction of this structural change.

One of the results of the increased attention on historical inflation measurement issues has been to highlight considerable methodological and data quality inconsistencies in inflation measures over the very long term. The clothing and footwear issues the ONS sought to correct in 2010 were not isolated. In the UK, the data quality issues are particularly severe prior to 1938 and there would have been analogous issues in other jurisdictions too. There therefore remains considerable uncertainty in the longer term foundations of TMR estimates – an area for legitimate consideration and judgment in making TMR estimates.

ILG market movement

The RFR estimates in PR14 and RIIO-T1/GD1 were described as longer term. The methodologies for determining them were not well defined. However, the UKRN study suggested that they could be characterised as gradualism, akin to a dragging anchor or trailing average approach. The UKRN study's authors were concerned that the ropes to these anchors may have been unduly elastic, but they accepted the potential legitimacy of a gradualism approach.

[20] Board of Trade Labour Gazette, February 1921, pp 69-72 as cited in Robert O'Neill, Jeff Ralph, Paul A Smith 'Inflation – history and measurement', 2017

Table 1 – Regulators' gradualism RFR estimates

Review	Data adopted for trailing average	Regulator's estimate (RPI)	15-year trailing average of 15-year ILG yields	20-year trailing average of 20-year ILG yields
RIIO-T1/GD1	31 October 2012	2.00%	1.69%	2.14%
PR14	31 October 2014	1.25%	1.30%	1.77%

Against the reference point of ILG trailing averages, it is not clear that either regulator's estimates were too high.

To illustrate the effect of a change in the ILG market environment, therefore, we have estimated the change as being from the regulator's actual estimates in 2012 and 2014 through to a trailing average estimate of 1.53% in CPIH terms for PR19 and RIIO-T2/GD2, using the trailing 20-year trailing average of 20-year ILG yields as at 31 October 2019 as a suitable place holder figure.

Non-gradualism RFR

As described in the UKRN study, the regulators had the option of adopting a gradualism approach to the RFR. Indeed, three of the four authors of the study recommended they should adopt such an approach in the event that they adopt a gradualism approach to the cost of debt[21], which they both did. It is evident in Ofgem's RIIO-2 open letter that at that time it anticipated adopting a trailing average approach for their proposed CoE index. Nevertheless, both regulators eventually chose to use a non-gradualism approach and use current spot ILG yields as the basis for their estimates. This was a policy decision.

By itself, it does not create an enduring structural change in estimates of the CoE since spot rates would tend to oscillate around gradualism estimates. At present, spot rates are substantially lower, hence the need for a reconciling item to our reference points.

There remains the issue as to whether combining a non-gradualism approach to the RFR with a gradualism approach to the cost of debt distorts decisions, as the UKRN study authors suggested.

Other adjustments for a suitable reference point

These are adjustments we need to make to provide comparable reference points for the regulators' and CMA estimates. In making these adjustments, we are not judging their suitability for an actual decision, but merely describing the scope of the regulators' and CMA's judgements relevant to this analysis. These adjustments relate to betas, which we need to adjust for to isolate the truly generic/comparable issues, and two areas of judgement that weren't explicit in the PR14 or T1/GD1 decisions. These are the spreads on AAA-rated corporate bonds relative to gilts and the uplift for parameter uncertainty.

Beta

To ensure we can isolate the generic issues, we have adopted the regulators' own estimates for asset beta in the construction of our reference points. Asset betas would be, and would decidedly

[21] Stephen Wright, Phil Burns, Robin Mason and Derry Pickford, *'Estimating the cost of capital for implementation of price controls by UK Regulators'*, March 2018, UKRN – page 33

have been, important issues for regulatory judgement. It happens that in neither case did the CMA depart from the regulator's own estimate.

AAA-spreads

Perhaps because the regulators chose to adopt today's very low spot rates for their ILG estimates, the question of whether ILGs are the most suitable measure of the RFR emerged in this cycle of reviews. AAA-rated corporate bonds are, like gilts, nearly risk-free but exhibit significantly different yields. The regulators have not yet articulated a good understanding of the risk and other characteristics of these ostensibly similar financial instruments to explain the gap in yields. This understanding would be necessary to determine which better reflects the characteristics of a hypothetical zero-beta regulated business remunerated by Ofgem's RFR index or Ofwat's periodic re-estimates of the RFR.

Until that work has been carried out, it is a matter of judgement how to weight the two.

The uplift for parametric uncertainty

This emerged as an important issue in the CMA PR19 appeals (and, in energy, the CMA decided that Ofgem's related negative 'uplift' for expected outperformance was wrong). For the purpose of specifying our reference points, we have adopted the value of 0.5% representing the adjustment considered by the CMA in its PR19 provisional findings[22] (in its final report, it attenuated this uplift to 0.25%).

Analysing the judgements made by the regulators and the CMA

Having specified neutral reference points on a consistent basis for both sets of decisions, we have analysed the outcomes of both regulators' reviews and both sets of CMA appeals. These are described in the following charts. As far as possible, we have analysed the two stages of movements so that individual components can be readily identified:

- for the movements between our reference points and the regulators' determinations:
  - separating out individual components so they can be identifiable with reference to Table 5 in Appendix 3
- for the movements between the regulators' determinations and the CMA's determinations:
  - separating out individual components so they can be identifiable with reference to the explanations set out in the respective CMA reports.

[22] The CMA, in paragraph 9.674(c) of its RP19 provisional findings, selected a point estimate of the cost of equity midway between the midpoint (4.56%) and the top (5.60%) of its range, an uplift from the midpoint of 0.52%.

Figure 6: CoE movements: RIIO-T2/GD2 reference point to Ofgem, to CMA

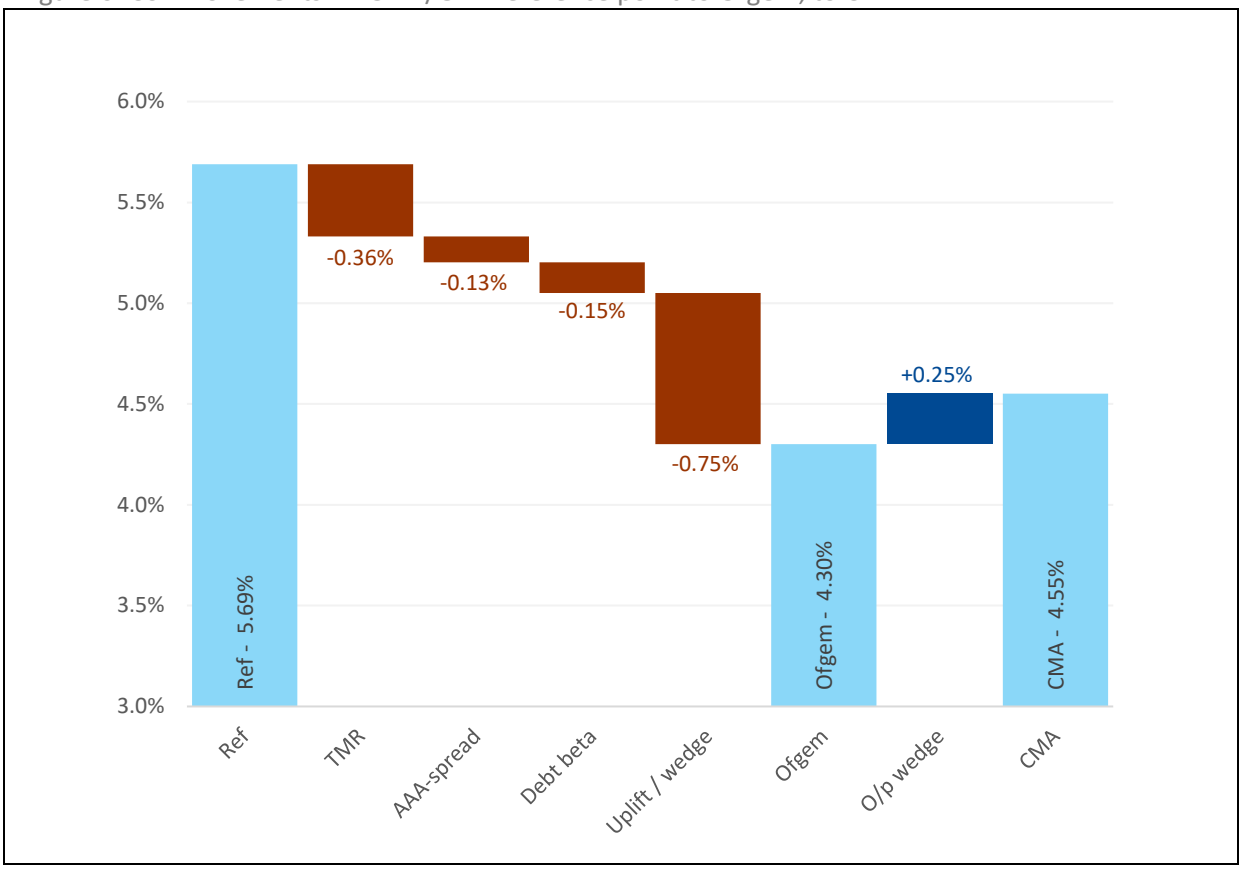
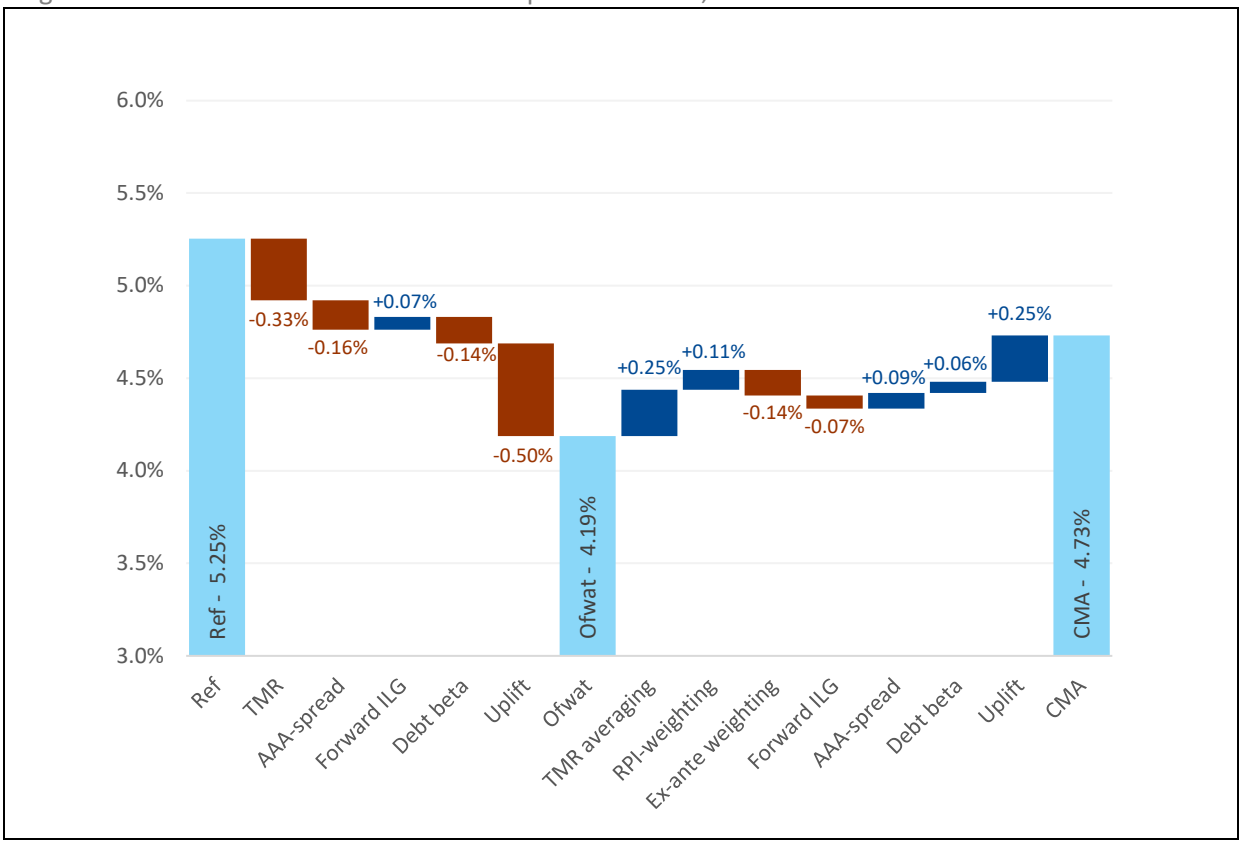


Figure 7: CoE movements: PR19 reference point to Ofwat, to CMA



Reviewing the above two charts, it is immediately apparent that the outcome of the PR19 appeals was rather more involved. On further examination, the outcome of the PR19 appeals was not just more involved, it reflected a sequence of judgements made by the CMA where it considered Ofwat's estimates were mostly too low. By contrast, in the RIIO-T2/GD2 appeals, the CMA found that Ofgem's parameter estimates for the cost of equity were within its margin of appreciation, only departing from Ofgem in respect of its separate downward adjustment for expected outperformance. It is evident from the rationales given by the CMA that it relied heavily on Ofgem's margin of appreciation.

It seems clear that these contrasting outcomes are a direct consequence of the differences in the two appeals frameworks. For RIIO-T2/GD2 the CMA concluded that the various grounds of appeal were not able to demonstrate that Ofgem had made any errors that meet the criteria set out in the relevant Acts. It was evidently important in the CMA's thinking that the threshold for establishing an error was tantamount to showing irrationality (see paragraph 40 of the PD summary and paragraph 8.276 of the FD cited on page 12 above).

This means that the prospect of securing a positive outcome for an appeal is structurally worse for an energy appellant than a water appellant, and this prospect is neatly illustrated in the outcomes for these two sets of appeals.

The outcomes for these two sets of appeals would seem consistent with, and thus evidently indicative of, this underlying structural difference. We could not expect other appeals cycles to show identical outcomes, but the outcomes for this cycle represent the best available indication of the overall effect on investor risk.

That overall effect can be summarised in the following table.

Table 2 – Estimated effect of appeals regime on risk

Review	CoE effect of regulators' judgements	CMA adjustments to regulators' decisions	Proportionate exposure post-CMA	Risk uplift relative to PR19
PR19	-1.07%	0.54%	49% (1.07%-0.54%)/1.07%	
RIIO-T2/GD2	-1.39%	0.25%	82% (1.39%-0.25%)/1.39%	1.7 x 82%/49%

5. Inferring the effect on relative risk between energy and water

Chapter 2 establishes that systematic risk substantially arises from 'between-period' regulatory processes rather than 'in-period' performance uncertainty. Chapter 3 establishes that by construction, even if unintentionally, the energy appeals regime provides a structurally lower level of protection to investors for the risk in those regulatory processes. Chapter 4 demonstrates that the evidence is also consistent with a structurally lower level of protection for interested parties in regulated energy networks[23]. Since we have established that systematic risk is transmitted through regulatory processes, reduced protection for interested parties would imply a relatively unattenuated exposure to that risk. The evidence from the most recent (and current) appeals indicates a risk factor of around 1.7 relative to water.

These results are unambiguous and indicate there would be a substantive difference in exposure to regulatory risk between energy and water. This means that, since we've identified that regulatory risk conveys systematic risk, we would expect regulated energy networks to have a higher beta than the comparator regulated water networks.

To help understand how this would work, we can recognise that both regulators and CMA would be quite properly influenced by wider societal and economic factors, through which systematic risk must be conveyed. However, the CMA's role is inherently one of attenuating regulatory decisions. The way panels are constituted, with one-time membership, means that they are liable to be less prone to some external influence or pressure from political, media or public opinion. In general, therefore, we would see CMA as systematic risk attenuation rather than amplification, and in particular attenuating decisions that may have been disproportionately influenced by societal/political/wider economy factors or influenced by disproportionate societal/political/wider economy factors.

We should recognise that not all systematic risk would derive from judgements that could be subject to CMA appeal. We showed in Chapter 2 that systematic risk must substantially arise from 'between-period' regulatory processes rather than 'in-period' performance uncertainty. However, these processes would include the effects of legislation that would fall outside the scope of the energy appeals regime.

We should also recognise that the relative protection afforded by the two CMA appeals processes is not necessarily proportionate across the entire scope of appeals, insofar as it relates to systematic risk. Our evidence necessarily comes from the generic components of the cost of equity and does not include other building block components such as cost assessment, calibration of output incentives or beta[24]. Because these other components are less generic, we have not been able to make a direct comparison of the effects of CMA appeals as we have for the generic components of the cost of equity. However, the same principles apply, there would be comparable scope for regulatory discretion and we would expect comparable limits to the scope of CMA's interventions under the legal framework for energy appeals to attenuate that discretion.

On the other hand, there are also reasons why the evidence from Chapter 4 may understate the relationship between energy betas and water betas. It is possible that Ofgem would be emboldened

[23] Recognising that parties representing consumers can appeal, as British Gas Trading did for RIIO-ED1, as well as companies.

[24] We note that, in the last cycle of appeals, the CMA did not depart from Ofwat's estimate of beta.

by its relatively permissive appeals regime, especially in light of its RIIO-T2/GD2 experience, to exercise discretion more liberally than Ofwat. The 30% scale difference in the CoE effect of regulators' judgements shown in Table 2 above could plausibly reflect this. Ofgem may be emboldened further in future reviews, including RIIO-ED2, encouraged by the outcome for T2/GD2. The effect seen in formal price control reviews may be further aggravated in the design of price controls, for example by introducing uncertainty mechanisms where Ofgem retains some discretion in triggering or determining the scale of price control adjustments, confident that licensees are less likely to succeed in an appeal.

Taken together, these indicate we can expect significantly higher betas in energy networks than for water networks. On balance, recognising there are some regulatory/legislative influences outside the scope of the appeals regimes, we might expect a differential lower than the raw result of 1.7x shown in Chapter 4. However, given the widely-accepted and structural importance of appeal rights since the time of privatisation and the evident importance ascribed to them by companies and their investors, it would be difficult to discount much of the effect. An estimate of the differential in equity betas between water and energy that would arise from the differences between the respective appeals regimes of 1.1x[25], for example, would be unreasonably low. A reasonable estimate would be significantly higher.

[25] on an equivalent gearing basis, and leaving aside other risk differences

6. Implications for wider relative risk analysis

The implications of Chapter 2 for wider relative risk analysis are far reaching. Hitherto, analysis by regulators and their advisors would be consistent with an assumption that exposure to systematic risk relates to the activities undertaken by companies and the characteristics of their in-period regulatory mechanisms rather than the wider context of their regulation. Consequently, analysis of relative risk has sought to acquire evidence from betas observed for companies in the same sector and ostensibly similar regimes. The findings in this report indicate such an approach is structurally unsound.

An example is CEPA's recent relative risk analysis for Ofgem, especially pertinent as it informed Ofgem's thinking for RIIO-T2/GD2.

CEPA's relative risk analysis

Ofgem's thinking on relative risk for RIIO-T2/G2 was informed by analysis by CEPA reported in a technical annex to the RIIO-2 draft determinations, 'Beta estimation issues'[26]. CEPA drew conclusions about the risk exposure of GB regulated energy networks relative to regulated water companies and energy networks in mainland Europe.

CEPA broke down its discussion (and assessment) of relative risks (section 2.2 of its report) into the following components and subcomponents:

- Market risk
  - Demand, regulatory framework and political risk
  - Dynamic risks
- Price control building block risk
  - Total expenditure
  - Financing
  - Pensions
  - Other
- Firm structure risk
  - Operational gearing
  - Asset intensity

These subcomponents can also be seen in Figure 3 on page 9 above.

Summary of CEPA's findings on relative risk

CEPA set out its qualitative review of relative risk for each of these subcomponents, in the first instance comparing energy networks with water (and also aviation) in the UK.

Although CEPA noted that its overall assessment of relative risk would depend on the relative weighting of each category of risk analysis, it did not set out what those weightings should be. It set out some discussion of relative weights in its section 2.1, noting that *"The 'Market risk' category generally deals with long-term drivers of value while the 'Price control building block risk' category*

[26] Published as 'Draft Determinations - Beta Estimation Issues Annex (CEPA).pdf' included in https://www.ofgem.gov.uk/sites/default/files/docs/2020/07/draft_determinations_-_technical_annexes_part_two_2.zip, evidently incorrectly described in the DDs finance annex as 'Beta advice.pdf'

focuses on shorter-term cash flow issues. Short-term cash flows are likely to be particularly significant to investors' assessment of risk by virtue of being less heavily discounted, however, much of the price control related risk is likely to be performance based and idiosyncratic in nature." The report did not resolve this apparent ambiguity.

As it happened, CEPA seems to have been able to reach its conclusions without referring to weightings at all. For the comparison between energy and water, this is because it assessed those relative risks across the components as broadly similar (section 2.4). It did note that energy and water networks will face different sources of dynamic uncertainty, but that *"On balance it is difficult to conclude that these differences consistently indicate that energy networks are exposed to greater systematic risk than water networks (or vice versa)"*.

CEPA's discussion in its section 2.4 went on to suggest Ofgem should continue to have regard to GB water networks in forming its judgement of beta. However, its concern around differences in dynamic risk exposure led it to indicate that "*European energy networks as a comparator group and investment substitute to a GB energy network may more closely reflect these sector-specific risks that GB energy networks are exposed to"*.

Evaluation of CEPA's findings

Firstly, CEPA did not have the benefit of the analysis set out in Chapter 2 above. This would have given it a firmer basis to weight the different categories of risk. It would , in particular, have been able to conclude that the systematic component of what it describes as short term cash flow risk, much of which it noted "is likely to be performance based and idiosyncratic in nature", would be relatively small.

Secondly, CEPA did not recognise the structural difference in the UK appeals regimes for water and energy networks. It did differentiate between the two appeals regimes in Table 2.1 of its report, describing energy's appeals mechanism as "CMA appeal" and water's as "CMA review", but without ascribing any implications for risk exposures. Indeed, it noted in section 2.2.1 (page 16) of its report that, among their "closely aligned features", *"Both energy and water sectors – current and previous price controls – have a well-established RAV framework supported by a clear licensing and appeals mechanism"*.

Thirdly, CEPA seems to place undue weight on sectoral similarities between businesses in different jurisdictions. While energy networks across different countries are likely to face similar engineering and cost challenges and similar dynamic risks, they will be regulated in different societal, political and administrative contexts. As we show in Chapter 2 and illustrate further in Appendix 2, these could significantly affect how regulatory decisions are influenced by systematic factors.

Conclusion on CEPA's findings

Taken together, the first two issues identified above indicate that CEPA's conclusions on relative risk between water and energy are unsafe. Together with the third, they also indicate that any read-across from betas observed for energy networks in mainland Europe (or indeed anywhere else, including the US) would need to be interpreted in light of potentially wide ranging differences in context.

Interpreting differences in context

The main finding from analysis in the previous chapters, notably Chapter 2 and illustrated by Appendix 2, is that the context of regulation is centrally important to an understanding of exposure to systematic risk. That would mean considering the comparability of the institutional and

administrative arrangements surrounding each business's regulation. Accordingly, the following are liable to be relevant factors in considering the comparability of risk environments between two regulated businesses:

- The structure of regulation, including the periodicity and scope of reviews
- The quality of regulatory independence from government, including the potential scope of ministerial direction and systems of accountability
- The level of judicial involvement in regulatory decisions
- The level of insulation in practice from wider public pressure, including formal and informal arrangements for the involvement of consumer bodies (eg in making appeals)
- The effectiveness and scope of appeals regimes and other protections for investors

These would not be exhaustive.

These factors would be highly relevant for any analysis of relative risk with European energy companies. These have the potential to be direct comparators for GB energy networks, but they are regulated in different jurisdictions with different historical backgrounds, legal frameworks and institutional arrangements. Any evaluation of relative risk would require a careful interpretation of these differences.

They would also be relevant for any decomposition of the observed betas for National Grid, the closest direct evidence of betas for GB regulated networks. It would be necessary to evaluate the beta specific to National Grid's US energy network interests with reference to these factors.

Finally, they would help inform the relative risk with offshore transmission operators (OFTOs). We would expect the longer term competed licence arrangements for these businesses would make them poor proxies for the risk environment surrounding mainstream regulated networks.

Appendix 1 Taxonomy of in-period risk influences

To help cross-check the conclusion in Chapter 2 above that there is little room for systematic risk in in-period risk influences, Table 3 sets out a taxonomy of these in-period risk influences. It comments on the scope of systematic risk in light of general regulatory treatment by Ofgem or Ofwat. The table notes where treatment is substantially different for water, specifically the comparator listed companies of SVT and UU.

Table 3 - Taxonomy of in-period risk influences on regulated networks

Risk	General approach	Short-term (in-period)	Longer-term
Uncertain demand for energy	Revenue invariant in-period. Between periods subject to regulatory reset.	Largely cost-invariant (see capacity below)	Longer term cost implications able to be captured in regulatory reset.
Uncertain demand for capacity and other outputs	Revenue invariant in-period with scope for volume drivers and other UMs. Between periods subject to regulatory reset.	Cost implications would tend to be counter-cyclical (demand growth --> additional cost --> lower returns), if not covered by volume drivers or other UMs.	Longer term cost implications able to be captured in regulatory reset.
Uncertain input prices	Revenue invariant in-period with scope for RPE indexation (energy). Between periods subject to regulatory reset.	Cost implications would tend to be counter-cyclical (demand growth --> capacity constraints in supplier markets --> higher input prices --> lower returns), if not covered by RPE indexation.	Longer term cost implications able to be captured in regulatory reset.
Uncertain delivery/ productivity/ efficiency	Generally incentivised in-period. Between periods subject to regulatory reset.	Principally idiosyncratic. Scope for some pro-cyclicality driven by any rapid productivity changes in the wider economy.	Longer term productivity changes able to be captured in regulatory reset.
Defined benefit pension schemes	In energy, remunerated as triennially reassessed cost pass-through, in water consistent with IN 13/17.	Energy: pass-through. Water shareholders exposed to incremental changes in deficits, though equity in scheme assets is low for SVT and especially UU (2021 equity included in £350m of "other" relative to £11.7bn RCV) --> low beta impact.	
Uncertain market interest rates	Remunerated through CoD index weighted to ensure NWOs are broadly protected from changes in the interest rate environment.	CoD index is weighted to ensure NWOs are broadly protected from changes in the interest rate environment.	CoD index re-calibrated at each price control review.

Table 3 indicates how there could be some direct exposure to systematic risk in the short term, though the balance between pro-cyclical and counter-cyclical influences is unclear. It lends credence to how the regulatory regimes for networks in large part disable the mechanisms by which

systematic risk is transmitted to the generality of businesses in the wider economy. For those businesses, exposure to the wider economy in large part comes from changes in demand for services and the consequent creation of excess or constrained capacity within the relevant markets. In good times, demand increases and businesses can sustain higher prices and higher margins. In bad times, businesses experience the opposite effects. Regulated businesses are largely insulated from these influences by their regulatory regimes, notably their revenue-based form of control, and if anything would tend to experience counter-cyclical effects through their exposure to supplier markets.

Table 3 also identifies some small structural differences between the water and energy regimes. There could be some differential in risk exposure through differences in the treatment of RPEs and defined benefit pensions, but the effects of these differences would tend to counteract each other.

This tends to conform CEPA's conclusion in its relative risk analysis that the influences on in-period returns are substantially idiosyncratic.

Appendix 2 Between-period risk influences

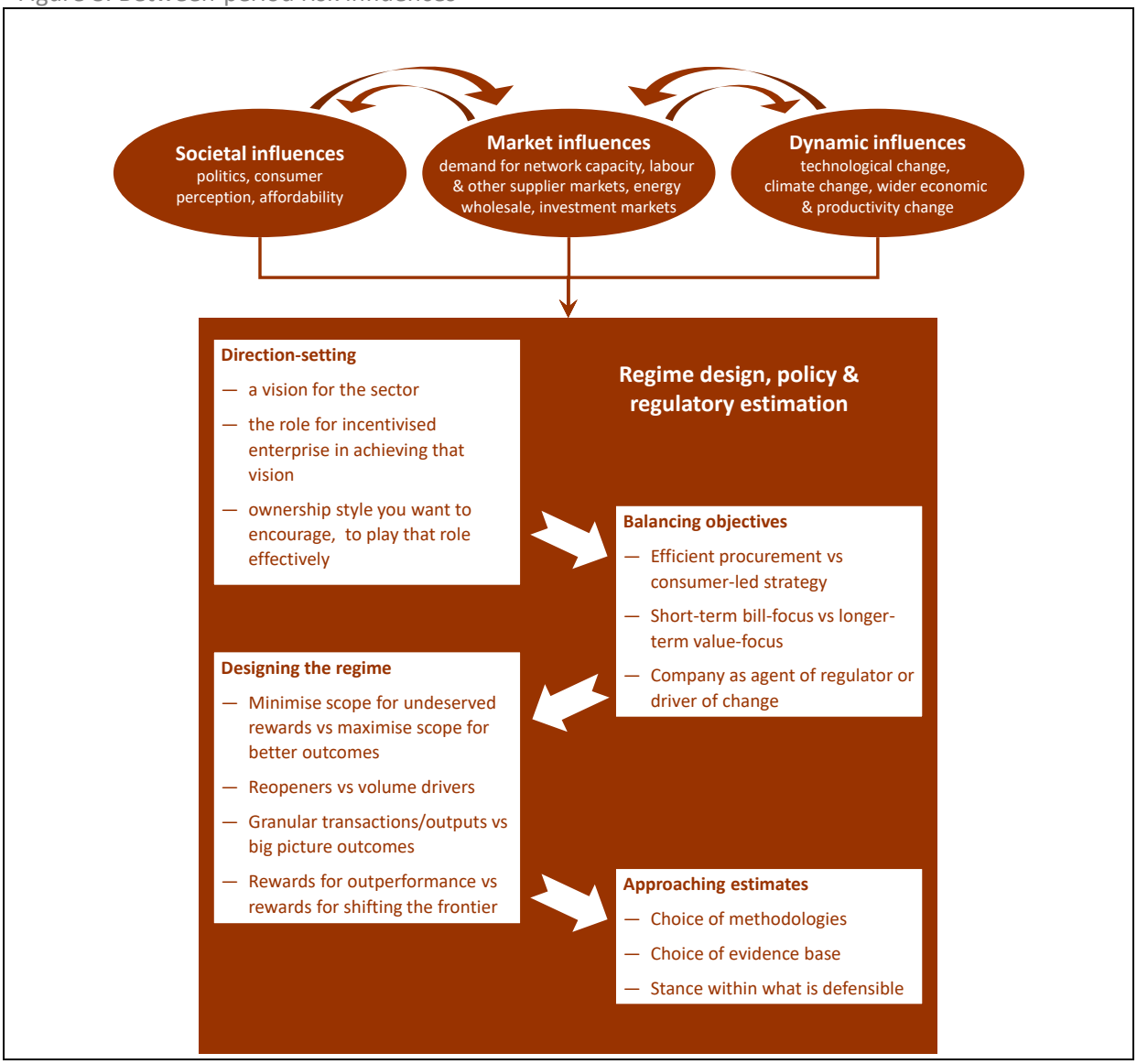
We use the description of 'between-period' risk influences to cover influences over regulatory processes, the decisions that regulators make. Classically, these are in periodic reviews, 'between-periods', but do also sometimes arise within periods, for example where uncertainty mechanisms involve regulatory discretion in triggering or scaling a price control adjustment.

It is quite proper for regulators to be informed and influenced by the wider societal and economic environment in which regulation takes place. Regulators would be failing society if they were blind to its evolving needs or blind to the ever-changing economy and market conditions.

The diagram in Figure 8 below describes a wide range of regulatory considerations that would properly be influenced by such wider societal and economic factors.

Our findings in Chapter 2 indicate that systematic risk in regulated networks is principally conveyed through these regulatory processes.

Figure 8: Between-period risk influences



We can consider the plausibility of these influences having the implied impact on water sector betas.

Unlike the contained and hypothetical circumstances we considered in Chapter 2 for in-period risk under our null hypothesis, we are here considering big strategic influences over regulatory processes that could create structural shifts in the prospects for returns. Structural shifts in the prospects for returns would implicitly have a bearing on asset values, and so we need to consider variability in terms of asset values rather than in-period RoRE returns.

If we suppose, for the sake of this plausibility test, that these between-period risk influences amount to 0.5 of a water company's equity beta, that is broadly consistent with a five-yearly standard deviation of value of about 17.5%. A value deviation of 17.5% would arise, for example, if there were to be an enduring change in the prospects of real equity returns of 17.5% divided by the real cost of equity. If the cost of equity is in the region of 4.55%, the 5-yearly variability of the enduring prospects of real equity returns, in the minds of investors, would therefore need to be in the region of 0.8%.

With reference to Table 2, we see a 0.49% post-CMA impact in respect of only the generic components of the cost of equity. The scope of price control reviews, of course, goes well beyond just the generic components of the cost of equity while the regulatory processes that could impact on the prospects of equity returns go beyond the scope of what's appealable through the CMA. On balance, relating a benchmark 5-yearly variability in real equity returns of 0.8% to the observed outcome of a 0.49% impact in respect of only one component, it would seem plausible that the influences on regulatory processes illustrated in Figure 8 could have the effect implied by our analysis in Chapter 2.

Appendix 3 Summaries of CoE estimates

Table 4 – Summary of CoE estimates for PR19

WACC parameters	Ofwat PR14	Rebased to CPIH	PR19 reference	Ofwat decision	CMA
Market parameters					
TMR	6.75%	7.71%	6.96%	6.50%	6.81%
AAA spread			0.58%		0.29%
ILG	1.25%	2.16%	-1.64%	-1.39%	-1.63%
ERP	5.50%	5.55%	8.02%	7.89%	8.15%
Equity					
Raw equity beta			0.633	0.633	0.633
Adjusted RAV gearing			54.20%	54.20%	54.20%
Unlevered beta	0.300	0.300	0.290	0.290	0.290
Debt beta				0.125	0.075
Asset beta	0.300	0.300	0.290	0.358	0.331
Notional gearing	62.50%	62.50%	60.00%	60.00%	60.00%
Equity beta, calculated	0.800	0.800	0.725	0.707	0.714
CoE midpoint	5.65%	6.60%	4.75%	4.19%	4.48%
Uplift/wedge			0.50%		0.25%
Cost of equity	**5.65%**	**6.60%**	**5.25%**	**4.19%**	**4.73%**

Table 5 – Summary of CoE estimates for RIIO-T2/GD2

WACC parameters	Ofgem RIIO-GD1	Rebased to CPIH	T2/GD2 reference	Ofgem decision	CMA
Market parameters					
TMR	7.25%	8.22%	6.96%	6.50%	6.50%
AAA spread			0.58%		
ILG	2.00%	2.92%	-1.58%	-1.58%	-1.58%
ERP	5.25%	5.30%	7.96%	8.08%	8.08%
Equity					
Raw equity beta			0.622	0.622	0.622
Adjusted RAV gearing			50.00%	50.00%	50.00%
Unlevered beta	0.313	0.313	0.311	0.311	0.311
Debt beta				0.075	0.075
Asset beta	0.313	0.313	0.311	0.349	0.349
Notional gearing	65.00%	65.00%	60.00%	60.00%	60.00%
Equity beta, calculated	0.895	0.895	0.778	0.759	0.759
CoE midpoint	6.70%	7.66%	5.19%	4.55%	4.55%
Uplift/wedge			0.50%	-0.25%	
Cost of equity	**6.70%**	**7.66%**	**5.69%**	**4.30%**	**4.55%**